PLANT HEROES

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

INSECT SOUTHERN PINE BEETLE

PLANTHEROES.ORG

ADVANCED ACTIVITY BOOK

BE A PLANT HERO!

Help Laura stop the southern pine beetle from damaging pine forests.

Laura Wilkins

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)

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The Plant Heroes are four friends who love spending their free time in nature climbing trees, fishing, and camping. They've teamed up together because they've heard that the forests they love are in trouble.

Some of the insects and fungi in our forests have become extremely aggressive, and have caused the death of many trees. These insects and fungi generally do not cause so much destruction, but humans have changed the environment they live in, allowing them to spread rapidly and harm our forests. The plant heroes are working to stop the spread of these pests.

Follow Laura to hear the story of how she stopped the spread of the southern pine beetle...

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It's All About Ecosystem Balance

PLANT HEROES

SOUTHERN PINE BEETLE

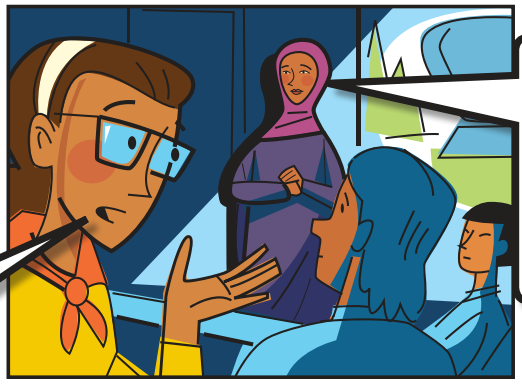
Laura is studying to be an entomologist (a scientist who studies insects) at the University of Georgia. Today, she learns that pine forests in the southeastern United States are threatened by growing numbers of southern pine beetle.

The southern pine beetle is native to the area and serves a purpose: When the ecosystem is balanced, the beetles attack old, weak or dying trees and make room for young, stronger ones.

But when healthy trees become stressed because of drought, or because they were planted too close together and compete for water and other resources, the southern pine beetles suddenly have lots of weak trees to feed on and their numbers grow out of control.

With so many beetles around, even healthy trees are at risk of attack!

Laura's professor shares that, unfortunately, all the affected trees must be removed when the attack is confirmed. Foresters need to act quickly to prevent the beetle from spreading to new areas.



But what happens to the cleared area?

More resistant pine species should be planted, and they need extra care to keep them healthy, so they are not vulnerable to beetle attacks.

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A natural area nearby was recently cleared and they are looking for volunteers to help replant longleaf and slash pine.

Laura invites her friends and they decide to have their annual spring break camping trip at Oconee National Forest!

The professor connects Laura with the Forest Service specialist at Oconee National Forest.

During spring break ...

Planting starts the next day, so they spend the afternoon setting up camp and exploring the area.

Laura shares what she learned in class: what the beetles looks like and which trees they attack.

Laura and the rest of the heroes spend the next day replanting longleaf pines under the guidance of the Forest Service. Their efforts will help restore the balance and regenerate this forest!

The heroes learn that every insect has its place. Southern pine beetles are an important part of the ecosystem, but they turn into a problem when that delicate balance is lost.

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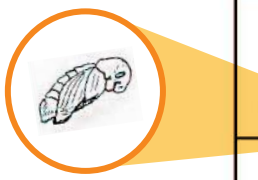
Lifecycle Maze

The southern pine beetle starts its life as a small egg in a pine tree. The eggs hatch and larvae emerge, and they begin to create tunnels (known as "galleries") through the tree. Eventually, the larvae pupate (or go through a "metamorphosis") to become adult beetles. The adult beetles chew their way out of the tree and fly away to search for a mate. When they've found a mate, they locate another tree in which to lay their eggs. Follow the stages of the beetle through the maze to learn more about its life cycle.

START →

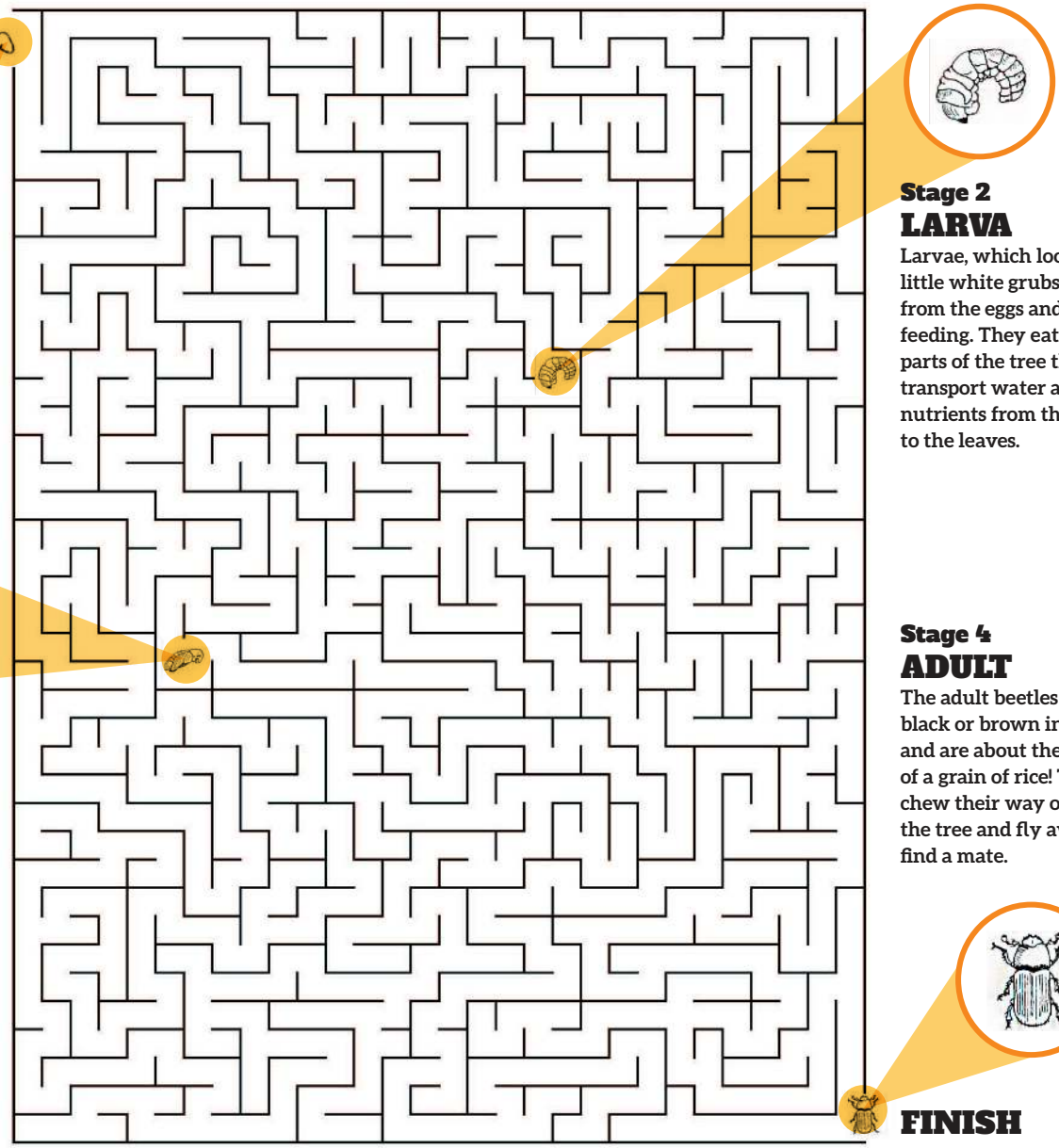
Stage 1
EGG

The adult beetle lays its tiny white eggs in "nurseries" along the galleries it has created.



Stage 3
PUPA

The larvae stop feeding and begin their resting stage. While they rest, they change into adult beetles. During this time of metamorphosis they are called pupae.



Stage 2
LARVA

Larvae, which look like little white grubs, hatch from the eggs and begin feeding. They eat the parts of the tree that transport water and nutrients from the roots to the leaves.

Stage 4
ADULT

The adult beetles are black or brown in color and are about the size of a grain of rice! They chew their way out of the tree and fly away to find a mate.

FINISH

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ILLUSTRATIONS of egg, pupa, larva, adult: Ben Powell, *Identifying the Southern Pine Beetle*, Clemson University Cooperative Extension.

A Beetle Feast!

Southern pine beetles will eat and live inside any type of pine tree. Pine trees are known as "hosts" for the beetles, because the beetles are the guests that live inside them. Pine trees have long thin leaves called "needles" and cones that hold the seeds. Match the drawings to the descriptions of the trees below and then see if you can spot any of these trees near you.

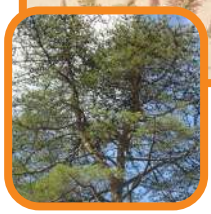
1

Pinus echinata / shortleaf pine

2

Pinus taeda / loblolly pine

3



Pinus virginiana / Virginia pine

A. Needles are in bundles of three, 6–10" long with finely serrated edges. Cones have a sharp curved spine, and the tree is oval-shaped with horizontal branches.

B. Needles are in bundles of two, 1.5–3" long. Cones have a prickle. The tree has a messy appearance and is named after one of the states in which it grows.

C. Pine cones are spiky. Needles are relatively short, held in bundles of two, and have little serrations. Bark is reddish-brown and divided into square-like segments.

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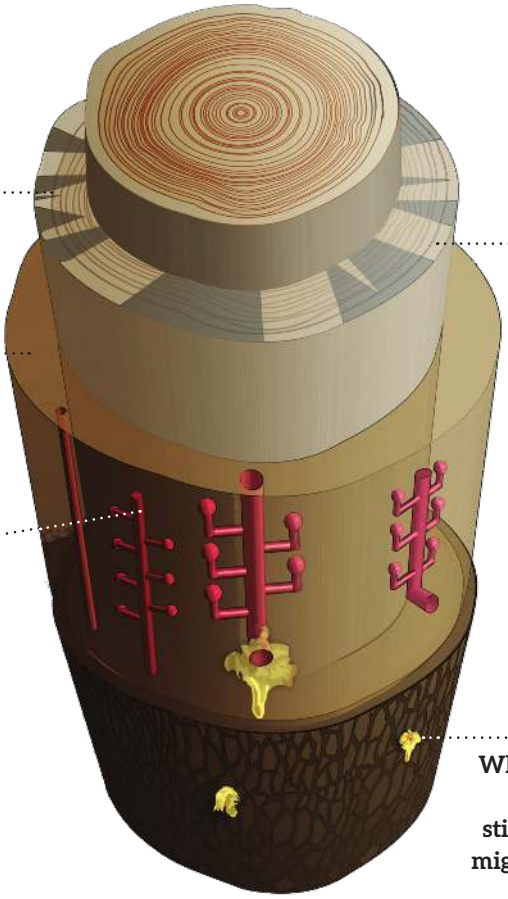
TREE DRAWINGS by François André Michaux from The North American Sylva, flickr.com, CC BY 2.0; PHOTOS from left: Vern Wilkins, Indiana University, Bugwood.org; John Ruter, University of Georgia, Bugwood.org; David Stephens, Bugwood.org

Trees in Danger

The southern pine beetle causes the death of many pine trees each year by starving the trees of food by chewing tunnels in the tree's phloem cells. Below are some of the signs that a tree might be hosting southern pine beetles. See if you can label all of the parts of the tree correctly!

WORD BANK:

FUNGUS, PHLOEM, PITCH MASSES, GALLERIES, XYLEM



1. water transport cells

2. food transport cells

3. The beetles make many tunnels under the bark. These tunnels block the phloem (food transport cells) of the tree, and cause it to starve to death!

4. This organism travels on the beetles and harms the tree, staining the inside of the tree blue.

5. When the tree is attacked by beetles, it responds by producing pitch, a sticky fluid from inside the tree. You might see pitch masses on the outside of a tree; they look like popcorn!

OTHER SIGNS OF DANGER!

When a tree is stressed, you might see something called "necrosis" or "chlorosis." A tree is showing signs of necrosis when its leaves are dead and brown. Yellowing leaves are a sign of chlorosis. Do you see any signs of unhealthy plants around you? Look closer and see if you spot any insects or fungi. List what you've noticed below.

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GRAPHIC: By Wesley Watson, graciously provided by the *Casper Star Tribune*.

A Balanced Ecosystem

Southern pine beetles play an important role in ecosystems. An ecosystem is a community of living things (animals, plants, fungi) and the environment they live in. If an ecosystem is in balance (has the right number and type of species), southern pine beetles will only attack weak, dying trees. When ecosystems are out of balance, beetles can multiply too fast and cause lots of damage. Use the elements of an ecosystem below to predict how beetle populations will change.

Woodpeckers eat the southern pine beetles.

Blue-stain fungi harm pine trees and beetles.

Mites hitch a ride on southern pine beetles and carry with them blue-stain fungi.

Hot weather makes southern pine beetle numbers increase!

Pine trees support the southern pine beetle.

The **checkered beetle** is a predator of the southern pine beetle.

HOW WILL POPULATIONS CHANGE?

What will happen to the pine trees, woodpeckers, blue-stain fungi, mites, southern pine beetles, and checkered beetles if the following things happen? Try to predict how the population numbers of each plant, animal, or fungus will rise, fall, or stay the same with the information you have been provided. Write your answers in the blanks.

1. Temperatures are warm throughout the year.

_____

2. Many of the southern pine beetles begin to die.

_____

3. There are many more mites than previous years.

_____

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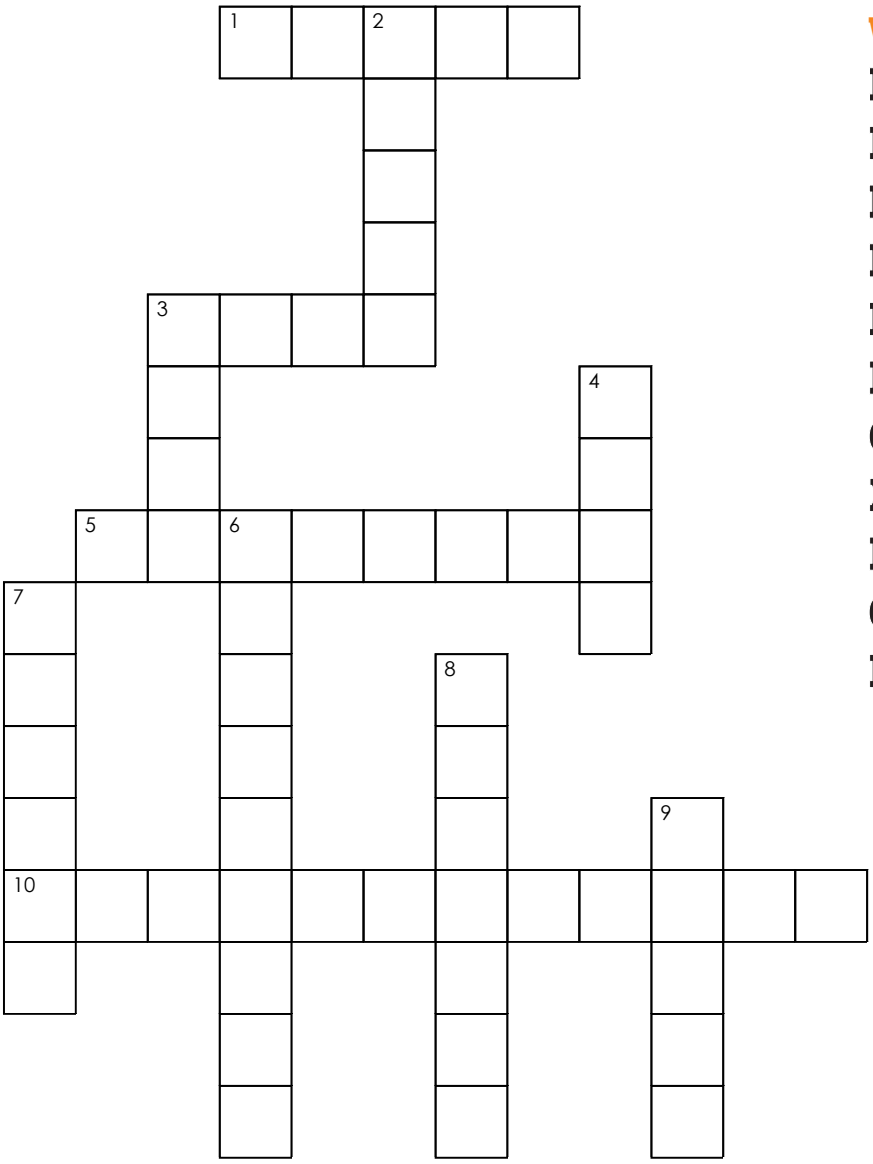
Crossword

Test your knowledge about the southern pine beetle with this crossword!



WORD BANK:

LARVA
PUPA
NECROSIS
HOST
ENTOMOLOGIST
PITCH
GALLERY
XYLEM
PHLOEM
CHLOROSIS
PINE

ACROSS:

1. Cells that transport water inside a tree
3. Resting stage of an immature beetle
5. Brown foliage that indicates tree stress
10. A scientist who studies insects

DOWN:

2. The immature, grub-like stage of the southern pine beetle
3. Evergreen tree with long, thin needles in clusters and seeds held in cones
4. The name for a specific plant a living being (such as a beetle) requires to live
6. Yellow leaves as a sign of tree stress
7. Cells that transport food inside a tree
8. The name for a tunnel a beetle creates inside a pine tree
9. A sticky fluid produced inside a tree as a defense against invading beetles

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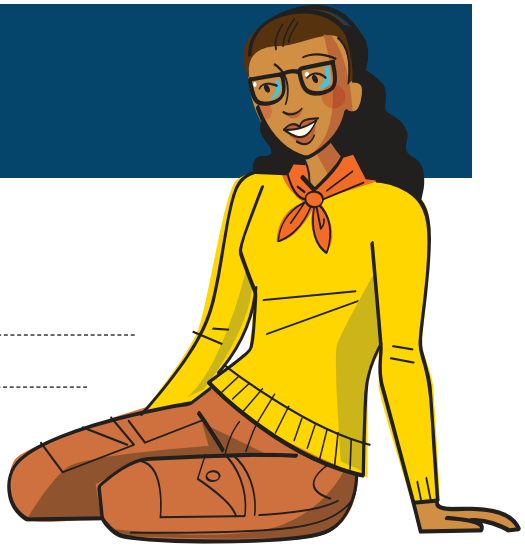
Time to Journal



1. What do you remember most about southern pine beetles?

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

3. Can you name three different symptoms of trees affected by southern pine beetles? (Hint: use your field guide to help answer this question)

4. What is your favorite plant you want to help protect? Why?

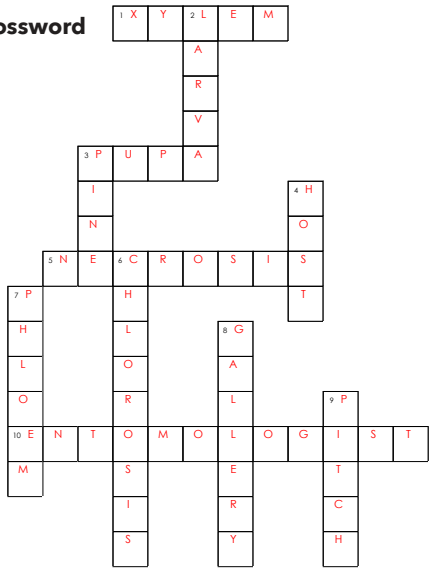
ANSWER KEY

A Beetle Feast! **1:** Pinus echinata: C; **2:** Pinus taeda: A; **3:** Pinus virginiana: B

Trees in Danger **1:** xylem; **2:** phloem; **3:** galleries; **4:** fungus; **5:** pitch masses

A Balanced Ecosystem There are multiple right answers! Here's one way you could answer the questions. 1) woodpeckers, southern pine beetles, mites, fungi, and checkered beetle populations will increase; the number of healthy pine trees will decrease, 2) woodpeckers, blue-stain fungi, mites, and checkered beetle populations will decrease; the number of healthy pine trees will increase, 3) blue-stain fungi will increase; southern pine beetles, woodpeckers, checkered beetles will decrease; and the number of healthy pine trees will likely increase if there are fewer beetles to carry the mites and blue-stain fungi to the trees.

Crossword



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PLANT HEROES

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** 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.

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