



Help the Plant Heroes protect our forests by slowing the spread of pests and diseases!

PLANTHEROES.ORG  
ADVANCED  
ACTIVITY  
BOOK

INSECT

# INVASIVE SHOT-HOLE BORERS



**Aponi Star**



**BE A PLANT HERO!**  
Help Aponi slow the spread of the invasive shot-hole borers!



Plant  
Protection  
Program

AMERICAN PUBLIC GARDENS ASSOCIATION

# Meet the PLANT HEROES!



## LAURA WILKINS

From: Athens, Georgia  
Hobbies: playing the trumpet,  
gardening, studying ecology

## FRANKIE BARKER

From: Shrewsbury, Massachusetts  
Hobbies: climbing trees, camping

## NATE GREEN

From: Tacoma,  
Washington  
Hobbies: going on  
adventures, learning  
about fungi

## APONI STAR

From:  
Southeast  
Illinois  
Hobbies:  
learning  
more about  
entomology  
(the study of  
insects)



[plantheroes.org](http://plantheroes.org)

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The Plant Heroes are four friends who love spending time in nature more than anything else! They enjoy climbing trees, walking trails, and camping.

The heroes are learning about why our forests are in danger. There are insects and fungi that can impact trees, sometimes affecting the health of whole forests. Trees may become sick or die when they are weakened by an invasive species, a living thing that can cause damage to existing organisms when it is introduced to a new environment.

**Follow Aponi to learn the story of how she helped slow the spread of the invasive shot-hole borers...**



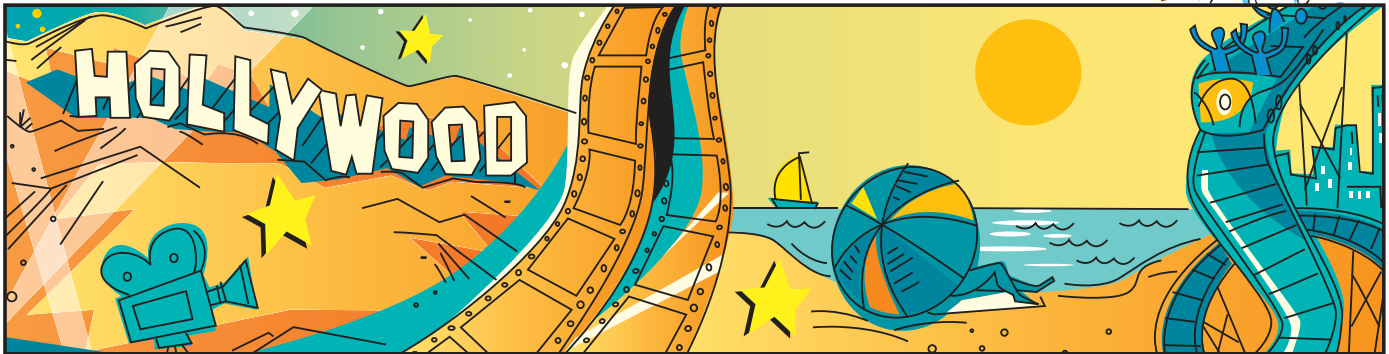
# CAMP SMART

with

## SAFE FIREWOOD



Aponi spent the entire summer with her cousins in southern California—amusement parks, movie stars, the beach... it's been a big adventure and they've decided to wrap it up with a weekend camping trip to a nearby state park!



The day before they leave, Aponi's uncle mentions that he saw a pile of wood on the curb in front of someone's house on his way home from work. "Maybe we could swing by on the way out of town and ask if we can take it for our campfire?"



Aponi remembers seeing some trees being taken down while they were visiting one of the nearby public parks a few weeks earlier ...



The groundskeeper explained that the trees were dying because they had been attacked by a tiny new beetle called the invasive shot hole borer.

She was amazed to see how **TINY** the beetle's exit holes were!

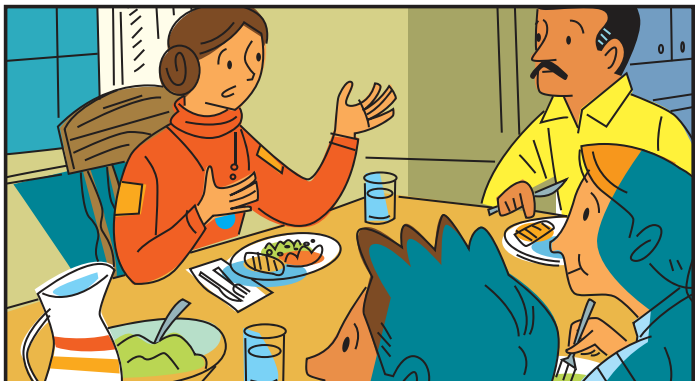


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# HOLD ON!!

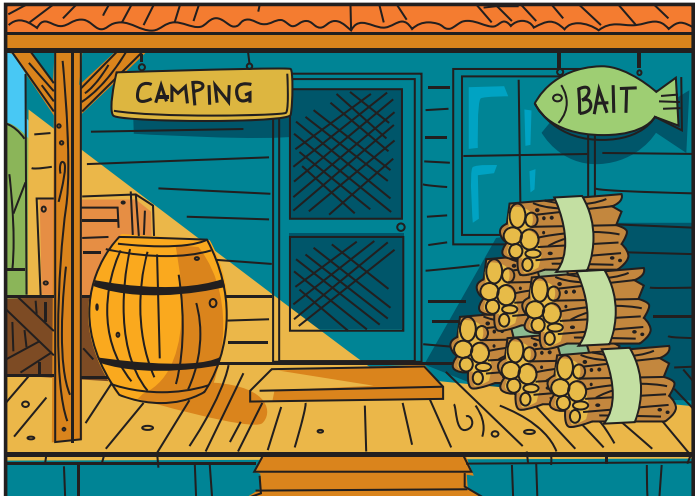
What if the pile of wood that you saw is infested with the same thing!?



Aponi suggests that they look for heat-treated firewood instead, as that would kill any wood-boring insects.

The next morning they call the campground and the ranger gives them the name of a place nearby that sells heat-treated firewood.

They stop by the camping supply shop on the way to the park...



... and the owner points out the treated firewood label on each of the bundles. They know they've made the right choice!



That night, as they tell ghost stories around the campfire, they can all enjoy their s'mores even more knowing that they didn't introduce a dangerous pest to the forest.

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# A Small Beetle and a Fast-Growing Fungus



Invasive shot-hole borers are TINY—about the size of a sesame seed! They were accidentally brought to North America in 2002 from its home in southeast Asia. It is not the beetle itself, but the fungus it carries, that can really hurt trees. The beetle vectors (or carries) the fungus inside special pouches in its mouth, so when it chews tunnels into another tree, the tree will also be infected with the fungus.



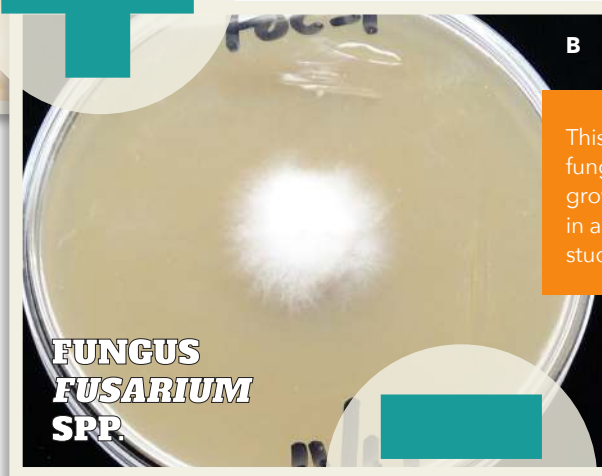
**INVASIVE SHOT-HOLE BORER**

## WHAT IS A FUNGUS?

A fungus is a living organism, or being, that is neither a plant nor an animal. Fungi are the great recyclers of the environment, getting their nutrition from organic matter (like a tree). Some common fungi you might recognize include mushrooms and molds.

### HANDY TIP:

Fungi means more than 1 fungus; fungus means just one fungus.

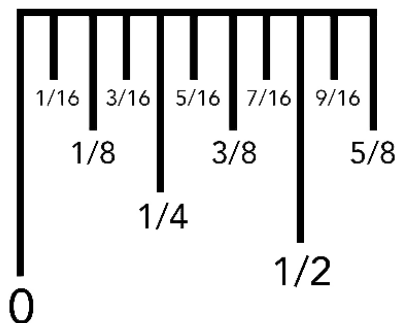


**FUNGUS FUSARIUM SPP.**

This *Fusarium* spp. fungus was purposely grown in this petri dish in a lab for scientists to study it more closely.

Invasive shot-hole borers are super small! They measure between a 1/16th to an 1/8th of an inch long.

Can you draw a beetle in its correct size next to the ruler? →

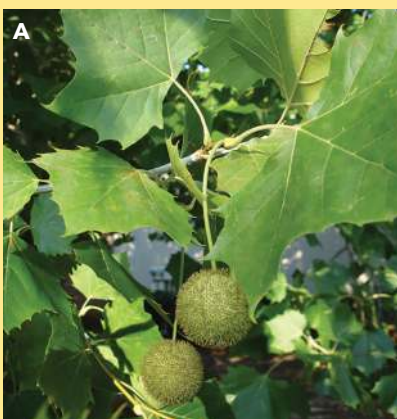


**FUSARIUM WILT**

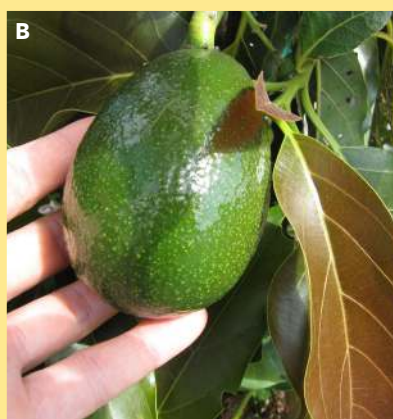


# Fertile Ground for Farming

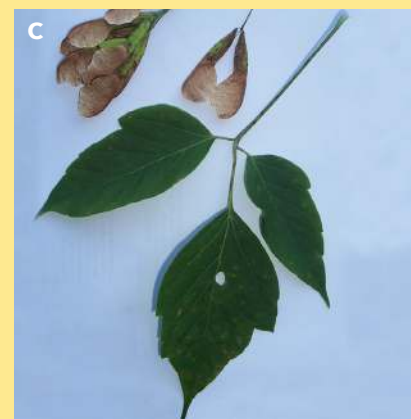
Scientists refer to invasive shot-hole borers as farmers because they “farm” the fungi they carry with them. The adult beetles “plant” spores of the fungi inside the tunnels they chew into trees, and when their eggs hatch into larvae, the larvae eat the fungus that has grown through the tunnels. Invasive shot-hole borers won’t farm fungi anywhere—they prefer specific trees to raise their young. Learn about a couple of the most common trees they prefer below by matching the descriptions to the images.



**Sycamore /  
*Platanus racemosa***



**Avocado /  
*Persea americana***



**Boxelder maple /  
*Acer negundo***

**1**

- Fast growing tree.
- A type of maple, although the leaves sometimes look a little different.
- The seeds are called “samaras,” and when they are carried by the wind they look like helicopter blades.

**2**

- Long, glossy leaves up to 8” long, stay on the tree during the winter.
- Pear-shaped fruit with a dark green bumpy exterior and pit inside.

**3**

- Large trees, 30-80 feet in height.
- The leaves generally have five lobes, but some only have three.
- They produce round and fuzzy seed heads.

For more images of host plants, see page 5 in your field guide!



# Trees in Trouble



Trees give us several different clues that they are impacted by invasive shot-hole borers. Learn more about the trees' symptoms by matching up the descriptions with the photos.

1



Oozing sap (a sticky liquid substance produced in the tree) and dark patches around the borer holes.

.....

2



Leaf wilting and dead branches.

.....

3



When invasive shot-hole borer females enter or leave their host trees, they leave holes smaller than the tip of a ballpoint pen on the tree's bark.

.....

4



Some trees produce "sugar volcanoes" to try to stop the beetles from entering through the bark.

Invasive shot-hole borers have four different life stages; **egg, larva, pupa, and adult.**





# Lifecycle Maze

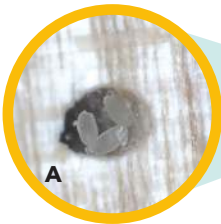


An invasive shot-hole borer goes through several changes during its lifetime. Adult psyllids beetles lay eggs inside trees. The eggs hatch into larvae, they feed and grow inside the tree, then turn into pupae, and finally transform into adults and leave the tree. Learn more about the lifecycle of invasive shot-hole borers by completing the maze below!

**START** →

## EGG

Very tiny, oval-shaped, and whitish.



## LARVA

Creamy-white, they eat and grow inside the tree.



## PUPA

Resting period when the larva transforms into an adult.



**FINISH**



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# Time to Journal



**1.** What do you remember most about the invasive shot-hole borers?

.....

.....

.....

.....

**2.** What is the most interesting thing you learned in this book?

.....

.....

.....

.....

**3.** Can you think of some signs that a plant is not healthy?  
If you have plants near you, observe them carefully and write down what you notice.

.....

.....

.....

.....



**4.** Do you have a favorite tree?  
Write the name below. Describe why you love it.

.....

.....

.....

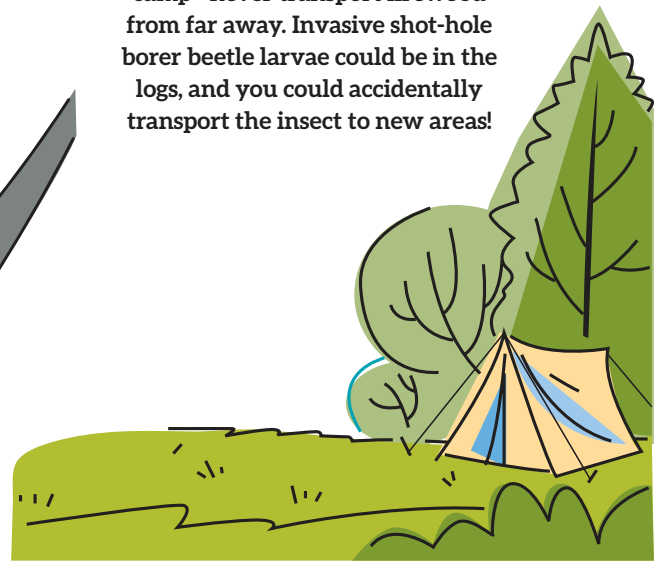
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## **SLOW THE SPREAD!**

If you like to go camping, buy your firewood only near where you camp—never transport firewood from far away. Invasive shot-hole borer beetle larvae could be in the logs, and you could accidentally transport the insect to new areas!



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## **ANSWER KEY**

**Fertile Ground for Farming:** 1. Boxelder maple; 2. Avocado; 3. Sycamore

**Trees in Trouble:** From top to bottom: 4, 1, 2, 3



### **HOW DO PLANTS DRINK?**

Check out this video with a cool experiment all about how plants drink!  
Scan the QR code with a phone or type in <https://bit.ly/howdoplantsdrink>





Join our team of Plant Heroes and learn about trees, forests, and the natural world around you!

**PLANTHEROES.ORG**

### You can be a Plant Hero!

Are you curious about plants and animals? Do you like asking questions about nature? Do you enjoy being outdoors and having fun, climbing trees, balancing on logs, or finding a new butterfly or beetle? If so, you are already on your way to becoming a Plant Hero! We invite you to join forces with Nate, Laura, Aponi, and Frankie to protect the plants and ecosystems we all love.

### How can you become a Plant Hero?

Join our team and go on a journey with Nate, Aponi, Laura, and Frankie. As a Plant Hero, you will learn to notice when plants are in trouble. You will also find out ways you can act quickly to help find solutions in your own neighborhood. Follow their adventures and learn how they help plants and ecosystems stay healthy.

**On the Plant Heroes website, you will find** materials to help you learn about plants, forest health, and ecosystem balance. The more you know, the more you can help protect plants and ecosystems in your own yard, neighborhood, and community!

**Plant Heroes strives to spark curiosity about nature and science in all children.** Our program provides hands-on, nature-based learning materials for educators to engage children in topics of plant health, ecosystem balance, and forest health. We also spotlight the amazing work our public gardens do in protecting the plants and ecosystems we all depend on through our website and printed materials. Visit [plantheroes.org](http://plantheroes.org) today to learn more!

**Plant Heroes is brought to you by the American Public Gardens Association**, founded in 1940. Over the last eight decades, the Association has supported the work of public gardens in North America and beyond. Our mission is to champion and advance public gardens as leaders, advocates, and innovators in the conservation and appreciation of plants. Our vision is "A world where public gardens are indispensable" as they provide botanic, conservation, community, education, and economic resources to their community.

The Association is committed to increasing the knowledge of public garden professionals throughout North America through information sharing, professional development, networking, public awareness, and research, so that they have the tools to effectively serve visitors and members.



**American  
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Association**

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