The Emerald Ash Borer

Invading Ash Trees in the Oxbow

Student Scientists

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Glossary

Non-native (nän **na** tiv): Not naturally occurring in an area.

Invasive species (in **va** siv **spe** ses): Any plant, animal, or organism that is not native to the ecosystem it is in, and is likely to cause harm to the environment, the economy, or human health.

Adversely (ad **vürs** le): Results in negative effects.

Economic (**e** ko **nom** ik): Of or relating to the production, consumption, or distribution of goods and services.

Ecological (**e** ko **lawj** uh kül): Dealing with the relationships of organisms and their environment.

Monoculture (**maw** no kül chür): A population of one kind of organism.

Native (**na** tiv): Naturally occurring in an area.

Abundant (uh **bun** dent): Plentiful.

Global Positioning System (GPS) (**glo** bul po **sish** un i*ng* **sis** tem): A radio navigation system that allows land, sea, and airborne users to determine their exact location, speed, and time 24 hours a day, in most weather conditions, anywhere in the world.

Pronunciation Guide

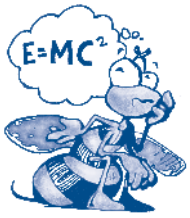
a	as in ape	**ô**	as in for
ä	as in car	**u**	as in use
e	as in me	**ü**	as in fur
i	as in ice	**oo**	as in tool
o	as in go	***ng***	as in sing

Accented syllables are in **bold**.

Thinking About Science

Scientists often work as a team. Within a team, each scientist contributes his or her special skills to the research. In this research, the student scientists used the assistance of a scientist to help them collect their data. The scientist taught them how to identify and classify the health of ash trees. When you work as a team, it is best to match a person's knowledge and skills with the task they can do best.

Thinking About the Environment



Sometimes, animals and plants that are not native to an area invade a new area. When the **non-native** species causes harm to the environment or economy, it is called an **invasive species**. After an invasive species has invaded a new area, it can spread further. This research is about an invasive insect called the emerald ash borer (EAB).

EAB adults can fly at least a ½ mile from the ash tree from which they emerge as adults. EAB can spread even farther when people move infested ash nursery trees, logs, or firewood into new areas. Shipments of ash nursery trees and ash logs with bark are now regulated by government agencies. Transporting firewood outside of quarantined areas is illegal, but many people are not aware of this restriction. Transport of infested firewood remains an ongoing concern, because it causes the further spread of many invasive species.

Introduction

The natural environment offers many things to learn about. It is interesting to learn the way different organisms grow and develop, how they survive, and how they continue to change over time. As a class we studied invasive species. An invasive species is an organism that is living where it did not originate and that **adversely** affects the habitats it invades.

An invasive species may cause **economic**, environmental, or **ecological** harm. The organism is so reproductively successful and aggressive that it can dominate the area it invades, often to the point of becoming a **monoculture**. An invasive species can seriously interfere with the natural functioning and diversity of the system where it becomes established. Examples of invasive species are garlic mustard, pampass grass, and EAB.

EAB is unique and it is as invasive as any other invasive species you could find **(figure 1)**. This alien invader is from northern China and Korea. It may also be found in eastern Russia, Japan, and Mongolia. It isn't a major pest of ash trees in its **native** range, but it causes trouble in the United States. In 2002, it was identified in Southeast Michigan in the city of Canton **(figure 2)**. Canton is a suburban community of metro Detroit.

Researchers believe the EAB arrived in Southeast Michigan 10-12 years earlier, probably as a stow-away in wooden packaging materials aboard a ship. Since no one noticed the death of ash trees until the EAB became **abundant**, it is difficult for researchers to find a solution to stop these insects. It would have been easier to control them when their numbers were low. The exact number of EAB in Michigan is unknown but it's probably more than several million.

Figure 1. Emerald ash borer.
(Photo courtesy of bugwood.org)

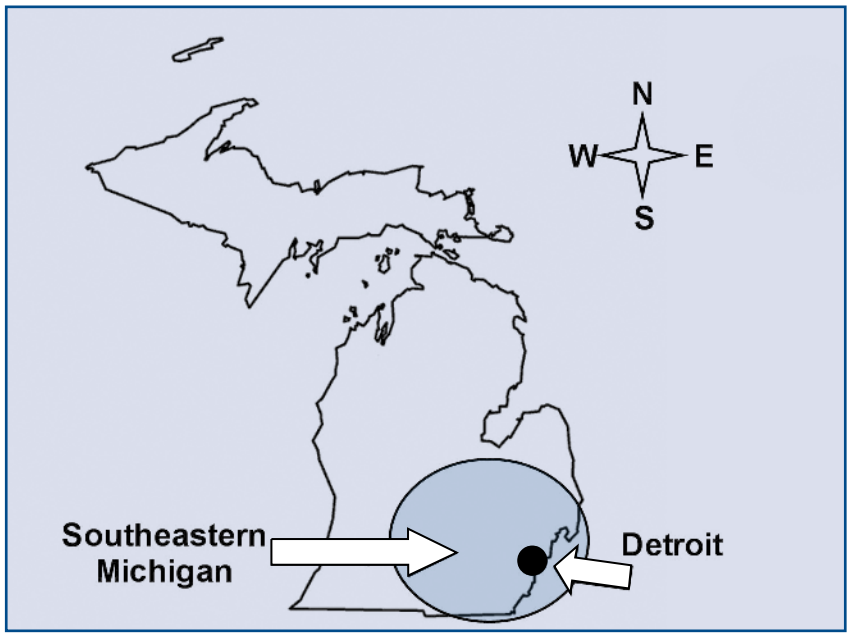


Figure 2. Southeast Michigan.

EAB has killed tens of millions of ash trees in Michigan and the economic impact far exceeds the $1 million. **(figure 3)**. (Contact the Michigan Department of Agriculture at 517.241.2485 for correct dollar value.) Because of this more than $1 million has been lost because of infested wood. Not only is there an unfavorable impact on economics, but also on the animals that make a home in or around the ash trees.

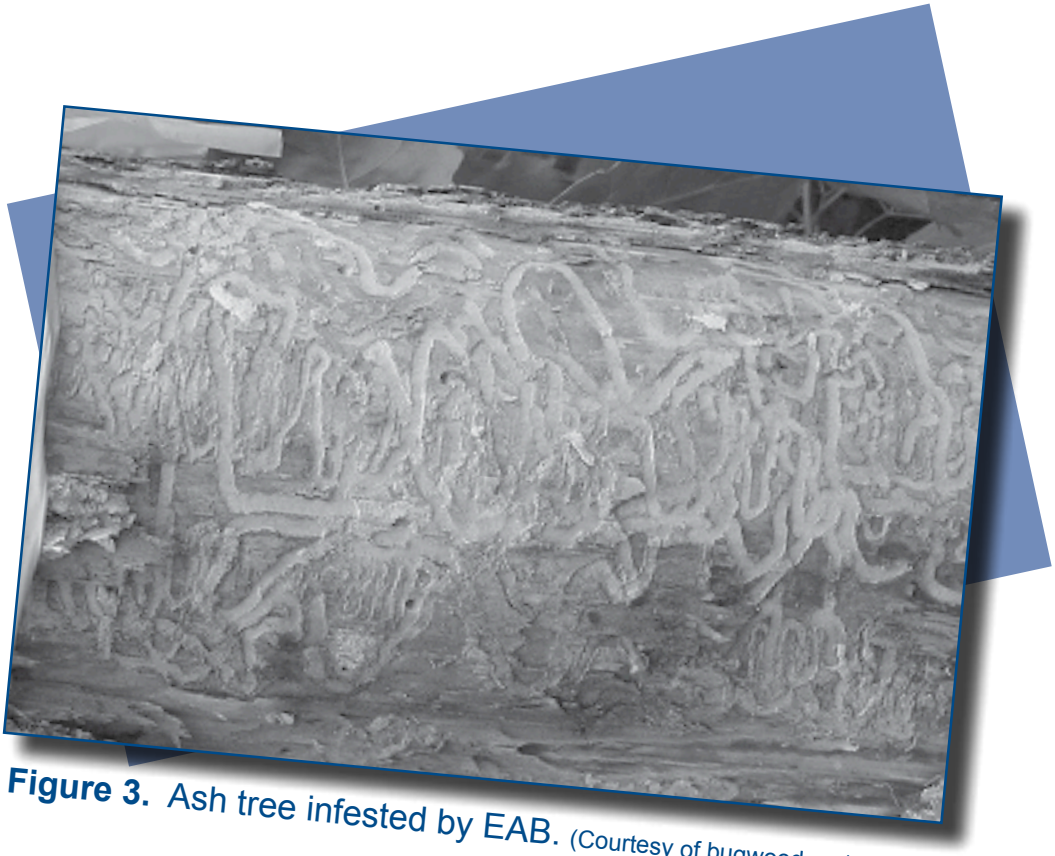
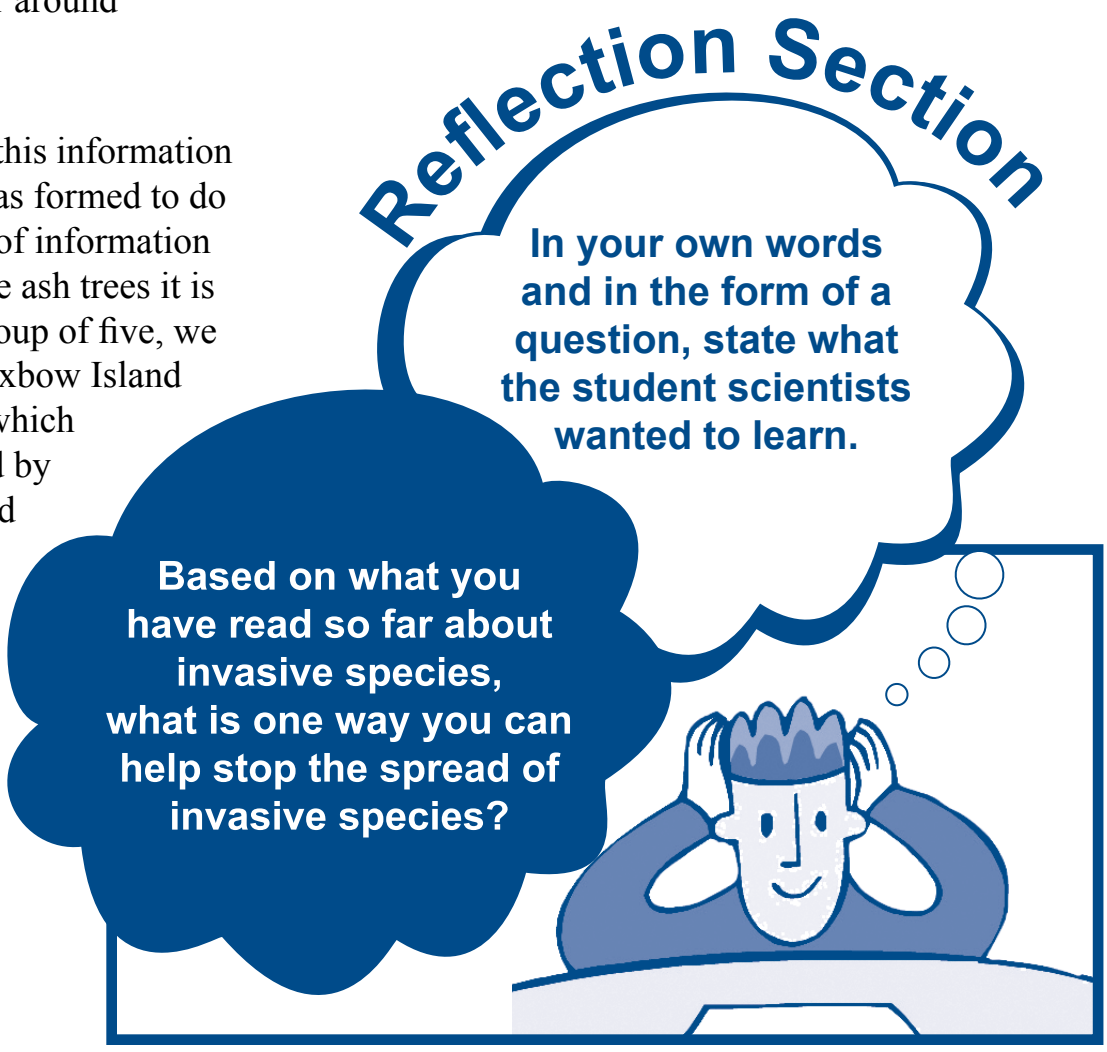


Figure 3. Ash tree infested by EAB. (Courtesy of bugwood.org)

After learning this information a student group was formed to do further collecting of information about EAB and the ash trees it is infesting. As a group of five, we investigated the Oxbow Island and the ash trees which have been infested by EAB. We decided to study the effects of EAB in the Oxbow.



Method

We randomly investigated a number of ash trees and collected data such as the **global positioning system (GPS)** number, the tree's diameter, whether the tree was dead or alive, and if it had epicormic shoots. Epicormic shoots are small branches that grow from the base of the trees. They may also be called water shoots. They often grow after a tree has been severely pruned, or an unhealthy tree has lost many of its leaves.

The first step in collecting the data in the EAB experiment was figuring out what trees the EAB were infesting, and where EAB was found. The information was collected through Internet articles and other resources on EAB infesting of ash trees. There were an abundance of ash trees close to us for us to do research. These trees were located in Dearborn, Michigan on land near our school. We were able to research the ash trees located on an island behind the Henry Ford Academy known as Oxbow Island **(figure 4).**

Oxbow Island is home to a variety of animals, plants, and other living organisms. We noticed that the Oxbow Island contains a lot of ash trees. An area was picked randomly in which the research and experiment would be done.

Figure 4. The Oxbow Island.

As a group we decided that it would be best if the data were collected in a span of two days in the middle of November. The reasoning was that we wanted to collect as much data as possible before the weather became extremely cold and had a chance of affecting our data collection. The idea was that if we could collect as much data as possible on the ash trees in the Oxbow, then the rest of the time could be dedicated to finding information on the background of EAB, the possible future of EAB in Michigan, the money being spent to stop EAB, and ways EAB could be stopped.

Our inexperienced group was assigned a person named Toby who was knowledgeable in the field of classifying trees. Toby showed us how to determine if a tree was alive or dead and infested or not infested by EAB. These two things were tested by looking at the bark of the tree. We looked to see if the bark was loose, if there were exit holes in the bark, if the pattern of branches had been disrupted, and what color the tree was inside the bark. When examining the bark a blade was used to cut off a small portion of the tree without harming it. Once we were aware of those things we were able to place the trees in different categories.

We collected a lot of information about the ash trees **(figure 5)**. With a tape ruler we were able to find out the diameter of the tree's trunk. Joseph, a member of the group, wrote down the information we collected. Ta'Janae tied

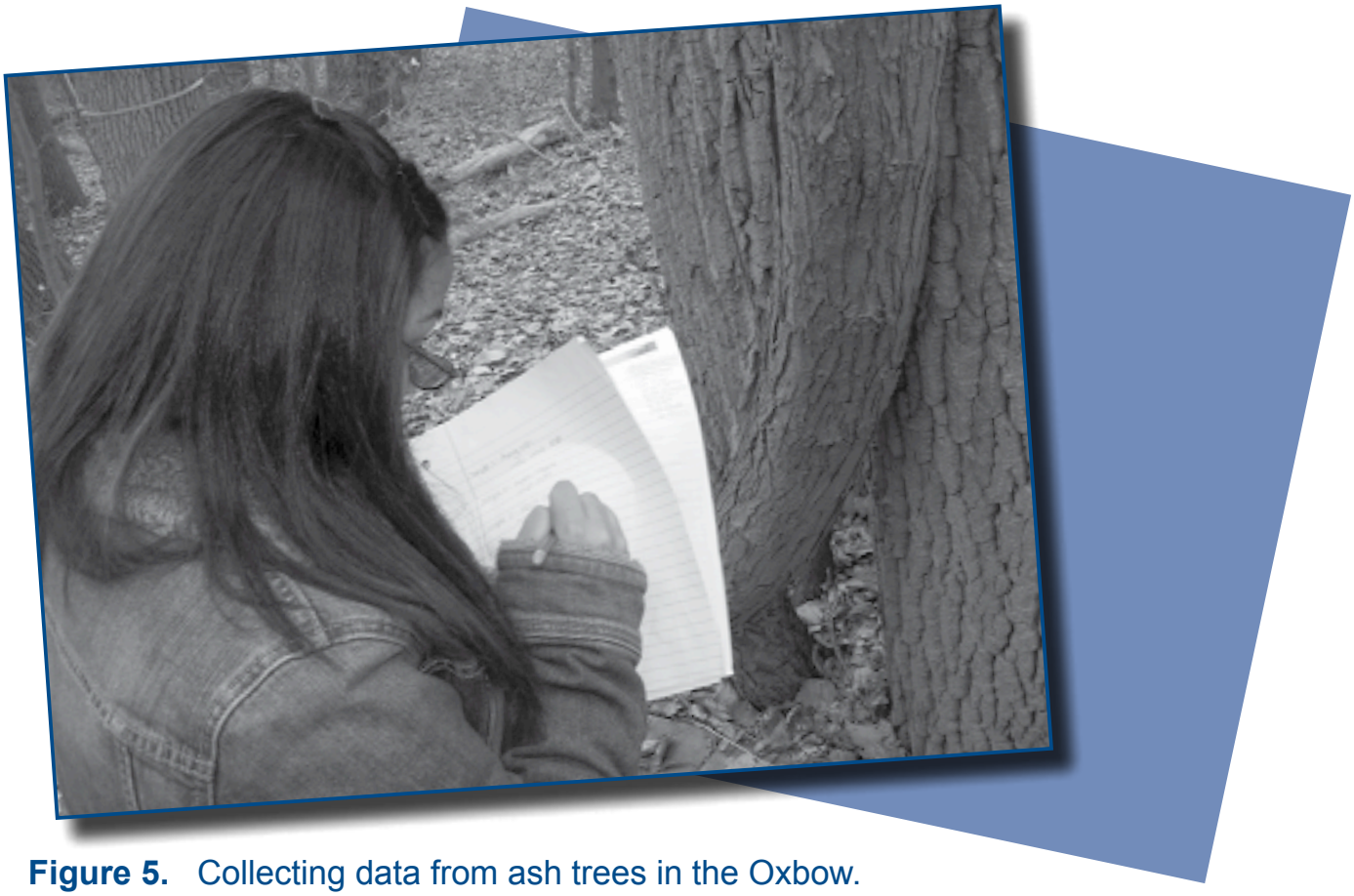
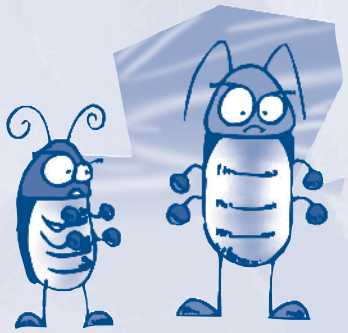


Figure 5. Collecting data from ash trees in the Oxbow.

a rope around each tree we measured so we would not lose track of the number of trees we examined. Every person in the group was obligated to complete a chart with accurate information. This information included the tree's diameter, whether the tree was alive or dead, and if it had epicormic shoots, woodpecker holes, beetle exit holes, or loose bark. The exit holes are "D" shaped holes that show where recently developed adult beetles have left a tree.



Reflection Section

The student scientists collected their data over a two-day time period. Do you think this was enough time? Why or why not?

Often scientists work in teams or have an expert provide information on a certain subject area. The student scientists had Toby help them with tree identification. Think of a time when someone helped you with your project. What are the advantages and disadvantages of having someone help you with a project?

Findings

Data collected from seven ash trees in the Oxbow is presented in **figures 6 and 7**.

Tree	GPS #	Diameter (in feet)	Dead	Epicormic shoots	Woodpecker holes	Exit holes	Loose bark
1	001	4.7	No	Yes	Yes	Yes	No
2	002	5.9	No	Yes	Yes	Yes	No
3	003	4.7	No	Yes	Yes	Yes	No
4	004	3.7	Yes	Yes	Yes	Yes	Yes
5	005		No	No	Yes	No	No
6	006	1.8	No	Yes	No	No	No
7	007	4.6	Yes	Yes	Yes	Yes	Yes

Figure 6. Data collected from seven ash trees in the Oxbow.

Tree Condition	Number of Trees
Ash trees with exit holes	36
Ash trees without exit holes	22
Dying ash trees	36

Figure 7. More ash tree statistics.

Reflection Section

Look at Figure 6 again. What do you notice about the two trees that are dead compared to the other trees?

Based on the student scientists' findings, do you think the five trees that are still alive will survive? Why or why not?

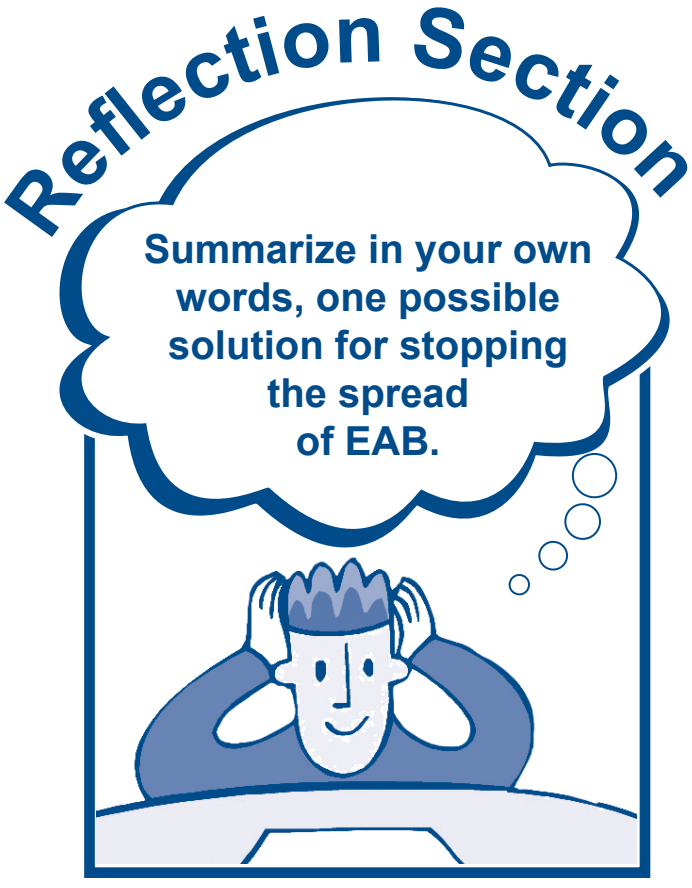
Discussion

As you can see from our research, EAB is infesting the ash trees in the Oxbow. Two out of the seven trees we studied had already died. The other five trees had signs of distress like exit holes and woodpecker holes. Therefore, it is important that we understand and put a stop to the spread of EAB.

EAB is not only affecting the environment but also has a financial impact in Michigan. We should help stop or at least get this invasive species under control. As a group we decided to do research on the EAB to find out why it is not harmful in China but it is harmful in the United States. The information we found could be a key to stopping the EAB. U.S. Forest Service research entomologists from Michigan have now completed a study of the EAB in its natural habitat in China. They have discovered three tiny parasitic wasps that keep it under control there.

The three wasps are drawn only to ash trees. Some walk all over the bark looking for EAB eggs to lay their own eggs in; others listen for ash borer larvae below the surface and then drill through the bark. Then they lay their eggs on the EAB. What happens next is a tiny version of the "Alien" movies. After wasps lay their eggs, the eggs hatch by bursting out of the embryonic borers, killing them. This is only one way the wasp kills the EAB. The wasps also go into the tree when the EAB is at its larva stage and eat the larva before the EAB are able to develop.

This investigation allowed us not only to come up with an experiment, analyze data, and create a conclusion, but to also grow knowledgeable in a variety of areas. For instance we became knowledgeable about tree classification, invasive species, and habitat concerns for humans, animals, and plants. Because of regulations, we were not able to release the stingless wasps on the Oxbow Island. But hopefully in the future, the possible solution may be used by Forest Service scientists in the Oxbow to see if the EAB can be controlled with stingless wasps. If the stingless wasps work, then the rest of the ash trees may have a chance of survival.



FACTivity

In this FACTivity, the question you will answer is: What is the health of the trees around my school?

The method you will use to do this is the following:

Divide up into pairs or small groups.

Examine Figure 1 and discuss the different parts of a tree.

Get a pencil and the tree health survey and head outside. Each pair should survey 1 tree in the school yard. Assign trees so that trees are not surveyed twice.

Look at the examples pictures of decay, cracks, holes/pest damage, and wounds and injury (see Figures 1–10) so you have an idea of what to look for when you are examining the tree. It would be helpful to have some books on trees available in the classroom as well.

Once you have collected your information, share it with your class and create a class chart for all the trees in the school yard. Discuss what you found. Are the trees healthy? Why or why not? Look at the Growing Conditions worksheet to give you some help. If they are not very healthy, what can be done to help the trees?

An extension for this activity is to begin by identifying the trees using tree guides and other resources. After you have identified the tree you can create a presentation about your tree.

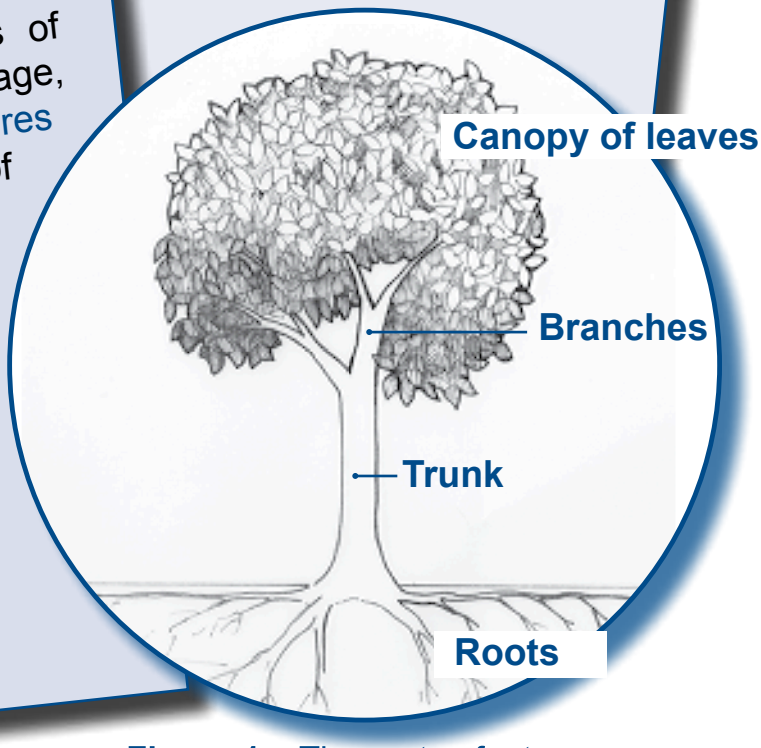


Figure 1. The parts of a tree.

Tree Health Survey

To survey the health of the tree, make sure you look at the tree carefully. Walk all the way around the tree and observe the tree from a distance and up close. Put a check mark in any column where you see a problem. When you have finished surveying the trees, calculate your total points and circle the tree health rating at the bottom of the sheet.

Problem	Not evident	Very little	Some	A lot
Trunk				
Missing Bark				
Decay				
Leaning				
Cracks				
Holes/ Pest damage				
Wounds/injury				
Roots				
Decay				
Wounds/injury				
Crown				
Dieback (branch tips in the crown that are dead)				
Not much of a crown				
Broken branches				
Lack of balance				
Total # of Checks				
	Total x 0=	Total x 1=	Total x 2=	Total x 3=

Overall Point Total= _____

Dead/Dying	Poor	Fair	Good	Excellent
Greater than 20	15-19	10-14	5-9	0-4

Growing Conditions Survey

Place a check mark in each column where there is a problem. When you have finished surveying the area your tree lives in, calculate the point total and circle the growing condition rating.

Condition	Not evident	Very Little	Some	A Lot
Not much space for the tree to grow				
Tree is close to roadway				
There are a lot of other plants competing for the same space				
There are problems with the ground cover				
Total # of Checks				
Sub-totals	Total x 0=	Total x 1=	Total x 2=	Total x 3=

Overall point total= _____

Poor	Fair	Good
Less than 7	4-7	0-3

(Note:This tree health survey is from American Forests. Please visit http://www.americanforests.org/productsandpubs/citygreen/school.php for more information.)

Examples of Different Problems with Trees.

(Note: All photos courtesy of bugwood.org and forestpests.org)

Figure 1. A tree with a canker.

Figure 2. A tree with damaged bark.

Figure 3. An emerald ash borer's exit hole in the bark.

Figure 4. A tree with peeling bark.

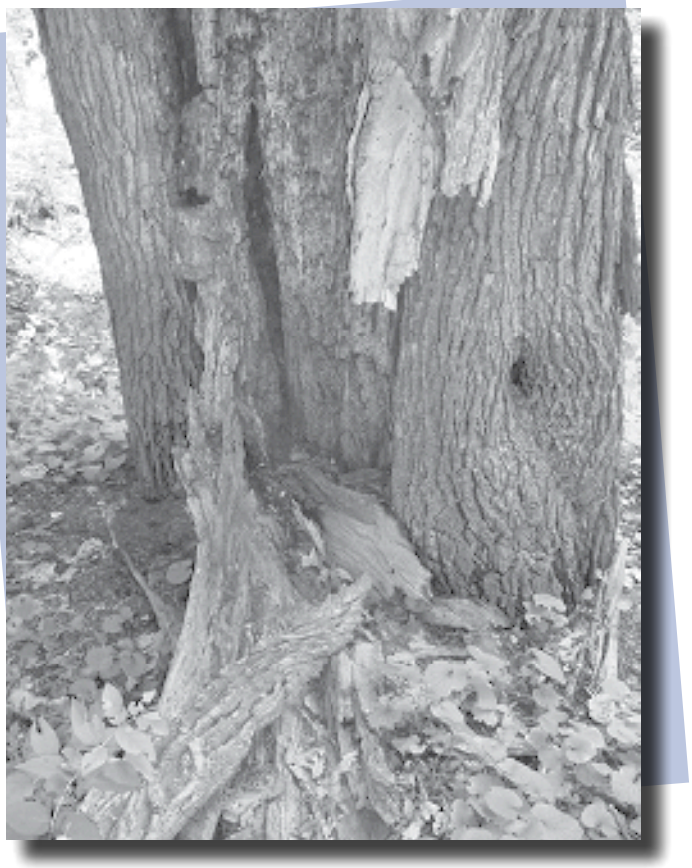


Figure 5. A decaying tree.

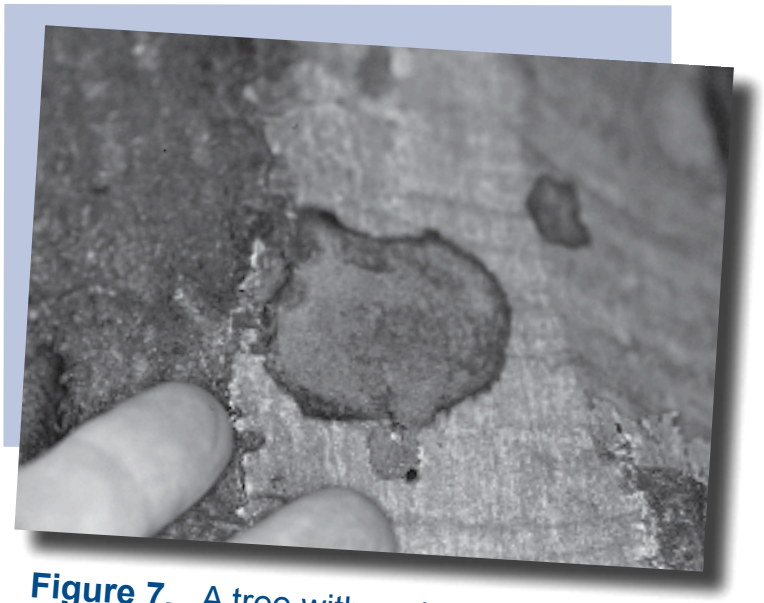


Figure 7. A tree with sudden oak death.

Figure 6. A tree with a gall in the crown.

Figure 8. A tree with crown dieback.

PLT

If you are a PLT-trained educator, you may use #77 "Trees in Trouble" as an additional resource.

Figure 9. A tree with root rot.

Figure 10. A tree with root disease.