NEWS RELEASE • Ohio Department of Agriculture

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Columbus, Ohio: March 31, 2007

PRESS RELEASE

Among invasive insects, the metallic-green beetle, **Emerald Ash Borer (EAB), poses one of the greatest threats** of becoming a major pest in the United States. Since its discovery near Detroit in May 2002, it has killed millions of ash trees in Michigan and surrounding states, including Ohio. Researchers are working to find control methods to prevent EAB from spreading throughout the United States.

In the lifecycle of EAB, eggs are deposited on the bark of an ash tree. These eggs hatch into larvae that tunnel into the cambium layer, killing the tree by cutting off its supply of food and water. Thousands of them feed under the bark, killing the tree in three to five years. As a mature adult, the pest bores a D-shaped hole to escape the tree and move on to infest more trees. Since EAB does not have any natural enemies in North America, there is no way to stop it from destroying the entire ash tree population. However, many people are working on solutions to keep EAB from spreading. One solution to stop the spread of EAB is to enforce laws that prohibit the transportation of firewood out of infested areas by unknowing campers.

EAB is found naturally in Asia. Experts believe it was accidentally introduced here by wooden packing material imported from China. An ash tree is a valuable hardwood that provides a habitat for wildlife and wood for handles, oars, baseball bats, furniture, and baskets. Ash trees are also valued for their shade and beauty. Perhaps researchers and scientists will discover a way to save the ash tree population from EAB.

EAB ONLINE

Go to:
• Quarantine Map
www.ohioagriculture.gov/eab/plnt-eab-maps.stm

ID Your Trees

Look at your tree. Use drawings or words to identify the tree.

Tree Investigator

Name_____

Date_____

Tree Name	Bark	Leaf	Fruit	Branches	Ash Tree?
Ash	Tight with diamond-shaped ridges	Compound 5-11 leaflets	One-winged, flat	Opposite branching	☒ Yes ☐ No
Tree 1					☐ Yes ☐ No
Tree 2					☐ Yes ☐ No

A tree investigator must look closely at trees. Did you find any ash trees? ☐ Yes ☐ No
If yes, look for signs of distress. Do you see:

- D-shaped holes in the bark? . . . . . ☐ Yes ☐ No
- Sprouts growing up from the bottom of the tree? . . . . . ☐ Yes ☐ No
- Thinning leaves at the top of the branches? . . . . . ☐ Yes ☐ No

EAB ONLINE

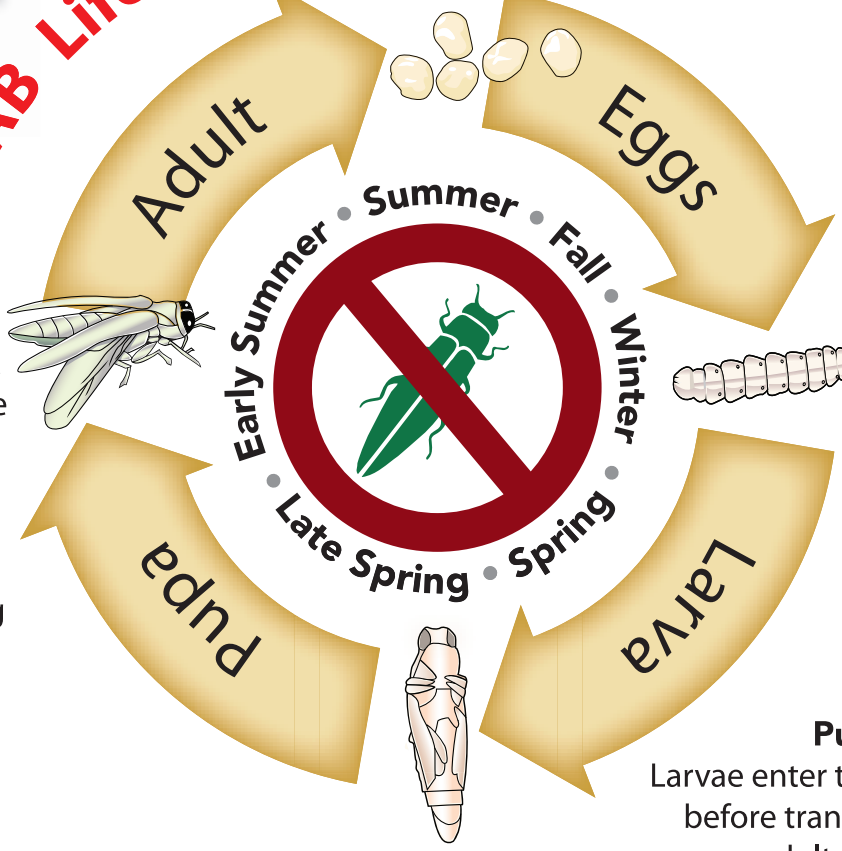
Play the **Tree ID animation game** at The National Arbor Day Foundation Web site: *www.arborday.org/trees/wtit/*

Dichotomous Tree Key activity go to *www.dnr.state.wi.us/org/caer/ce/eek/veg/treekey/needle.htm*

The Ohio Department of Agriculture does not endorse or approve any commercial Web sites.

ID the Pest

EAB Life Cycle



Eggs
The female lays 60-90 eggs on the bark of ash trees.

Larva
Eggs hatch and larvae eat through the bark. During summer and fall the larvae feed in S-shaped paths.

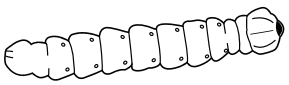
Pupa
Larvae enter the pupal stage before transfoming into adult beetles.

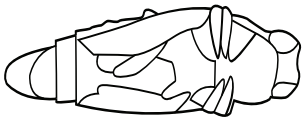
Adult
Beetles emerge through D-shaped holes and the cycle begins again. Adults feed on leaves at the top of the trees. They begin mating and laying eggs for 3-4 weeks before dying.

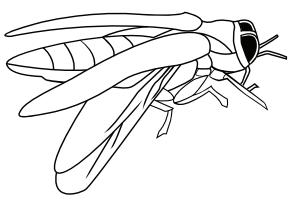
A closer look

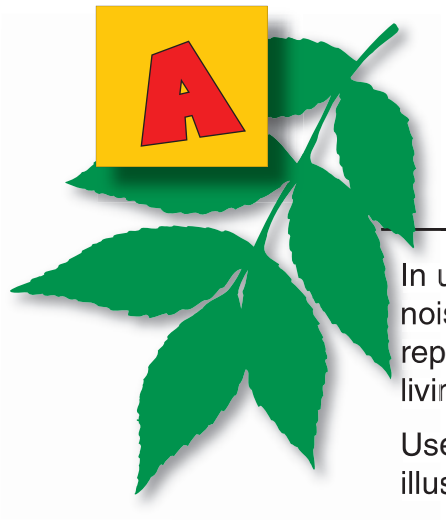
- Color, label and cut out the life cycle cards.
- Work as a team. Hold up the card that answers each question.

1. Which insect stage creates the D-shaped hole in the bark?
2. Which stage is active in the fall?
3. Put the cards in order from the beginning of the cycle.
4. Ask two more questions that can use the life-cycle cards for the answers.









Community Impact

The Urban Tree

In urban areas, trees provide beauty and shade and serve as wind and noise barriers. They also filter air pollutants, help conserve energy, and replenish oxygen. Trees can provide important wildlife habitat for birds living in urban areas. Trees increase property values in neighborhoods.

Use a digital camera and a photo editing program, or draw sketches to illustrate what happens to a neighborhood when trees are removed.

1. Take a photo or draw a picture of trees in your neighborhood. Choose a view that shows the tree canopy (overhead leaf cover) lining the street or shading a yard.

2. Imagine the neighborhood without trees. Create a second view by removing just the mature trees from your photo or sketch. Next, create a view in which all trees are removed.

3. Take a photo in a neighborhood where you have identified ash trees. Check to see if the ash trees show signs of distress such as:

- Branches without leaves
- Sprouting at bottom of trunk
- D-shaped exit holes

Take photos illustrating the signs and symptoms of distress. Produce a final image by removing all of the ash trees from the original picture.

4. Create a brochure, flyer, or news article to share your photos and the information you have learned. Address the following questions:

What visual changes occur in the neighborhood when trees are removed?

_____

_____

_____

How does the removal of the tree canopy affect the wildlife or temperatures in the area?

_____

_____

_____

What is the economic impact related to tree removal: cost of heating, air conditioning, tree replacement, cost of removal, property values, etc.?

_____

_____

_____

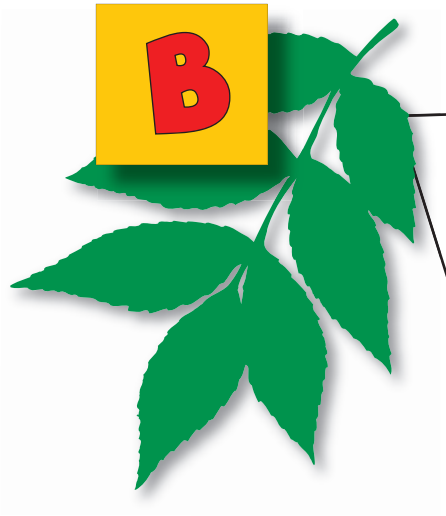
For information on urban forests tree canopy goals:

- www.americanforests.org/resources/urbanforests/analysis.php
- www.americanforests.org/resources/urbanforests/treedeficit.php

For information on photo vanishing tools:

- www.graphicssoft.about.com/od/photoshop/ss/cs2vanishing.htm
- www.gimp.org/about/

The Ohio Department of Agriculture does not endorse or approve any commercial Web sites.



Materials
- EAB Background Information Cards (8)
- Student Research Log - 1 per student

Resources
- Press release - copy available at EAB Online
- Additional Fact Sheets
  EAB—ashalert.osu.edu/what_is_eab.pdf
  Invasives—www.dnr.state.oh.us/dnap/invasive and www.invasivespeciesinfo.gov

Collaborative Learning

Emerald Ash Borer and other Non-Native Species

Introduction

The following information in FAQ format can be used in a variety of ways. Organized as a collaborative learning lesson, it provides the opportunity for students to teach others what they know about Emerald Ash Borer (EAB). Students can present their findings as a panel discussion or a simulation of a city council presentation. This FAQ format can also be used by students to research other exotics and non-native species.

Activity

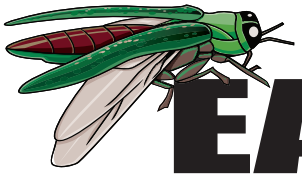
1. Divide the class into eight cooperative learning groups assigning each group one EAB Background Information section. Students will become "experts" on their assigned section, and then, by re-grouping, they will teach their peers what they have learned.
2. Provide each student one copy of an **EAB Research Log** to guide their research.
3. Allow 10 minutes for students to read EAB Background Information sections and record the main idea and 3 important details on Part 1 of the Research Logs.
4. While students work, visit groups and assign each student a number by counting off.
5. Once the experts are prepared, students form new groups according to assigned numbers: all the "1's" will gather, all the "2's," etc. Each group should contain an "expert" from each cooperative learning group.
6. Each expert should share newly acquired knowledge in 1-2 minute presentations.
7. After the presentations, students discuss the problem and prepare Part 2 of the Student Research Log.
8. Use the same process to create FAQ Background Information Cards about other non-native species.

Adapted from USDA, Animal and Plant Health Inspection Services, Notebaert Nature Museum of the Chicago Academy of Sciences, *Beetle Busters: Saving Chicago's Trees, 2006.*

Non-Native Species

These alien invaders are sometimes called exotic pests, introduced pests, and invasive species. Choose one to create FAQs Background Information Cards.

	Plants	
	Autumn-olive	*Elaeagnus umbellata*
	Bush honeysuckle	*Caprifoliaceae diervilla*
	Buckthorn	*Rhamnus catharticus*
	Common reed grass	*Glyceria maxima*
	Garlic mustard	*Alliaria periolata*
	Japanese honeysuckle	*Lonicera japonica*
	Japanese knotweed	*Polygonum tenuicaule*
	Multiflora rose	*Rosa multiflora*
	Purple loosestrife	*Lythrum salicarla*
	Reed canary grass	*Phalaris arundinacea*
	Meadow fleabane	*Inula britannica*
	Apple of Peru	*Nicandra physalodes L. Gaertn*
	Giant hogweed	*Heracleum sphondylium*
	Insects	
	Hemlock woolly adelgid	*Adelges tsugae*
	Asian long-horned beetle	*Anoplophora glabripennis*
	Boll weevil	*Anthonomus grandis*
	Sirex woodwasp	*Sirex noetilio F.*
	Common pine shoot beetle	*Tomicus piniperda*
	Japanese beetle	*Popillia japonica*
	Africanized honey bee	*Apismellifera scutella*
	Viburnum leaf beetle	*Pyrrhalta viburni*
	Soybean cyst nematode	*Heterodera glycines*
	Gypsy moth	*Lymantria dispar*
	Diseases	
	Sudden oak death	*Phytophthora ramorum*
	Dutch elm disease	*Ceratocystis ulmi*
	Soybean rust	*Phakopsora pachyrhizi*
	Others	
	Zebra mussel	*Dreissena polymorpha*
	Round goby	*Neogobius melanostomus*
	Sea lamprey	*Petromyzon marinus*
	Feral pig	*Sus scrofa*
	European starling	*Sturnus vulgaris*
	Giant African snail	*Achatina fulica*



EAB Research Log

Part 1

Directions: *Read your assigned section. Working with your group, identify the main idea and three important details.*

Main idea: _____

_____

_____

Important detail # 1: _____

Important detail # 2 : _____

Important detail # 3: _____

Part 2

Directions: *In your new group, share the main idea and the three most important details you recorded above. Then discuss and answer the following questions:*

1. What do we know about this exotic species? _____

_____

2. What do we know about how it spreads? _____

_____

3. How does its impact become a bigger problem? _____

_____

4. How can we reduce the threat?_____

_____

5. How can we teach others to help reduce the threat? _____

_____

Emerald Ash Borer FAQs

What Is EAB?

A new exotic beetle from Asia, known as the Emerald Ash Borer, was discovered killing ash trees in southeastern Michigan in June 2002. Larvae feed in the phloem and outer sapwood, just under the bark, producing galleries that eventually girdle and kill branches and entire trees. Surveys using detection trees and destructive sampling to determine the extent of the spread of the infestation are underway.

Adult beetles are 7.5 to 13.5 mm (about ½ inch) long, and females are larger than males. The adult body is brassy or golden green overall, with darker, metallic, emerald green wing covers. The top of the abdomen is purplish to coppery red in color. EAB larvae are white with a long, narrow, segmented abdomen that is also flattened, which gives them the look of small tapeworms. Larvae reach a length of 25.4 mm (1 inch).

EAB Background Information Card

1

What is the Life Cycle of EAB?

The Emerald Ash Borer typically has one generation per year, although it has been observed that some may take two years to complete the life cycle. This usually occurs when populations are new to an area, and the trees are healthy and vigorous. Adult emergence begins in mid- to late May, and continues through early August. The peak of emergence is usually in the early part of July. The adults are active during the day, particularly when conditions are warm and sunny. Most beetles remain in protected locations in bark crevices or on foliage during rain, heavy cloud cover, high winds or temperatures above 32°C (90°F).

Male adults live an average of 13 days and females live about 21 to 22 days. Females can mate multiple times and oviposition begins 7 to 9 days after the initial mating. Females lay 60 to 90 eggs during their lifetime. Eggs are deposited individually on the bark surface or in bark crevices on the trunk or branches.

Eggs hatch in 7 to 10 days. After hatching, larvae chew through the bark and into the cambial region. Larvae feed on phloem and the outer sapwood for several weeks, which cuts off the flow of nutrients and water up and down the tree. The S-shaped feeding gallery winds back and forth, becoming progressively wider as the larva grows. Galleries are packed with fine frass. In some areas, woodpeckers feed heavily on larvae and are often used as a diagnostic tool when looking for EAB infestations.

The insect overwinters as a full-grown larva in a shallow chamber excavated in the sapwood. Pupation begins in late April or early May. Adults may remain in the pupal chamber for 1 to 2 weeks before emerging head-first through a D-shaped exit hole that is 3–4 mm (1/16 to 1/8 inch) in diameter.

EAB Background Information Card

2

How Did EAB Get to the United States?

EAB is not native to the United States. Scientists believe that the beetle "hitchhiked" to this country in wooden crates and other wooden packing materials used to import cargo and products from Asian countries. Survival was possible because the wood that was made into the pallets or crates was not fully debarked and there were enough nutrients left in the remaining cambium layer to sustain life in the wood. The products were then shipped to the United States, and the beetles emerged from the wood of the crates and thus infested the closest ash trees they could find.

Once established, EAB spread by flying to new ash trees in the local vicinity. They move much farther through the unintentional movement of infested firewood, ash logs, ash nursery stock, pallets, wooden crates, or other ash tree materials.

First discovered in Michigan in June 2002, EAB was found in Ohio in 2003, northern Indiana in 2004 and northern Illinois in 2006. EAB has also been identified in Maryland, Pennsylvania, West Virginia, and Ontario, Canada. Since its discovery, EAB has killed millions of ash trees, cost municipalities, property owners, nursery operators and forest product industries tens of millions of dollars, and caused regulatory agencies and the USDA to enforce quarantines and fines to prevent people from moving potentially infested ash trees, logs or firewood from areas where EAB occurs.

EAB Background Information Card

Why Is EAB a Problem?

EAB is an exotic, invasive species that does not occur naturally in the United States. The predators, diseases, and environmental conditions that keep the EAB population under control in its native land do not occur here. An invasive specie is one that spreads readily. This situation means that beetle populations can increase quickly and destroy thousands of trees in a short time.

The Emerald Ash Borer is indigenous to Asia and is known to occur in China, Korea, Japan, Mongolia, the Russian Far East and Taiwan. In the United States, this borer has been observed only on ash trees. It has killed green ash, white ash, blue ash, pumpkin ash, and black ash, as well as several horticultural varieties of ash. At this time there is no known cure, although researchers are working very hard to learn more about this insect and treatment options. Trees that are attacked are usually dead within 3-5 years.

Loss of ash tree populations could hurt industries that depend on wood, such as the lumber and furniture industries and baseball bat companies. It is estimated that if EAB is not stopped, these industries could lose millions of dollars. Trees in urban and rural areas provide beauty and shade, improve air quality, prevent soil erosion and shelter animals like birds, squirrels, and native insects. If trees become infested with EAB, those trees will eventually die, which decreases the quality of life for the people living nearby.

EAB Background Information Card

How Can an Infestation Be Identified?

Emerald Ash Borer kills ash trees of various sizes and conditions. Larvae develop on trees as small as 5 cm in diameter. Bigger diameter trees used for poles and lumber are also affected by EAB. Stress likely contributes to vulnerability of ash trees. However, Emerald Ash Borer also attacks and kills vigorous trees in woodlots and urban trees under regular irrigation and fertilization regimes.

Infestations of Emerald Ash Borer can be difficult to detect until canopy dieback begins. Infested branches in the canopy die when they are girdled by the serpentine tunnels excavated by feeding larvae. Many trees appear to lose about 30 to 50 percent of the canopy in one year and the tree is often killed after 3-5 years of infestation.

Callus tissue produced by the tree in response to larval feeding may cause vertical splits 5–10 cm (2 to 3.9 inch) in length to occur in the bark. Distinct, larval tunnels etch the outer sapwood and phloem of the trunk and branches. An elliptical area of discolored sapwood, likely a result of secondary infection by fungal pathogens, sometimes surrounds larval feeding galleries in live trees.

Often several shoots grow at the margin of live and dead tissue on the trunk. When trees are dying, dense root sprouting occurs as the tree's last effort to survive.

Evidence of infestation includes D-shaped exit holes on branches and the trunk. These holes are left behind when the beetle exits the tree. Woodpeckers like to eat the larvae under the bark. Woodpecker damage also is often evident.

EAB Background Information Card

5

How Is EAB Being Controlled?

EAB is an extremely destructive plant pest, and it is responsible for the death and decline of millions of ash trees. Ash in both forested and urban settings constitute a significant portion of the canopy cover in the United States.

When an infested tree is found, a quarantine area is created and local, state, or federal inspectors survey nearby ash trees to look for more infestation. A quarantine makes it illegal to move ash tree material and all hardwood (non-coniferous) firewood out of infested areas. Putting an area under quarantine decreases the chance of individuals accidentally spreading the beetle to a new location by moving infested materials out of the area.

In Ohio, quarantine regulations have been imposed to prevent the movement of firewood from quarantined counties within the state.

To learn more about quarantine restrictions and to see a current map of the quarantined counties go to: www.ohioagriculture.gov/eab

The United States Department of Agriculture (USDA) has quarantined the entire state of Ohio and other states to prevent the spread of Emerald Ash Borer. The quarantine makes it illegal to take all ash tree material and all hardwood (non-coniferous) firewood out of quarantined states.

EAB Background Information Card

6

What Can Be Done To Slow the Spread of New EAB Infestations?

Monitor

Ohio is continuing its use of detection trees to identify the insect where it has been introduced through the movement of infested firewood or ash tree materials. To do this, Ohio Department of Agriculture surveyors are examining detection trees that have been set in the state. Detection trees, which attract insects already in the area, currently are the best available tool for EAB. If suspicious larvae are found in detection trees, they are sent to an USDA lab in Michigan to be identified. Counties with Emerald Ash Borer are quarantined to regulate the movement of ash tree material and firewood out of the county.

Regulate

Quarantines are in place to prevent infested ash firewood, ash logs or ash nursery trees from being transported out of infested areas. It is illegal to move ash trees, ash tree logs, ash branches, ash wood chips, ash bark, and all hardwood firewood out of Ohio's quarantined areas. A federal quarantine prohibits the movement of ash tree materials and hardwood firewood out of the state of Ohio without federal certification.

EAB Background Information Card

7

What Can the Public Do To Help?

Watch ash trees for signs and symptoms and report findings. Properly and safely dispose of dead and dying ash trees. Follow all regulations and...

Don't Move Firewood!

Outreach and education programs have been implemented to inform the public and enlist their help. Messages highlighting the importance of buying and burning local firewood are shared through public meetings, public service announcements on radio and television, billboards, road signs, advertising at sporting events and direct mailings. Comprehensive EAB Web sites for citizens and stakeholders help raise awareness of EAB and the importance of the quarantine. Information on invasive pests have been supplied to the school age audiences to increase knowledge of the impacts of invasive species on the local natural resources.

Restoration activities can also help. Restore the canopy of trees by replanting. And remember to diversify tree varieties when landscaping.

EAB Background Information Card

8

EAB Report Form

Attack Back! Please send in your reports immediately!
Answer each question. Be sure to write neatly!

Your name: _____

Grade: _____ Date you searched: _____

Street address of property you searched:

_____

_____

Zip Code of property you searched: _____

Location of ash tree(s) on property (front yard, backyard, etc.): _____

_____

Did the trees look healthy? ☐ Yes ☐ No

Did you see an Emerald Ash Borer or evidence of EAB at this location?

☐ Yes ☐ No

On the back side of this paper, draw or use words to describe what you saw.

Ohio Department of Agriculture
Emerald Ash Borer Program
8995 East Main St.
Reynoldsburg, Ohio 43068

Postage Stamp

Map Your Ash Trees Using Google™

Google™ Maps enables you and your students to look up and study addresses anywhere in the United States and view satellite imagery. It is an online application (no downloading required), and you can access it from any computer that's connected to the Internet. Use this tool to survey your neighborhood for infestations of EAB.

1. Go to **maps.google.com.** Enter the school or home address (number, street, city, state, zip). Click on "Search Maps".

2. Test your zoom tool. Zoom out to look at the school on the continent. (See fig. 1). Zoom in to look at the streets around the school. (See fig. 2).

3. This map can be used to mark the trees with an X. Circle all ash trees in red. Use arrows to identify any trees that have signs of EAB infestation. (See fig. 3).

   Optional: Click on Satellite to get photo picture of your school. (See fig. 4). Use the zoom tool and mouse to center the school on the page and include the streets that you want to survey. Print out the map and circle the trees. Go outside and identify the trees you have marked. Use red to identify ash trees. Use arrows to identify ash trees that show signs of EAB.

4. Create your own EAB map to share with others using the MyMaps feature.

EAB ONLINE

Find out how other educators have been using this tool: *http://weblogg-ed.com/2007/make-your-own-google-mapstoo-cool/*

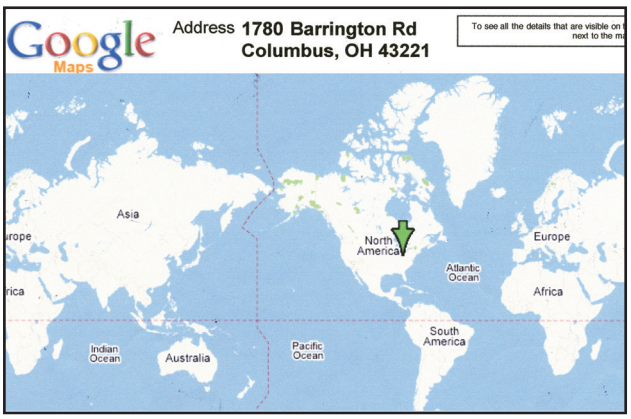


fig. 1

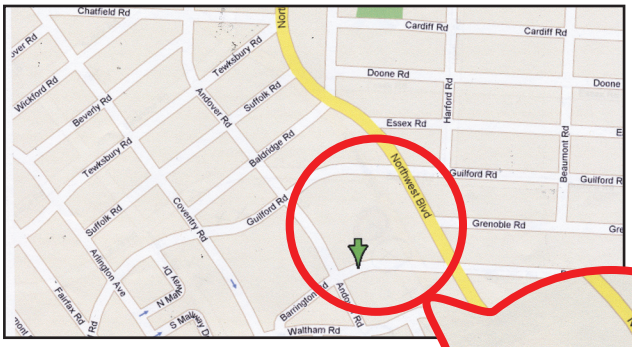


fig. 2

fig. 3

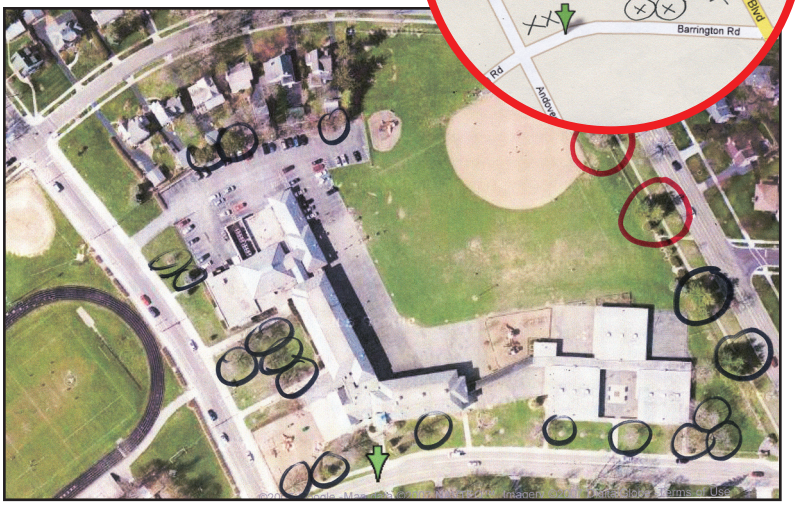


fig. 4

The Ohio Department of Agriculture does not endorse or approve any commercial Web sites.

GPS/GIS for Problem Solving and Critical Thinking

Use Global Positioning System (GPS) and Geographic Information System (GIS) to engage in inquiry and critical thinking. Hand-held GPS units are used to gather environmental data that can be viewed and analyzed using GIS computer software programs.

What can be done about EAB?

Problem

EAB is an exotic species that has attacked ash trees in Michigan, Ohio, Illinois, Indiana, Maryland, Pennsylvania, West Virginia, and Ontario, Canada. Once infested, a tree will die within 3-5 years. The spread of this insect will potentially wipe out huge populations of ash trees. With answers to the right questions the insects can be monitored and the devastation can be slowed.

Goals

Early detection is the key to controlling the Emerald Ash Borer and the inevitable damage that occurs. Generate an ash tree inventory by visually inspecting trees on public lands and private property, with the appropriate permission.

Results

Know where the ash trees are located. Know the condition, healthy or unhealthy, of the ash trees in your area. Keep local authorities updated on the status of EAB as it is located and moves throughout Ohio. Estimate and predict the spread of EAB. Prepare for the outcomes.

Action

1. **Define the problem:** Ask geographic questions.
   - Are there ash trees in the area? Divide your community or county into areas that can be surveyed.
   - What is the estimated number of ash trees in a square mile (640 acres). Calculate how many ash trees there are in a designated area based on the survey sample.

2. **Prioritize and investigate**: Acquire geographic information.
   - What are the attributes of the ash trees in each area? Record the size, location, abundance, spatial distribution, land use type (urban vs. rural), signs of stress, and evidence of EAB.
   - How can the data be entered and organized into geodatabases or datasets? Use the GPS tools to record specific locations of trees, ends of tree lines or edges/corners to woodlots, and/or features in the landscape created by humans. Consider non-natural influences such as major highways, human population density, campgrounds, and locations of wood products industries.

3. **Determine the solution:** Explore geographic data.
   - What is the topography of the area? Are there nearby forest populations? Is the area fragmented by agricultural or urban/suburban land?
   - Layer in other environmental GIS data that you think is important (such as hydrology, elevation, climate and/or soil and nutrient level).
   - Consider adding aerial and satellite imagery to get a better visual of the world around you.

4. **Present solutions:** Analyze geographic knowledge.
   - Is EAB currently a problem in the area? Is it a potential problem?
   - What geographic factors can help predict the spread to the area?
   - What human activity will potentially spread EAB to the area?
   - Outline some ways that you can help.

5. **Take action steps:** Act on geographic information.
   - How will EAB affect my community? How can a community use tree inventory data to prepare for EAB?
   - Consider the consequences of reduced tree canopy: aesthetics, wildlife habitat, air quality, heating and cooling implications. Report your research. Tell others.
   - Enlist help from the community.

Background Information

What is GPS?

The Global Positioning System (GPS) is a navigational system that can accurately locate a specific position. The United States freely provides this world-wide service to all civilian users. The GPS uses more than two dozen earth-orbiting satellites to transmit signals that give the satellites current position and atomic time. The GPS receiver processes the data from four or more satellites using a method called trilateral to provide latitude and longitude and elevation information. Users can get positions accurate to within 5 meters or less.

GPS has a number of important applications including search and rescue missions, helping pilots avoid collisions, and providing farmers with information to make accurate application of farm fertilizers and other pesticides. GPS can be used for recreation as a navigation tool for orienteering, hiking, hot air ballooning, boating and many other activities. The time signal is used by cellular telephone sites to synchronize all of their networks. GPS is the data collection tool that will provide the coordinates to determine the exact location of the ash trees in your survey.

What is GIS?

A Geographic Information System (GIS) is a collection of computer hardware and software that stores, retrieves, analyzes and displays geographic data. GPS data can be uploaded to a GIS to gain a powerful visualization of the world around us. While GPS tells us "where," GIS tells us "what." Together, they help us locate, organize and map our communities. A GIS consists of two kinds of information or databases. One is geographically referenced information: latitude and longitude coordinates, spatial or location information, or "where things are." The second is attribute or descriptive information: characteristics or qualities of that place, or "what things are like."

The layers of information you combine depends on your purpose. For example, different data is needed to find the best location for a new soccer field than is needed to analyze the environmental damage from a tornado. You may use existing data (e.g., census), or create your own (e.g., use a hand-held GPS unit to record each ash tree location in your neighborhood). The data is processed and compiled in a GIS until it is time to be mapped.

Resources

The Ohio Department of Agriculture does not endorse or approve any commercial Web sites.

GPS Tutorials

- www.gps.gov
  (general public education Web site created by the U.S. Government)

GIS Tutorials

- www.gis.com
  (guide to GIS created by the Environmental Systems Research Institute, ESRI)
- www.esri.com
  (guide to GIS and mapping software created by ESRI)
  www.esri.com/k12 (GIS for schools Web site created by ESRI)

GIS help

- support.esri.com
  (ESRI support center)

GIS Data Collection

- www.usgs.gov
  (U.S. Geological Survey Web site)
- www.census.gov
  (U.S. Census Bureau Web site)
- www.terraserver.com
  (online aerial and satellite imagery)

Service-Learning

Teacher Resource and Team Planning Sheet

Step One: Identify a Genuine Need
How is the ash borer affecting your community?

Step Two: Establish Learning Objectives
What connections to learning standards will you make as part of this project?

Using Service Learning in Your Classroom to Attack Back!

Service Learning is a teaching and learning approach that integrates community service with academic study to enrich learning, teach civic responsibility and strengthen communities. Projects typically follow a general plan that will help to create productive and memorable experiences for students.

Step Three: Planning & Preparation
What preparation needs to be done in order to make this experience meaningful? The more work that the students can do in relationship to this step the more solid the learning experience. What background information is needed? Who can help; what contacts need to be made? What supplies/materials/resources are needed? What is the timeline?

Step Four: Meaningful Service Experience
What will the students actually do?

Step Five: Observation and Reflection
How is it going? What are the students learning about science academic content (or English, or social studies or math)? What are they learning about themselves? About their community? What activities can be planned to demonstrate this? (Journaling assignments, presentations to classmates or others, artwork, photography journal, role-playing)

Step Six: Celebration
How can your students celebrate this accomplishment? (Newspaper articles, commendations from City Council, reception for family members)

Step Seven: New Applications
What next steps could be taken?

Attack Back!

Team Name: _____

Team Members: _____

_____

_____

_____

The Need...

What is your message? What do you want people to know?

_____

_____

_____

Prepare and Plan...

What could you do? How will you take action against EAB?

_____

_____

_____

_____

_____

Who can help you? What partnerships could you create?

_____

_____

_____

What is the timeline? _____

What are the tasks? Who will take responsibility?

_____

_____

_____

_____

_____

_____

What supplies will you need?

_____

_____

_____

The Experience...

What happened? What did you do?

The Reflection...

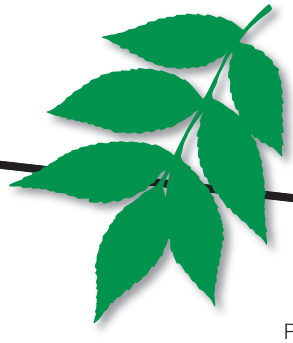
What did you learn from completing this project? About yourself? About your community?

The Celebration...

How did you celebrate your accomplishment?

New Applications...

What could you do next?



Ohio Science Academic Content Standards

Science Standards and Indicators which can be addressed with this material:

Life Science-Diversity and the Interdependence of Life

Grades K-2

- Investigate the habitats of many different kinds of local plants and animals and some of the ways in which animals depend on plants and each other in our community.
- Investigate that animals eat plants and /or other animals for food and may also use plants or other animals for shelter and nesting.
- Recognize that seasonal changes can influence the health, survival or activities of organisms.

Grades 3-5

- Compare the life cycles of different animals including birth to adulthood, reproduction and death.
- Describe how organisms interact with one another in various ways.
- Analyze how all organisms, including humans, cause changes in the ecosystems and how these changes can be beneficial, neutral or detrimental (e.g., beaver ponds, earthworm burrows, grasshoppers eating plants, people planting and cutting trees and people introducing a new species).

Grades 6-8

- Investigate how organisms or populations may interact with one another.

Grades 9-12

- Predict some possible impacts on an ecosystem with the introduction of a non-native species.
- Give examples of how human activity can accelerate rates of natural change and can have unforeseen consequences.
- Recognize that ecosystems change when one or more new species appear as a result of immigration or speciation.
- Investigate the impact on the structure and stability of ecosystems due to changes in their biotic and abiotic components as a result of human activity.

Science and Technology- Understanding Technology and Developing Abilities to Do Technological Design

Grades K-2

- Explain that using technology involves benefits and risks.

Grades 3-5

- Describe how technology can extend human abilities.
- Describe ways that using technology can have helpful and/or harmful results
- Use a simple design process to solve a problem; investigate positive and negative impacts of human activity and technology on the environment.
- Explain how the solution to one problem may create other problems.

Grades 6-8

- Describe how decisions to develop and use technologies often put environmental and economic concerns in direct competition with each other.
- Design and build a product or create a solution to a problem given constraints (e.g., limits of cost and time for design and production or supply of materials and environmental effects).

Grades 9-12

- Identify a problem or need, propose designs and choose among alternative solutions for the problem.
- Describe how new technologies often extend the current levels of scientific understanding and introduce new areas of research.
- Describe means of comparing the benefits with the risks of technology and how science can inform public policy.

Scientific Inquiry- Doing Scientific Inquiry

Grades K-2

- Use the five senses to make observations about the natural world
- Draw pictures that correctly portray features of the item being described
- Recognize that numbers can be used to count a collection of things
- Work in a small group to complete an investigation and then share findings with others
- Use oral, written and pictorial representation to communicate work.

Grades 3-5

- Analyze a series of events and/or simple daily or seasonal cycles, describe the patterns and infer the next likely occurrence; record and organize observations (e.g., journals, charts and tables)
- Communicate scientific findings to others through a variety of methods (e.g., pictures, written, oral and recorded observations).
- Develop, design and conduct safe, simple investigations or experiments to answer questions.
- Use evidence and observations to explain and communicate the results of investigations.

Grades 6-8

- Explain that there are not fixed procedures for guiding scientific investigations; however the nature of an investigation determines the procedures needed.
- Read, construct and interpret data in various forms produced by self, and others in both written and oral form
- Describe the concepts of sample size and control and explain how these affect scientific investigations
- Apply appropriate math skills to interpret quantitative data (e.g., mean, median and mode).

Grades 9-12

- Develop oral and written presentations using clear language, accurate data, appropriate graphs, tables, maps and available technology.
- Use appropriate summary statistics to analyze and describe data.

EAB ONLINE

Source for standards: **www.ode.state.oh.us**
(Click on Standards and Instruction)