Emerald Ash Borer Reading

Partner Names (F&L):

Hour Date: Why Late? Score:

**Directions: read the accompanying article and then use it to answer the questions below.**

1. What is the most likely explanation for how the emerald ash borer became introduced to the US?

2. The Wisconsin DNR estimates that the emerald ash borer (EAB) has killed how many ash trees?

3. Given that it is estimated that each large tree saves an average of $31 per year in energy costs per home, what is the economic impact in energy costs alone in the loss of the number of trees in the previous question? (Hint: multiply $31 by the number of ash trees already killed by EAB). *Show your work below!*

 $31.00 x = $
. number of ash trees killed economic impact of EAB related to increased energy costs
4. CALS Entomologist Chris Williamson says the word "cataclysmic" is appropriate to describe the devastation that this invasive species can cause. In your own words, define "cataclysmic". Then explain the expected damage that will occur from EAB.

*Cataclysmic means*

*By using this term, Williamson is implying that*

5. "The genie is out of the bottle" is used in this article to mean what?

6. In the space below, compare and contrast the scientific opinions of Williamson and of Raffa.

In what ways do they agree with each other?

In what ways do they disagree?

7. Why is the emerald ash borer able to cause so much damage? Why not just remove the trees that are infected? Why is the solution not as simple as that?

8. "They've destroyed the conductive tissues" means what? Answer by including the definition of the word "cambium".

*This means that*

9. The article describes at least 4 methods for controlling and even fighting the emerald ash borer. For each method, describe how it works, its benefits, and its drawbacks.

**Method 1**:

How it works:

Benefits:

Drawbacks:

**Method 2**:

How it works:

Benefits:

Drawbacks:

**Method 3**:

How it works:

Benefits:

Drawbacks:

**Method 4**:

How it works:

Benefits:

Drawbacks:

10. Why are there so many ash trees in US cities anyway? Include "Dutch Elm Disease" in your answer.

11. Which of the best would be an appropriate way to rephrase the term "Wisconsin ecological pioneer"?
A. Badger State Cowboy
B. Midwestern Tree-Hugging Fur Trapper
C. Great Lakes Founder of Environmentalism
D. Musket-Firing Hunter from the Central US

12. Big trees add 10% to the value of homes. If the average value of an American home is $300,000, how much value do large trees have per household on average?

Large trees are worth $ per household on average.
*Show your work below.*

13. Of the 10,000 street trees in Oak Creek, how many were ash trees?

What percent of Oak Creek's street trees were ash trees? % (*divide the number of ash trees by the total number of trees)*

14. In regards to the EAB problem, **lowland forests** are especially threatened. How would a lowland forest such as a black ash swamp change if it were invaded by emerald ash borer? List three specific changes that would be likely to occur.
**Change 1**:

**Change 2**:

**Change 3**:

15. What lessons should the emerald ash borer teach us about **biodiversity** (lessons that we maybe should have learned from Dutch elm disease)?

16. Complete this sentence: *Because of EAB, the new rule of thumb is that no species should represent*

17. Based on this article, how will urban forestry change? What will the forests found in Wisconsin’s cities be like in 20 years as a result of both the emerald ash borer as well as the lessons learned from this invasive species? Make two predictions for how you think our cities' forests and forestry practices will change over the next 20 years.

Prediction 1:

Why you think this will occur:

Prediction 2:

Why you think this will occur:

# The tiny emerald ash borer is decimating trees in the Upper Midwest. CALS researchers are helping communities understand how to prevent and contain the damage.

# Meet the Scourge

**The tiny emerald ash borer is decimating trees in the Upper Midwest. CALS researchers are helping communities understand how to prevent and contain the damage.**

**By Ron Seely, *Grow* Magazine. Fall 2014. College of Agriculture and Life Sciences, UW-Madison.**

**IT IS AN INSECT LITTLE BIGGER THAN A GRAIN OF RICE**. But the invasive emerald ash borer may as well be Godzilla for all the chaos it has brought to the Upper Midwest’s forested landscapes. The borer has already laid ruin to the ash that dominated urban and lowland forests in Michigan, where it first turned up near Detroit in 2002, likely a hitchhiker on wooden shipping pallets from China. And in dozens of Wisconsin villages and cities, street terraces are marked by the stumps of ash trees already removed because of infestation.

The Wisconsin Department of Natural Resources says the borer has killed more than 50 million ash trees and is now found in a dozen states, including more than 30 counties in Wisconsin. Though it is not a threat to human health, the ash borer’s inevitable spread is likely to dramatically change the face of both urban and state and national public forests. The insect has already cost Wisconsin communities millions of dollars as they prepare for its assault and as they begin to remove and treat infested and threatened trees.

And it has proven a massive challenge to researchers—including entomologists at CALS—as they bring science to bear on understanding and slowing the march of the tiny, tree-killing insect and reducing its impact where it is established.

CALS entomologist Chris Williamson, who has studied the insect since 2003, says the word “cataclysmic” is not too strong to describe the eventual devastation that will be wrought by the emerald ash borer.

“The emerald ash borer means the demise of ash trees in North America,” says Williamson, who is also a UW–Extension specialist.

His colleague, CALS entomologist Ken Raffa, has researched and introduced parasitic wasps as potential predators that might help at least slow the insect’s steady march across the continent. But Raffa also said there is little doubt that such efforts are mostly holding actions against a foe that cannot be stopped. *“The genie is out of the bottle,” Raffa says.*

Even so, in the face of what seems to be nothing but bad news, research at CALS and elsewhere has provided weapons that are proving effective at slowing the insect, giving communities time to plan and homeowners the ability to treat and possibly save treasured trees with insecticides.

In fact, Williamson, surveying a stand of ash trees he has treated and studied at Warner Park on Madison’s North Side, says he actually gets irked when someone says there’s nothing that can be done to save an ash tree. He has spent long hours in the field, testing various insecticides. And he has found that treating an ash tree early enough and repeating that treatment every couple of years can save even large, prized trees that homeowners want to protect. Insecticides such as emamectin benzoate, marketed under the brand name “TREE-age,” have also given urban foresters an effective tool to slow the loss of ash and temper the impact on a community’s cooling leaf canopy.

Treatment has also been found to be less expensive than was originally anticipated. Experts with Arborjet, a company that has worked with a number of communities on treatment, says that an injection treatment, in which the insecticide is shot into the tree through holes bored in the bark, costs on average $50 to $60 every two years for municipalities. The cost is more for individual homeowners, according to Arborjet, but still cheaper than removal and replacement.

Research by Williamson and others has shown that when it comes to protecting an ash from the voracious borer, action must be taken.

“If you have an ash tree you want to preserve and you don’t treat it, it will die,” says Williamson.

**WHAT MAKES** the emerald ash borer, also known as EAB, such an effective killer? First, it is an invasive species. As such, it arrived on our shores to find it had won the insect lottery—millions of acres of tasty ash, no natural enemies poised to make a dent in its growing populations, and ash trees with no natural defense against the feeding larvae.

Added to this deadly mix of traits, according to Williamson, is the insect’s near invisibility at the early stages of infestation. The flying insect is only about an eighth of an inch wide, he says, and it lays its eggs high in a tree’s upper branches. The larvae emerge within a month, bore through the tree’s bark and begin feeding on the soft wood beneath, creating a crazy map of looping trails. All of this—from the infestation by flying adults high in the tree to the burrowing by larvae beneath the bark—is nearly impossible to spot, Williamson says. The only way to detect an infestation is through a laborious process of peeling away the outer bark of a tree and looking for the telltale trails left by the gnashing larvae. Unfortunately, by the time such evidence is found, it is too late to save the tree.

This cloak of invisibility, Williamson says, has made the borer a particularly deadly foe. Entomologists have estimated that, based on the extent of the damage to ash stands in Michigan, the borer had been dining on trees for nearly a decade before its presence was discovered, notes Williamson.

In the interim, the larvae were fatally damaging the ash trees’ inner tissues, or cambium, the layers of the tree that carry food down to the roots and water and nutrients up to the leaves.

*“It’s like me going to your house without you knowing it and destroying your plumbing,” says Williamson.*

Williamson notes that if the tree’s cambium is significantly damaged as a result of the feeding larvae, treatment is likely futile. “They’ve destroyed the conductive tissues,” he says.

While Williamson has focused on the study of insecticides, Raffa has worked to find predators that might help slow the borer.

Researchers with the U.S. Department of Agriculture studying the insect in 2003 in its native China haunts found parasitic wasps that feed on the ash borer larvae, Raffa notes. Scientists narrowed their focus to three species that they concluded might be effective and would not attack native insects. Eight states released these parasitic stingless wasps between 2007 and 2010, and in 2011 Raffa, researchers from his laboratory, and members of state agencies cooperatively released specimens of the three species at Wisconsin’s Riveredge Nature Center, near Newburg.

Raffa felled four infested trees in 2013, sectioned the logs and searched for wasps. He found that one species had survived and thrived.

“We knew they had established a population,” says Raffa. “There’s no doubt they were killing ash borers because that’s all they feed on.”

Now more of the wasps are being released by DNR pest specialists. But Raffa warns that, with the rapid spread of the ash borer, it is too late to hope that the wasps will have an immediate impact. Rather, Raffa says, the wasps may multiply and provide control after this initial, destructive wave of ash borer activity. Once the ash borer destroys much of its food source, the wasps may have a better shot at keeping their numbers in check.

“Their numbers are inadequate to affect this first big wave,” Raffa says. “I’m hoping the wasps will be there to kick EAB when it’s down.”

Raffa adds that other researchers, including scientists at Ohio State University, are searching for and studying ash trees that survive the first ash borer attacks. Such trees may offer hope because of a natural resistance that, once understood, could be bred into a new borer-resistant strain of ash.

The problem, both Williamson and Raffa say, is that such science takes time. “And time is not our friend here,” notes Williamson.

Most effective in the short term at slowing the spread are DNR rules aimed at preventing the movement of firewood around the state. Raffa says the insect does not travel far on its own, and that the insect spread through the state is due mostly to its hitching rides on firewood.

A federal and state quarantine on counties where the ash borer is present requires tree nurseries and the wood industry to take precautions that prevent the spread of the borer in nursery stock or logs (see map on page 20). General public restrictions for bringing firewood onto state properties are posted [here](http://datcpservices.wisconsin.gov/eab/).

**AT STAKE ARE**extensive stands of ash that most communities planted in the wake of another tree calamity—Dutch elm disease. Often cited as being similar in impact to the emerald ash borer’s spread, Dutch elm disease first appeared in the late 1920s and moved steadily across the continent through the 1970s. Caused by a fungus and spread by bark beetles, the disease killed 77 million of the much-beloved American elms between 1930 and 1989. Lost in that disaster were the beautiful urban tree stands that graced so many city and village streets, creating cathedral-like arches of shade.

In the wake of that loss, urban foresters planted millions of green and white ash trees. They grew fast, adapted well to urban growing conditions and resisted droughts. Madison’s streets, for example, are lined with ash. The city’s forestry department estimated that 21,700 of its publicly owned trees are ash. Thousands more are found in parks and on private property. Milwaukee has more than 30,000 ash trees lining its streets.

Statewide, Wisconsin has more than 770 million ash trees, according to the DNR’s forestry division. That’s 7 percent of the total tree population, and they dominate lowland forests. In the state’s urban areas, according to the agency, 20 percent of street trees are ash.

Wisconsin ecological pioneer Aldo Leopold observed that disturbing one part of an ecosystem often has powerful and far-removed consequences. So it is with the loss of the state’s ash trees, according to forestry experts. The loss of a large percentage of a community’s tree canopy can lead to everything from more flooding to increased energy bills for homeowners, according to Marla Eddy, Madison’s city forester.

In a 2004 study of urban trees in Minneapolis, researchers with the U.S. Forest Service found that the benefits of landscape trees dramatically exceed the costs of planting and care over their lifetime. Each year, the study found, 100 shade trees catch about 216,200 gallons of rainwater and remove 37 tons of carbon dioxide as well as 259 pounds of other pollutants.

The researchers calculated that one well-placed large tree provides an average savings of $31 in home energy costs each year. And trees add value to a home, according to the study, which found that each large front yard tree adds 1 percent to the sales price of a house. Big trees can add 10 percent to property value.

So losing such a large percentage of the tree canopy in a community is about more than just appearances. That’s why Milwaukee has chosen to treat as many as 28,000 of its 33,000 trees—to slow the loss of ash and keep as much of the canopy in place as possible as infested trees are removed.

In communities that were hit early by emerald ash borer, saving trees has been more difficult. In Oak Creek, just outside Milwaukee, EAB was discovered in November 2009, making it ground zero for the borer’s assault on Wisconsin. In the absence of tested pesticides at the time, the city started an ambitious removal and replacement program aimed at getting new trees up as soon as possible, according to Rebecca Lane, Oak Creek’s urban forester.

In fact, Lane, in anticipation of the insect’s arrival, had already been taking steps to protect the canopy. “When we heard about EAB, I almost immediately stopped planting ash trees,” Lane recalls. Of the city’s 10,000 street trees, 1,500 were ash. Of these, 750 have been removed and 750 are under treatment. “As treatments became deemed dependable, we began to use insecticides for long and short-term ash treatments,” notes Lane.

Other communities, too, have been able to take advantage of insecticides that have proven effective, thanks to the work of Williamson and other researchers.

Madison is treating all healthy street trees 10 inches in diameter or larger, and anticipates saving as many as 60 percent of its street ash tree population, according to city forester Eddy.

*“We have to think long-term,” says Karl van Lith, organizational development and training officer for the city of Madison. “We’re thinking about the tree canopy for the next generation.”*

**WHILE RESEARCHERS** have provided some help for urban forests, the more dense stands of ash in county, state and national forests will be much harder to save, according to Andrea Diss-Torrance, a plant pest and disease specialist with the Wisconsin Department of Natural Resources.The chemical treatments used in urban forests require application to individual trees, which is impossible when you’re talking about entire forests. Williamson says some research has looked at the effectiveness of aerial spraying a specific strain of Bacillus thuringiensis, similar to a bacterial strain used to control gypsy moth caterpillars. The pathogen is sprayed over the canopy and kills flying adults.

The practice remains limited, Williamson says, and comes with its own set of problems, not the least of which is the potential environmental impact of widespread spraying, as opposed to the controlled treatment of individual trees.

The bottom line is that saving extensive stands of ash trees in Wisconsin’s public forests is going to be very difficult, acknowledges Diss-Torrance. “Our forests are going to be greatly changed,” she says.

Diss-Torrance confirms that, just as the loss of urban ash trees will have environmental impacts, the death of thousands of forest trees is likely to cause damaging changes to the state’s forest ecosystems.

Of special concern are lowland forests, such as black ash swamps. Research has already shown that the loss of black ash in these wetland areas can result in a rise in water levels because the trees are no longer there to soak up the water. That change, in turn, results in the growth of problem species such as reed canary grass, which muscles out other plants and so changes the wetland that it is no longer able to support its native cohort of plants and creatures, from amphibians to insects.

“You end up with very different communities,” Diss-Torrance says. The loss of black ash would be keenly felt by several of Wisconsin’s Native American tribes, which have traditionally used the supple wood of the ash to make baskets for storing food.

“These baskets have always been a symbol of home and abundance,” Diss-Torrance says. “They’re central to the harvest and to Native tradition.”

In southern Wisconsin, green ash is prominent among the trees that line lakes, rivers and wetlands.

“We have a lot of lakes and a lot of wetland areas,” Diss-Torrance notes. “And they’re all dominated by green ash. Those trees help stabilize banks. What happens when they fall into the water?”

So the stakes are high as the battle continues against this tiny foe.

Williamson is spending less time on borer-related research but continues to spread the word about the use of insecticides—and he still spends a lot of time consulting with communities as they battle the insect.

In fact, Williamson says, with considerable misinformation circulating, the job of educating the public about the insect has been an important task of CALS scientists. He figures that between 2003 and 2013, he gave nearly 170 talks about the emerald ash borer.

One important lesson to come from the ash borer, Williamson says, is the need to diversify an urban forest’s population. It’s a lesson that should have been learned after the spread of Dutch elm disease, he notes. Now the rule of thumb is that no single species should represent 10 percent or more of a community’s total tree inventory.

Both Eddy, the city forester in Madison, and Lane, her counterpart in Oak Creek, say creating that diversity in their plantings is a priority in the wake of the emerald ash borer.

Both also say that the disastrous spread of the insect has given them new insight into the touching connections between people and the natural world, especially their attachment to the beauty and solace of trees.

“That human factor is so much larger than I thought when I first started doing this,” says Lane. “I thought of this as mostly a technical career.”

But around Yahara Place Park, on Madison’s near East Side, neighbors have seen ash trees beginning to fall and have decided to mobilize to protect what trees they can, according to Paul Nichols, one of the neighborhood organizers.

He and others went door to door collecting money to pay for treatment of healthy ash trees in the park alongside Lake Monona. Storms have recently roared through and destroyed a number of towering cottonwoods. So the remaining ash trees—about 22—took on added significance. Nichols and others took advantage of the city’s “Adopt-a-Park Tree” program—which allows residents to pay for treatment of treasured park trees—to make sure that the ash got treated.

Why make such an effort? Nichols, strolling the park on a pleasant summer morning, pointed to the stumps of the removed trees and recalled the beauty of the big trees and their arched branches—old friends that were once visible from the front window of his home.

Nichols and others say they miss the trees and understand they may not be around when the ash that are saved grow to maturity. But, he adds, they know that others will someday know and appreciate the view of the blue lake framed between stately trunks, or the pleasure of sitting beneath a shady canopy on a lazy summer afternoon.

“What we’re really talking about,” Nichols says, “is doing something for the generations to come.”

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