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PRESERVING TREES FROM EMERALD ASH BORER

The emerald ash borer (EAB) is a small (1/3 to ½-inch), bright metallic green beetle (Fig. 1), in the beetle family Buprestidae, native to eastern Asia. Since its detection in the Detroit, Michigan area in 2002, it has rapidly expanded its range through the Midwest and Northeast, killing hundreds of millions of trees and taking only about three years from its first detection in Connecticut (in 2012) to being found throughout the state (see http://www.emeraldashborer.info). The EAB only attacks true ash, species in the Genus *Fraxinus*, such as green ash, white ash, and black ash, and a close relative of ash, the white fringetree, *Chionanthus virginicus*. Range expansion involves flight by beetles (a few miles per year) assisted by unintended longer distance transport of larvae infesting firewood or nursery stock. EAB is now so broadly distributed that the federal government no longer treats it as a regulated pest. This guide summarizes the experience from researchers and municipal arborists regarding the dynamics of infestation and the ability to preserve valued ash trees.

EAB adults emerge and are active in June and July. Female beetles lay eggs in cracks in the bark on ash. The larvae feed on the inner bark creating serpentine galleries (Fig. 3) that eventually girdle and kill the tree. A heavy infestation can kill the tree in 3-5 years. Their distinctive sinuous galleries get larger as the larvae grow. Fully developed larvae are about 25 – 32 mm long (~ 1 inch), and overwinter doubled over into a J-shape prior to pupating in the spring. Larvae are called flatheaded borers for the greatly expanded but flattened thorax (Fig. 2), in which the head is mostly hidden. They typically require 1 – 2 years to complete development while consuming phloem tissues and outer sapwood under the bark. Newly molted adults chew a D-shaped hole (Fig. 4) to exit the tree.

Ash may still be an important urban tree species in some communities. While parasitic wasps are being reared and released in Connecticut for biological control, it is still too early to know what impact they may have in controlling EAB: it is hoped that insecticide treatment programs currently necessary for protecting trees may no longer be necessary once biological control becomes fully established. Urban ash trees are often under varying degrees of decline from a disease and/or other environmental stressors, which predispose them to be killed quickly by EAB. During the triage process for planning tree removals, communities and individual homeowners need to consider prompt removal of dead or dying ash trees,

as dead trees start shedding branches within about nine months. Removal of trees before they are completely dead is safer to the working arborist; once EAB have caused crown dieback in excess of 30% and there are epicormic shoots at the base of the trunk, it is not likely that the tree can be saved. However, trees can be treated with insecticides to protect valuable, uninfested trees or control EAB in lightly infested trees before severe injury symptoms are observed.

Individuals and communities should plan measures they are willing to take to manage their ash resources. Each tree should be analyzed for its value and for the relative cost of removal versus preservation. Ultimately, a plan can be used to optimize the number of preserved trees and to spread out the costs related to EAB infestation over a longer and more manageable interval of time.

Step 1: Inventory the quantity and quality of ash trees on your property. A useful tree value calculator is available online (http://extension.entm.purdue.edu/treecomputer/). Consider a triage process: the following are characteristics that range from placing high value on preserving a tree to considering the tree a current liability. Are the ash trees of historical or special aesthetic value? Does the tree provide shade that is important for reducing air conditioning expenses? Are there other species of trees that would be better suited for the site? Does the tree have structural defects or is already in decline for other reasons that would signal considering removal? Foresters have calculated that benefits provided by an ash tree from shade, reduced need for air conditioning, cleansing the air of particulate matter, and limiting stormwater runoff in an urban environment can be greater than the cost of protecting that tree with a systemic insecticide.

Step 2: Assess the options suitable for preserving trees. Trees can be kept healthy, with judicious and timely use of various insecticides. Options available include contact insecticides (bifenthrin, carbaryl, cyfluthrin, or permethrin) to kill adult beetles as they arrive on the treated plant surfaces, and systemic insecticides, which move throughout the tree in sap to protect phloem from larval feeding. Contact insecticides are relatively inexpensive and are effective, but usually require hiring arborists with hydraulic sprayers, for which application costs are relatively high. Spraying can lead to hazards to non-target organisms from spray drift; for example, spray landing on open flowers is lethal to visiting pollinators, including honey bees. Contact insecticides can be expected to perform moderately well irrespective of the tree size, if the entire tree can be sprayed. Treatment programs with contact insecticides usually involve two sprays, one in late-May and another in early July. Only contact insecticides (not applied during bloom!) should be considered for protecting white fringetrees, as otherwise pollinators could be adversely affected by systemic insecticides present in their nectar.

Systemic insecticides include (1) imidacloprid, which is a relatively inexpensive insecticide easily applied as a basal soil drench, (2) dinotefuran, with intermediate cost, applied as a basal soil drench or trunk spray, (3) clothianidin, similar in mobility to dinotefuran, but with longer insecticidal effects (not labeled for forest use) or (4) emamectin benzoate, which must be applied via trunk injection. The first three products principally work by killing adults that feed on foliage before laying eggs; emamectin benzoate also kills larvae feeding within the tree. Systemic insecticides are diluted within the volume of

the tree's living tissues, and so effectiveness can decrease as tree size increases, unless the dosage of insecticide is adjusted to compensate for this effect. A Connecticut law passed in 2016 requires that most of these systemic insecticides be applied by professional arborists. One registered formulation of emamectin benzoate is not a restricted use pesticide and could be applied by a suitably equipped homeowner to their own trees. Imidacloprid moves relatively slowly into trees and should always be used preventively; it can be effective if applied in the fall or from April to early May. Springtime application is slightly more effective. Dinotefuran and clothianidin are much more mobile within trees. Dinotefuran has effectively been used later in the season after infestations have been detected. To be continuously effective, imidacloprid, clothianidin, or dinotefuran must be applied once per year. Emamectin benzoate has been the most effective active ingredient to target larvae within trees; a single application can be effective for 2 – 3 years, even on large trees.

The impact of systemic insecticides on pollinators, especially of native and honey bees, is an important consideration, because ash produces abundant pollen which is avidly harvested by bees in April. The risk to bees from ash trees treated with systemic insecticides has not been quantified. Risk assessment will require knowledge of the insecticide concentration in pollen, the proportion of ash pollen in the bees' diet, and the sensitivity of various stages of bees and the entire colony to these insecticides. Application of the systemic insecticide with the shortest residual (dinotefuran) *after* ash trees have bloomed should minimize the exposure of bees to insecticides and consequently their risk. Imidacloprid and emamectin benzoate are known to be present in significant concentrations in the year following an application. These products and clothianidin may pose higher risk to bees than post-bloom applied dinotefuran, especially where systemically treated trees constitute a significant early-season pollen source.

Treatment guidelines may change with new research results. To stay informed of the latest information, please visit www.emeraldashborer.info

Fig. 1: Emerald Ash Borer adult

Fig 2: EAB larvae

Fig. 3: S-shaped galleries formed by larvae

Fig 4: D-shaped hole in bark

Photographer: David Cappaert: all photos used with permission.