Does My Ash Tree Have EAB (Emerald Ash Borer)?

Training developed by Julia Dugan & Caroline Kirby
This project was supported by the Resilient Communities Project (RCP), a program at the University of Minnesota that convenes the wide-ranging expertise of U of M faculty and students to address strategic local projects that advance community resilience and sustainability. RCP is a program of the Center for Urban and Regional Affairs (CURA) and the Institute on the Environment.

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**Executive Summary**

**Program Title:** Does My Ash Tree Have EAB (Emerald Ash Borer)?

**Program Purpose:** The purpose of the Emerald Ash Borer (EAB) Education and Tree Treatment/Removal Services Training is to inform the community of North St. Paul about the potential hazards of this species to ash trees in the area. It is also designed to notify residents of the management steps they may take to treat or remove trees. This is an important issue because tree treatment and removal services are an added cost and some community members may be unaware of the consequences EAB can have on the environment. Although ash trees may not show symptoms immediately after being infected, the impact of this issue is immediate. Because EAB adults can only fly a maximum of ½ mile, whole areas can be decimated rather quickly.

The city of North St. Paul is working in conjunction with the Resilient Communities Project who will do a cost-benefit analysis and develop recommendations for managing EAB in the city. RCP coordinated with the University of Minnesota's Organizational Leadership, Policy, and Development course: Designing the Adult Education Program, to develop an informative education program. Graduate students Julia Dugan and Caroline Kirby volunteered to create an education/training program that will inform the community homeowners about EAB risks and available solutions. It is expected that the training will help homeowners become aware of the risks of EAB and motivate them to treat/remove trees on their property.

**Program Description:** The “Does My Ash Tree Have EAB (Emerald Ash Borer)?” informal training will be delivered in-person at local community events. A booth/table will be set up with information, interactive learning activities, and take-away information. Training will be aligned with the culture of the city, which values the small town feel in an urban setting.

Two training locations that reflect these values and have a history of high attendance from members of the community have been selected by the training team. The locations include the Silver Lake Splash (July) and the History Cruze Car Show (June - September). Training will be interactive and engaging for participants and will reach families and active community participants. Activities such as comparing and contrasting ash trees to similar tree species and handling EAB specimens will inform community members and be interactive.

Those who do not attend these training events will receive information
about the threat and effects of EAB and possible solutions in the city’s utility newsletter that is mailed to every residential home. An additional strategy to reach a wider target audience is a mass e-mail that will provide the same information as the utility newsletter.

Pre-reading Material: Emerald ash borer: Minnesota DNR
(http://www.dnr.state.mn.us/invasives/terrestrialanimals/eab/index.html)

City of St. Paul, MN - Official Website - Emerald Ash Borer

Training Developers: Julia Dugan & Caroline Kirby
**Concept Map**

**Lead residents to call to action**
- Understand audience motivations
- Barriers: Cost of removal/treatment
- Protect environment
- Save energy costs
- Residents use tree treatment & removal services
- Where to go for services
- Know if you have an EAB issue

**Educate**
- Identify EAB (differentiate from other insects)
- Consequences of not treating/removing EAB infected ash trees
- Consequences of not treating/removing EAB infected ash trees
- Location: Fun atmosphere, engaging, & familiar to community
- Community events at Silver Lake Splash (July), History Cruze Car Show (June-Sept.)
- Interactive activities (that educate about consequences of EAB and how to identify ash trees)

**Public Engagement**
- Informal training at a local venue
- Resources needed (materials, handouts from MN Dept. of Agriculture, Science Museum, etc.)
- Article in Utility Newsletter
- Mass Email
- Training formats

**EAB Education Training**
Section 1: Needs Assessment

1.1 Organizations Analysis

- **Name of Organizations:**
  Resilient Communities Project, University of Minnesota, City of North St. Paul

- **Overview of Organizations (According to RCP website: http://www.cura.umn.edu/RCP):**

  The Resilient Communities Project (RCP) works with one Minnesota city per year to match community-identified sustainability projects with graduate courses at the University of Minnesota (U of M). RCP’s 2013-2014 partnership is with the city of North St. Paul. During this partnership, classes from the University of Minnesota will be working on twenty-two city projects; one being the Emerald Ash Borer (EAB) project.

RCP is intended to better connect University resources with communities, regional entities, and organizations interested in sustainability in the Twin Cities and other metropolitan areas in Minnesota. RCP provides the community with access to hundreds of students and faculty across a range of academic disciplines, from design, planning, and engineering to business, environmental sciences, and the humanities. In addition, the program offers students real-world opportunities to apply their knowledge and training, as well as to engage with students in other programs and fields of study.

RCP is working with the University of Minnesota’s Organizational Leadership, Policy and Development (OLPD) Department and course OLPD 5204: Designing the Adult Education Program, coordinated by faculty instructor Catherine Twohig, to construct an education program that will create public engagement and alert residents of North St. Paul of the potential impacts of EAB on their private property. Other departments, such as Forestry, are assisting RCP with different aspects of the project to help gain an interdisciplinary approach and understanding of the next steps for this project, ideas for possible solutions, etc.

- **Mission of the Organizations:**

  The mission of the Resilient Communities Project (RCP) is to connect communities in Minnesota with the wide-ranging expertise of University of Minnesota faculty and students to address pressing local issues in ways that advance sustainability and resilience.
The mission of the University of Minnesota-Twin Cities is founded in the belief that all people are enriched by understanding, is dedicated to the advancement of learning and the search for truth; to the sharing of this knowledge through education for a diverse community; and to the application of this knowledge to benefit the people of the state, the nation, and the world.

- **Business Strategy of the Organizations:**

  RCP is a direct response to the growing need to find sustainability solutions to issues facing our communities, by connecting the wide-ranging expertise of U of M faculty and students with cities, businesses, and organizations in Minnesota. RCP connects the project needs with existing graduate and upper-level undergraduate courses at the U of M. Doing so, U of M students are able to apply theory to practice, gain analytical skills, commit to public engagement and community sustainability, and are dedicated to the advancement of learning.

- **Analysis to Align Training with Business Strategy:**

  The EAB educational training program, created by the OLPD 5204: Designing the Adult Education Program course participants and training coordinators Julia Dugan and Caroline Kirby, responded to North St. Paul’s current and future needs as a community. When preparing this program, training coordinators considered the values and demographics of the North St. Paul community, RCP’s desired outcome for the education training program, and the OLPD course objectives and learning content/models. The training designers Julia and Caroline developed this training and activity manual, poster, and templates for RCP and the city of North St. Paul to use and act as a reference for future trainings.

1.2 Person Analysis

- **Training Audience:**

  According to the US Census Bureau, there are 4,615 homes in North St. Paul. The training’s target audience is private household owners that have ash trees on their property and could be at risk of EAB. Since there is a wide range in age groups (see chart below) and individuals are volunteering to attend the trainings, training coordinators Julia and Caroline designed an interactive and entertaining training activity for local community events that will captivate the target audience and lead them to a call to action item (tree treatment/removal if the resident has an ash tree).
Analysis of Person Characteristics:

Demographics: The median age in the city was 38.5 years. 22.7% of residents were under the age of 18; 9.9% were between the ages of 18 and 24; 25.3% were from 25 to 44; 29% were from 45 to 64; and 13.1% were 65 years of age or older. The gender makeup of the city was 49.1% male and 50.9% female.

Access to Technology: Many older city residents do not have computer access. An online training program is not feasible or effective for reaching all residential homeowners.

Knowledge: Roughly one-third of the trees in North St. Paul are ash, including 80% of the trees in parks and 80% of the trees on the north side of the city. Residential homeowners are not aware of the risk of EAB, how to identify EAB from other insect species, or how to identify ash trees from other tree species. Residents may not be aware of solutions to EAB, such as tree treatment or tree removal, or be aware of local businesses that can provide these services.

Attitude: The added cost of tree treatment and/or removal may be a deterrent/obstacle for motivating residents to address the EAB issue.

1.3 Task Analysis

- Trainee Job Description:

<table>
<thead>
<tr>
<th>Job Title: Training Coordinators</th>
</tr>
</thead>
</table>

The Training Coordinators are responsible for:
- Preparing for the event: Training coordinators need to plan the marketing materials, training and activity materials, coordinate logistics, and design a budget.
- Getting the word out to your community: Posters and materials will be posted in the community to inform city residents of program event details.
- Site Preparation: The training coordinators should contact the appropriate people for site use, custodial needs, equipment needs, etc. and perform a site visit if appropriate.
- Post-event follow-up: Send thank you letters to sponsors for their dedication to the corresponding training events.
1.4 Economic Analysis

For Residents: Ash tree treatment and removal for residents can be costly. For example, the average cost to remove a tree ranges from $500 to $1,000.

This particular training is free and does not require enrollment costs for the community. The training will be informal and will be conducted at various local community events.

For RCP and city of North St. Paul: Samples of the ash tree and EAB have been donated from the U of M Forestry Department. Brochures and handouts will be provided by the U of M Forestry Department and Minnesota Department of Agriculture at no cost.

Julia and Caroline created a project poster for the Resilient Communities Project End-of-Year Event. The signed contract was submitted so that the team could be paid for the poster.

Indirect costs for the organization include staff members’ costs and time spent on reviewing the project and implementing the EAB education program.
Section 2: Design and Development

2.1 Training Objectives

- Training will inform North St. Paul residents about the potential hazards EAB to ash trees in the area and the steps community members can take to treat or remove affected trees.
- Participants will identify emerald ash borer specimens, damage, and symptoms in ash trees.
- Participants will identify ash trees and similar tree species that are commonly confused with ash.
- Training will lead residential homeowners to explore their property, identify ash trees, and examine them for a possible threat or symptoms of EAB.
- North St. Paul residents will contact local tree treatment and removal services to treat and remove infected ash trees from their private property, if needed.

2.1 Learning Theory

To ensure high audience participation, two locations were chosen for the training. These locations were picked because they are engaging, would reach multiple audience demographics, and are accessible to the entire city.

When designing the training, Goal Setting Theory was kept in mind. According to Raymond A. Noe in *Employee Training and Development*, “goal setting theory suggests that learning can be facilitated by providing trainees with specific challenging goals and objectives” (Noe, 2013, pg. 158). All training participants will be given specific steps to go through when they inspect trees on their own property. The specific steps are in the form of an EAB checklist (accessible from and provided by the MN Department of Agriculture). This checklist will enable participants to determine if their ash trees have EAB and will provide contact information for local tree services.

2.3 Training Method

Since the training will be held at local community events that have a high residential participant attendance, the education program will consist of a short informative presentation (4-5 minutes) followed by several interactive activities (4-5 minutes). The informative talk will be an interactive dialogue with participants that includes references to brochures, images, ash tree samples, and EAB samples. Learning will be reinforced through questions; interactive activities such as comparing ash tree samples to similar tree species; and an optional trivia game about EAB and ash trees. The trivia game was provided by Sean A. Peterson, Technician for the University of Minnesota: Forest Resources, Tree Inspector Program. To enable participants to apply what they have learned, they will be given a checklist of next steps to determine if their
ash trees at home are infected with EAB and, if they are, who to contact for tree services.

### 2.4 Lesson Plan Summary

<table>
<thead>
<tr>
<th><strong>Course Title</strong></th>
<th>Does My Ash Tree Have EAB (emerald ash borer)?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lesson Length</strong></td>
<td>9-10 minutes</td>
</tr>
<tr>
<td><strong>Target Audience</strong></td>
<td>Residents and homeowners of the city North St. Paul</td>
</tr>
<tr>
<td><strong>Prerequisites</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Instructor</strong></td>
<td>Informal training where participants will be standing in front of or to the side of a booth/table in either a fan-type or a horseshoe standing arrangement. In the fan-type arrangement, participants will be able to see the information and samples from any point in the area. The horseshoe arrangement is similar in structure, but is ideal for trainings with limited presentation and high interaction. See appendix B for this training’s area arrangement.</td>
</tr>
<tr>
<td><strong>Equipment Needed</strong></td>
<td>Table, laptop for the trivia game, EAB larvae and adult samples, brochures/handouts.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Lesson Topic</strong></th>
<th><strong>Instructor Activity</strong></th>
<th><strong>Learning Activity</strong></th>
<th><strong>Time (minutes)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome &amp; overview (state why the training is important)</td>
<td>Presentation</td>
<td>Listening and Watching</td>
<td>1</td>
</tr>
<tr>
<td>Background of EAB and its threat to ash trees</td>
<td>Presentation</td>
<td>Listening and Watching</td>
<td>2</td>
</tr>
<tr>
<td>How does it affect participants?</td>
<td>Presentation, Answer questions</td>
<td>Listening, Watching, Ask questions</td>
<td>2</td>
</tr>
<tr>
<td>Examine EAB insect and larva samples, compare ash trees to similar-looking tree species</td>
<td>Presentation, Answer questions</td>
<td>Listening, Watching, Practice, Ask questions</td>
<td>3</td>
</tr>
<tr>
<td>Closing &amp; next steps (explain Does my tree have EAB? checklist and available resources for tree services)</td>
<td>Presentation, Answer questions</td>
<td>Practice, Ask questions</td>
<td>1</td>
</tr>
<tr>
<td>Trivia game about EAB and ash trees (optional)</td>
<td>Answer questions</td>
<td>Practice, Ask questions</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Time</strong></td>
<td></td>
<td></td>
<td>9-10</td>
</tr>
</tbody>
</table>

See Appendix C for the EAB training script.

**Note:** We want to provide information to the community, but still keep the dialogue and interaction with residents informal. To prevent the material from sounding too rehearsed, please use the training script as a guide for your conversation and allow for flexibility.
2.5 Learning Activities

Participants will listen during the presentation portion of the training, but are encouraged to ask questions at any time. Interactive activities that follow the presentation will inform, engage, and entertain the participants. The sites at which the presentations will take place were chosen because they are similar in nature (entertaining community events).

By examining adult and larval samples of EAB, ash trees, similar tree species, and by applying what they learned in the trivia game, participants will feel more at ease and open to the training’s call to action items (identifying ash trees on the private home property and tree treatment and tree removal, if needed).

2.6 List of Job Aids

- EAB adult and larvae samples
- Ash tree and similar tree species samples (black walnut, boxelder tree, American elm)
- EAB trivia game provided by Sean A. Peterson, Technician for the University of Minnesota: Forest Resources, Tree Inspector Program:
  https://netfiles.umn.edu/users/pete7795/eab trivia challenge for stsc.ppsx
- Does my tree have EAB? Checklist provided by the Minnesota Department of Agriculture:
  http://www.mda.state.mn.us/plants/pestmanagement/~_/media/Files/plants/eab/eab_doihaveit.ashx
- Brochures from U of M Forestry Department and Minnesota Department of Agriculture
- Handouts: Common Problems of Ash Trees/Ash Tree Identification; Distinguishing Ash from other Common Trees; Ash Tree Identification Bulletin retrieved from:
  http://www.emeraldashborer.info/identifyashtree.cfm#sthash.3fGDJciu.dpuf
- Poster displaying EAB information, ash trees, and other, general information

Minnesota Department of Agriculture Contact for brochures, materials, poster reservations:
Jennifer Dippel (phone: 651-201-6097); submit information request at least a couple of days in advance.
Section 3: Implementation

This training session will occur as an informal training to be delivered in-person at local community events. Training will be aligned with the culture of the city, which values the small town feel in an urban setting. Two training locations have been selected by the training team that reflect these values and have a history of high attendance from members of the community. The locations include the Silver Lake Splash (July) and the History Cruze Car Show (June-September). See contact information for the event coordinators in Appendix A.

Training will be interactive and engaging for participants and will reach families and active community participants. A booth/table will be set up with information, interactive learning activities, and take-away information.

3.1 Presentation Materials

- Table
- Samples of adult and larvae EAB, ash trees, and similar tree species
- Laptop
- EAB trivia game provided by Sean A. Peterson, Technician for the University of Minnesota: Forest Resources, Tree Inspector Program
- *Does my tree have EAB?* checklist from the Minnesota Department of Agriculture
- Brochures from U of M Forestry Department and Minnesota Department of Agriculture
- Poster displaying EAB, ash trees, and general information

3.2 Learning Activity

Activity 1: Examine and compare samples of EAB (adult and larvae), ash trees, and similar tree species. Refer to EAB Training Script for points of interest and information. The conversation should not be completely rehearsed and should allow for flexibility. See Appendix C for the EAB training script.

Objective: Participants will be able to identify EAB and ash trees and tell the difference between the ash trees and similar tree species.

Procedure (Facilitator):

1. Highlight EAB characteristics/properties while showing participants EAB adult and larva samples.
2. Present the characteristics of ash trees
   - Show ash tree sample that has been infected by EAB.
   - Have participants physically pick up and compare ash trees to similar tree species.
   - Point out the differences between tree species.
Activity 2: EAB trivia game (optional)

Objective: Participants will recall what they learned via an EAB trivia game

Procedure (Participants):

1. The participant will click on any category number to view a question then click on the arrow at the bottom of the screen to view the answer.
2. Facilitator(s) will be available to answer questions and clarify information from the trivia game.

3.3 Facilitator’s Guide

<table>
<thead>
<tr>
<th>Topic</th>
<th>Activity 1: Samples (interwoven in above dialogue)</th>
<th>Activity 2: EAB Trivia game (optional)</th>
</tr>
</thead>
</table>
| Welcome & overview (state why the training is important) | ● Welcome  
● Introduce RCP and how the organization is helping the city of North St. Paul  
● Ask if or what the participant has heard about EAB  
● General overview of why it is important to know about EAB and benefits of treatment and removal of ash trees (ex: energy savings for home if residents save or replant trees that provide shade to a home) | ● Direct participants to the trivia game and let them know you’re available for questions |
| Background of EAB and its threat to ash trees | ● Explain characteristics of EAB, show samples of larvae and adult EAB  
● Explain why EAB is harmful to ash trees and the environment, show samples of ash trees and similar tree species | |
| How does it affect participants? | ● Energy cost for residential homeowners  
● Dying trees can be a physical hazard  
● Impact to the environment | |
| Activity 1: Samples (interwoven in above dialogue) | ● Examine EAB insect and larva samples  
● Compare ash trees to similar tree species | |
| Closing & next steps (explain Does my tree have EAB? checklist and available resources for tree services) | ● Thank participants for stopping by and learning about EAB and ash trees  
● Provide Does my tree have EAB? checklist and go through general next steps  
● Provide list of local tree services that can treat/remove infected ash trees | |
3.4 Learner’s Guide

Since the training will be informal, short, and interactive, a formal learner’s guide will not be distributed. Brochures, the *Does my tree have EAB?* checklist, and other takeaways will be available for the public to take with them.
Section 4: Evaluation

The program objectives should match the evaluation method. Since this training is informal and it is difficult to gage how much the participants will use the information learned, apply what they have learned, and act if needed, evaluation of the program’s overall effectiveness can be challenging.

The Kirkpatrick method of evaluation is a widely used tool and the different levels will serve as checkpoints for the education program’s formative and summative evaluations.

4.1 Level 1 – Reactions

Reactions to the training will be collected via qualitative measures at the conclusion of the training. Following the training, facilitators will ask participants for their reactions and concerns to the presented program. From the given reactions, facilitators can discern if the information has been well received. Based off follow-up questions asked by participants (example: Do you have more information? Who are the local tree service companies?), facilitators will gain a better idea of whether the participants are likely to go home, examine their trees, and do the follow-up procedural steps for EAB as outlined in the checklist.

4.2 Level 2 – Learning

Because the locations at which the training is being held are fun, community events, the EAB trivia game is an optional activity to end the program. We are not requiring participants to participate in the trivia activity because we understand that families may not have enough time, children may not have a long attention span, etc.

If utilized, the trivia game can serve as a measuring tool to see how much information the participant learned in the training. Based on the total amount of correct questions and follow-up to questions answered incorrectly, facilitators can estimate/assess the achievement level of cognitive outcomes.

4.3 Level 3 – Transfer

Since there is no planned follow-up after the training, facilitators can deduct from the discussions with participants, learners’ attitudes, and expressed motivation how much of the information has impacted them and the level of learning transferred.

4.4 Level 4 – Results

The city of North St. Paul has no current estimate of the number of residential homeowners with ash trees on their property. Since we do not know who has ash trees on their property, there is no way of knowing the exact return of investment (ROI) from the training.
While it will be difficult to identify exactly who decided to use tree services (EAB treatment and tree removal services) within North St. Paul, one quantitative way to determine if the training was successful is to look for increased requests for tree services occurred after the training. If there is an increase in tree treatments and removals, it can be assumed that the training was successful. This assessment will not be difficult because infected ash trees may only be removed within the local quarantine area and there are only 8-9 tree service companies that may be used by North St. Paul residents.
Appendix

Appendix A: References


Contacts for brochures/information and events:

1. Minnesota Department of Agriculture Contact for brochures, materials, poster reservations: Jennifer Dippel (phone: 651-201-6097); submit information request at least a couple of days in advance.

2. Silver Lake Splash Event Coordinator: Mary Kvaal, Human Resources Administrator at Aetrium (phone: 651-773-3677 Ext. 677, fax 651-770-7975, and email: mkvaal@aetrium.com).

3. History Cruze Car Show, June 6 – September 19, 2014 from 6:00-10:00pm; City Contact: Laurie Koehnle (phone: 651.747.2504, email: laurie.koehnle@ci.north-saint-paul.mn.us) and Bruce and Sandy Fabio (phone: 651.253.1706, email: historycruzer@historycruzer.com).
Appendix B: Area/Booth Layout

Key:  
- Poster
- Participants

![Diagram of Booth Layout]

Does Your Ash Tree Have EAB?
Emerald Ash Borer Information
Resilient Communities Project & North St. Paul

Table w/ samples & brochures

Informational EAB & Ash Tree Poster
Appendix C: EAB Training Script

It’s small, it’s green, and they come in great numbers! No, I’m not talking about a fictional alien invasion. I’m referring to the tiny, green beetle, native to Asia and Eastern Russia, called the emerald ash borer (scientific name *Agrilus planipennis*). Have you heard about the emerald ash borer?

**Yes**- Perfect! So you are familiar with the EAB. Today, we are going to learn more about this insect species, how to identify it, and how to identify ash trees from similar tree species.

**No**- That’s okay. Today we are going to learn more about this insect species, how to identify it, and how to identify ash trees from similar tree species.

The emerald ash borer, also known as EAB, is one of the most destructive forest pests ever found in North America. It kills ash trees, and it does so in great numbers. Already, it has killed millions of ash trees in North America and has become a great environmental concern for the ash tree species. Without action, ash trees that may reach devastatingly low numbers within the near future. In addition, the scope of this problem will reach billions of dollars nationwide if not dealt with. State and federal agencies have made this problem a priority and so should we at the individual level.

The Emerald Ash Borer was believed to have been brought to America unintentionally in ash wood which was used to stabilize crates during shipping. It was first discovered in Michigan in June 2002. In Minnesota, EAB was discovered in the Ramsey, Hennepin, and Houston counties in 2009. It is important to be aware of this small yet devastating species because it has the potential to make a huge effect on Minnesota's landscape and the 998 million ash trees that grow in our cities and forests.

Minnesota has one of the largest populations of ash trees in the nation. To help become part of the solution, it is important to be able to identify this insect species and the tree species that are on private property. The ability to identify trees and the symptoms of EAB will enable residents to realize which trees are in danger of being infected and take the necessary tree treatment or removal steps.

On private property it is especially important that ash trees are identified because if an infected ash tree becomes unstable and dangerous to have on the property, it becomes a personal concern. On the other hand, the shade, protection, and energy conservation a healthy tree can provide for a house is invaluable. Finally, healthy trees can add value to a home by increasing its curb appeal.

When identifying EAB, it is important to be able to identify the larva and the adult insect. I have a sample of an EAB larva ([action: show EAB larva samples]). On page two of the handout *Common Problems of Ash Trees*, the EAB larva is also illustrated in picture #10 ([action: show picture in Common Problems of Ash Trees handout]).
This creamy white larva, which has 10 bell-shaped abdominal segments and a pair of small brown structures, will bore through the ash tree bark where they feed on the inner bark and phloem, creating “S”-shaped galleries under the bark. These galleries prevent nutrients from reaching the top parts of the tree. Here is a sample of what the bark of an infected ash tree looks like on the inside when it is infected by the EAB larva. It is also illustrated in picture # 9 (action: show picture in Common Problems of Ash Trees handout).

This identification feature is good to know because if you are cutting firewood and see this distinctive feature in the tree, you know you have an EAB problem. Woodpeckers also enjoy eating EAB larvae so if you see large numbers of woodpecker holes in your tree, you may have an infested tree.

Here is an example of what an adult EAB looks like once it completes its life cycle (action: show adult EAB samples). The adult EAB is also illustrated in picture #7 on page two of the handout Common Problems of Ash Trees (action: show picture in Common Problems of Ash Trees handout). It may take one or two years for a larva to complete its life-cycle into an adult. The amount of time needed depends on 1) the timing of egg deposition, 2) the health and stress level of the tree, and 3) local temperatures.

The adult EAB is a dark, metallic-green color, bullet-shaped, and about 8.5 millimeters long. The body is narrow and elongated, and the head is flat with black eyes. Adults begin to emerge from the trunks of ash trees after the accumulation of 400-500 growing degree days with a base degree of 50°F. In Minnesota that time is usually May or early June. To emerge from the tree, adults chew D-shaped exit holes through the bark (action: show ash tree with exit holes), which are also illustrated in picture #8 (action: show picture in Common Problems of Ash Trees handout). In addition, they are capable of immediate flight upon emergence. After emergence, adults fly into the ash canopy where they feed on leaves throughout their lives.

If you refer to pictures #5 and 6 (action: show picture in Common Problems of Ash Trees handout), you can see the effect of EAB on ash trees. The canopy of infested trees begins to thin above infested portions of the trunk. Major branches will die because the EAB destroys the water and nutrient conducting tissues under the bark. Sometimes ash trees push out sprouts from the trunk after the upper portions of the tree dies. Trees that have these signs and are heavily infested will die.

EAB adults can fly a maximum of ½ mile from the tree from which they emerged and rely on other means of transportation such as the movement of firewood to spread. Many infestations were started when people moved infested ash nursery trees, logs, or firewood into un-infested areas. To reduce further spread, shipments of ash nursery trees and logs with bark are now regulated, and transporting firewood outside of the quarantined areas is illegal. Unfortunately, the transport of infested firewood remains a problem. That is why it is especially important burn firewood where you buy it and not take any with you outside of the area.
For those who are not a forestry expert like me, it may be hard to identify ash trees from similar tree species. Many trees look very similar, but the ability to distinguish various species of trees on your property enables you to identify and examine your ash trees for signs of infection.

Now, we are going to learn about which tree species look similar to ash trees and how you can tell them apart. If you have trees on your home property you can refer to the handouts *Ash Tree Identification* and *Distinguishing Ash from other Common Trees*, to help you identify ash trees.

**Comparison of Ash Tree to Other Tree Species**

**Sample: Green ash/ash bark beetle**

Green ash trees are one of the most common ash trees planted. Ash is recognized by its compound leaves, which means they are arranged opposite of one another on the branches.

The impression in the bark is what makes this sample of tree so special. If you look closely, you can see small holes in the bark. While it may be tempting to think these are EAB exit holes, they were actually made by our native ash bark beetle.

Galleries can be "S-ish but you will only find small holes in the bark and they will not be "D" shaped as in EAB. These beetles aren't of much concern, according to a random MN Department of Agriculture sample of nearly 2,000 Minnesota ash trees in which ash bark beetles were found in about 70%. People are more likely at this point to find a native bark borer than Emerald ash borer in this area.

**Sample: Boxelder tree**

The boxelder tree, also known as the ash-leaved maple, is one of the most common and adaptable urban trees in North America. Similar to the ash tree, the twigs and buds are opposite; with a single bud on the end of the twig.

The boxelder tree may also be mistaken for a juvenile green ash tree because the bark characteristics of ash can vary greatly by age. For example, the boxelder tree is usually much smoother when very young, slightly "furrowed (groove, or narrow depression)" when juvenile and much more deeply furrowed after the first 20 years or so. This is the more signature "diamond" or "canoe" like pattern people use to identify it.
Sample: Black Walnut tree

Black walnut can be easily mistaken for ash. However, the black walnut tree has fruit that is large, dark, and has a brown nut inside a green husk.

The black walnut leaves are also compound like the ash. When compared to the ash tree, we can see that this tree has an alternate branching habit, its twigs are split lengthwise, and it has a chambered pith (core of the tree). Note the "semi-hollow pith."

Note: In trees, the pith is generally present in young growth. However, in the trunk and older branches the pith often gets replaced by xylem. The black walnut tree has distinctive chambered pith with numerous short cavities.

Sample: American Elm

Next, we have the American elm with the impression of the European elm bark beetle (EEBB). EEEB carries the fungus that causes Dutch elm disease. It is important to note that the native elm bark beetle does not spread Dutch elm disease.

The American elm galleries run with the wood grain. This bark-less sample of American elm could easily be mistaken for ash and the insect damage, for Emerald ash borer. The difference is the Emerald ash borers "S" shaped galleries.

How Can I Help?

Now that you’ve learned how to identify both adult and larvae EAB, their symptoms, and the actual ash trees, you’re probably wondering what steps you should take next. To begin, walk around your property and take an inventory of the ash trees there. Trees can be saved if they are healthy and vigorously growing, with more than half their leaves; enhancing the landscape; valuable to the owner; and showing only a few outward signs of EAB infestation. Trees should not be saved if they are unhealthy, with more than half their leaves missing; planted in poor sites or are not important to the landscape; or are showing many outward signs of EAB infestation, such as woodpecker damage, bark splits, and water sprouts at the tree base.

If you would like to save your trees, you have the option of treating them yearly with an imidacloprid-containing insecticide. You may complete this treatment yourself if your tree has a trunk less than 20 in. diameter at breast height (DBH). Trees can be treated with an over-the-counter soil drench product containing 1.47% imidacloprid and should be treated between April 1st and May 15th to be the most effective. It is important that all insecticide label directions are
followed. A professional tree care provider should be hired if the tree has a trunk greater than 20 in. DBH or if treatment will take place later in the year (different control materials must be used).

If you are not interested in saving your trees and would like to remove them, you can hire a tree care professional to do the job. Removing unwanted ash trees before they die can actually save you money and you may want to think about teaming up with your neighbors to seek discounts for managing all your trees at once! If you choose to remove your tree, the wood does not always have to go to waste. You may keep the wood to use in your own home or for landscaping, sell your ash wood to a reputable industry, dispose of your tree at a local wood disposal site (remember, infested wood may not leave the quarantine site), provide materials to local woodworkers or donate the wood within your community.

Whatever route you choose, you have the power to be a major player in the emerald ash borer eradication efforts. By not allowing any infested wood to leave the quarantined region, you are helping the state with the most difficult part of the battle.

Thank you for listening and learning!
**Common FAQ: How has the extreme cold this winter affected the EAB?**

Winter mortality for emerald ash borer is temperature dependent. The larvae can supercool to a certain point, but will die if they freeze. There is variability in tolerance among individual insects. Extreme cold might slow further damage, but it usually takes a sudden blast of cold to actually kill an insect. If the temperature drops slowly, the insect is able to regulate its metabolism with the change in temperature and survive the temperature drop. That being said, temperatures 30 degrees below zero can kill 98% of larvae. However, two percent that are still left will eventually reproduce, multiply and re-infest the area.

A recent study from the Forest Service in Minnesota showed that 5% of the insects die at 0F, 34% at -10F, 79% at -20F and 98% at -30F. However, there is the question of what temperatures the insects actually experience, since they spend winter under the bark of trees, and some of them close to the ground, where they may be insulated by the bark itself and possibly by the snow. This insulation effect can have a substantial effect if overnight minimum temperatures take a brief plunge and recover quickly. In such cases minimum temperatures under the bark can be 2-7F warmer than air temperature. That being said, with prolonged cold lasting all day and all night, then the insulating effect of bark becomes minimal. Also, the few insects that do survive the upcoming cold spell might be more resistant to cold than an average insect, and give rise to a new generation of more cold-tolerant insects, although we don’t know much about this type of selection in emerald ash borer.

Source:

Signs and Symptoms of the Emerald Ash Borer

Mary Wilson, MSU Extension. Eric Rebek, Michigan State University Dept. of Entomology

**Adult**

• Bright, metallic green (Figs. A, B).
• 1/2 inch long, flattened back (Figs. A, B).
• Purple abdominal segments beneath wing covers.

**Larva**

• Creamy white, legless (Fig. C).
• Flattened, bell-shaped body segments (Fig. C).
• Terminal segment bears a pair of small appendages.

Canopy Dieback

• Begins in top one-third of canopy (Fig. D).
• Progresses until tree is bare (Fig. E).

Epicormic Shoots

• Sprouts grow from roots and trunk (Figs. F, G).
• Leaves often larger than normal.
**Bark Splitting**

- Vertical fissures on bark (Fig. H) due to callous tissue formation (Fig. I).
- Galleries exposed under bark split.

**Serpentine Galleries and D-shaped Exit Holes**

- Larval feeding galleries typically serpentine (Fig. J).
- Galleries weave back and forth across the woodgrain.
- Packed with frass (mix of sawdust and excrement).
- Adults form D-shaped holes upon emergence (Fig. K).

**Increased Woodpecker Activity/Damage**

- Several woodpecker species (Fig. L) feed on EAB larvae/pupae.
- Peck outer bark while foraging (Fig. M).
- Create large holes when extracting insects (Fig. M).
What Is EAB (Emerald Ash Borer)?

The emerald ash borer is an exotic, invasive wood-boring insect that infests and kills native North American ash trees both in forests and in landscape plantings. It has the potential to virtually eliminate ash from North American forests, with dramatic effects on ecosystem processes as well as plant and animal communities. With the highest volume of ash trees in the U.S. and nearly a billion facing devastation, Minnesotans need to take this environmental threat seriously.

How does this affect me?

- According to the Minnesota Department of Agriculture, the potential economic and environmental impacts of losing these ash trees are substantial. The cost of removing and replacing a single tree can range from hundreds to thousands of dollars.

- Protecting your trees now can help you save money and ensure that you maintain a beautiful landscape! Healthy ash trees surrounding your home can protect it and offer shade that can help cool your home in the summer months, thus saving money on your AC bill as well as preventing tree removal costs.

How Can I Help?

Walk around your property and take an inventory of the ash trees on your property. Trees can be saved if they are healthy and vigorously growing, with more than half their leaves; enhancing the landscape; valuable to the owner; and showing only a few outward signs of EAB infestation. Trees should not be saved if they are unhealthy, with more than half their leaves missing; planted in poor sites or are not important to the landscape; or are showing many outward signs of EAB infestation, such as woodpecker damage, bark splits, and water sprouts at the tree base.

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