



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

WHITE PINE BLISTER RUST

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ADVANCED
ACTIVITY
BOOK

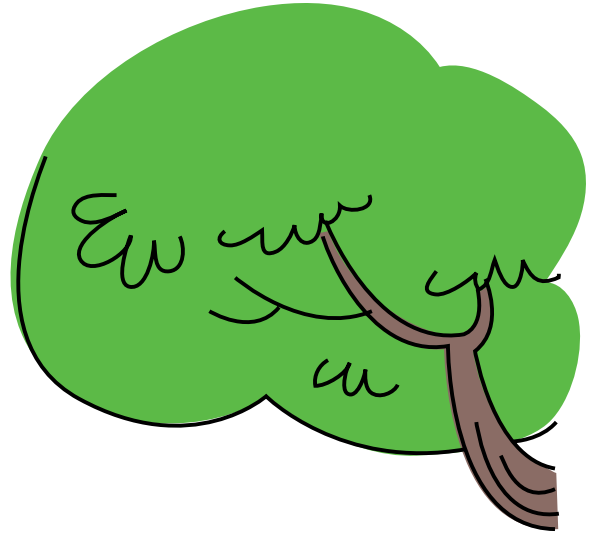
Nate Green



BE A PLANT HERO!
Help Nate slow the
spread of White Pine
Blister Rust!



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 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 is introduced to a new environment where it can cause damage to existing organisms.

Follow Nate to learn the story of how he helped slow the spread of white pine blister rust...



A 'CURRANT' THREAT



Nate and his parents spent winter break with his older sister, Karen, at her new home near Salt Lake City, Utah. They spent a bunch of time on the slopes and the snow was awesome!

Several months later they are getting ready for another visit ...

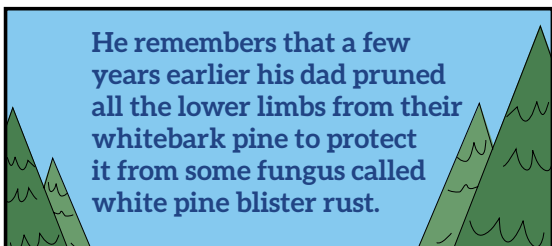
Nate's mom suggests that he dig up a few small black currant bushes from the backyard and bring them to Karen for her garden.



When Nate starts digging up the currant plants the next day, he notices that a lot of leaves are covered in orange spots.



He remembers that a few years earlier his dad pruned all the lower limbs from their whitebark pine to protect it from some fungus called white pine blister rust.



HANG ON!!

What was the funny name of those pines I didn't recognize at Karen's last winter... limber pine? Is that some kind of white pine?

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He looks it up on his phone and learns that all white pines have needles in bundles of five and that limber pine is in that group.

Nate texts his sister:



The pictures arrive and Nate was right ...

FIVE NEEDLES!!

“MOM! If we bring these plants, we might infect her pines with a deadly disease! Maybe we should find something else for her while we’re there.”



They wait, and, sure enough, they find a native plant nursery in Salt Lake City that specializes in edibles. The owner explains that white pine blister rust hasn’t been found in Utah yet, and they hope it never is.



He helps them pick out some choke-cherry and elder-berry bushes for Karen’s place and even sends them home with some samples of their fruit.

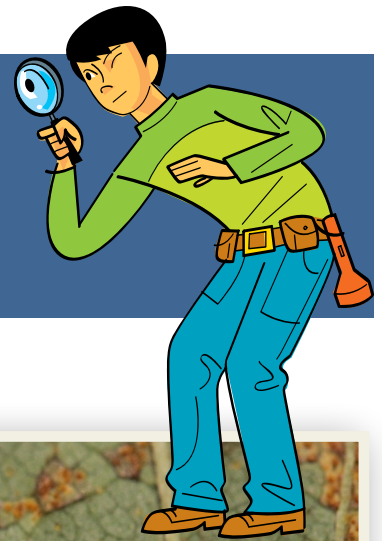


They put the plans in the ground that afternoon and then do some celebrating in the kitchen. Maybe it’s knowing that they weren’t the ones to introduce white pine blister rust to Utah, but everyone agrees, Karen’s scones taste extra sweet today!

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What Is White Pine Blister Rust?



White pine blister rust is a type of fungus that infects the living tissue of white pine trees, cutting off the trees' ability to transport nutrients. There are many different fungi called "rusts" for the rusty color of the fungus on leaves. Rusts usually have very specific hosts (sometimes more than one) and are often named after one of the plants they infect. The rust we are learning about today, white pine blister rust, infects currants and white pine trees.

DID YOU KNOW?

Not all fungi are harmful. Some fungi help plants get nutrients from the soil to grow!



HANDY TIP!

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



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PHOTO CREDITS: A: Björn S, Flickr.com; B: Robert L. Anderson, Bugwood.org

A Complicated Life

The life cycle of white pine blister rust is a complicated one. To complete its life cycle, the fungus needs to infect two different plants. Using page 3 of your field guide, match the description of the life cycle to the pictures below.

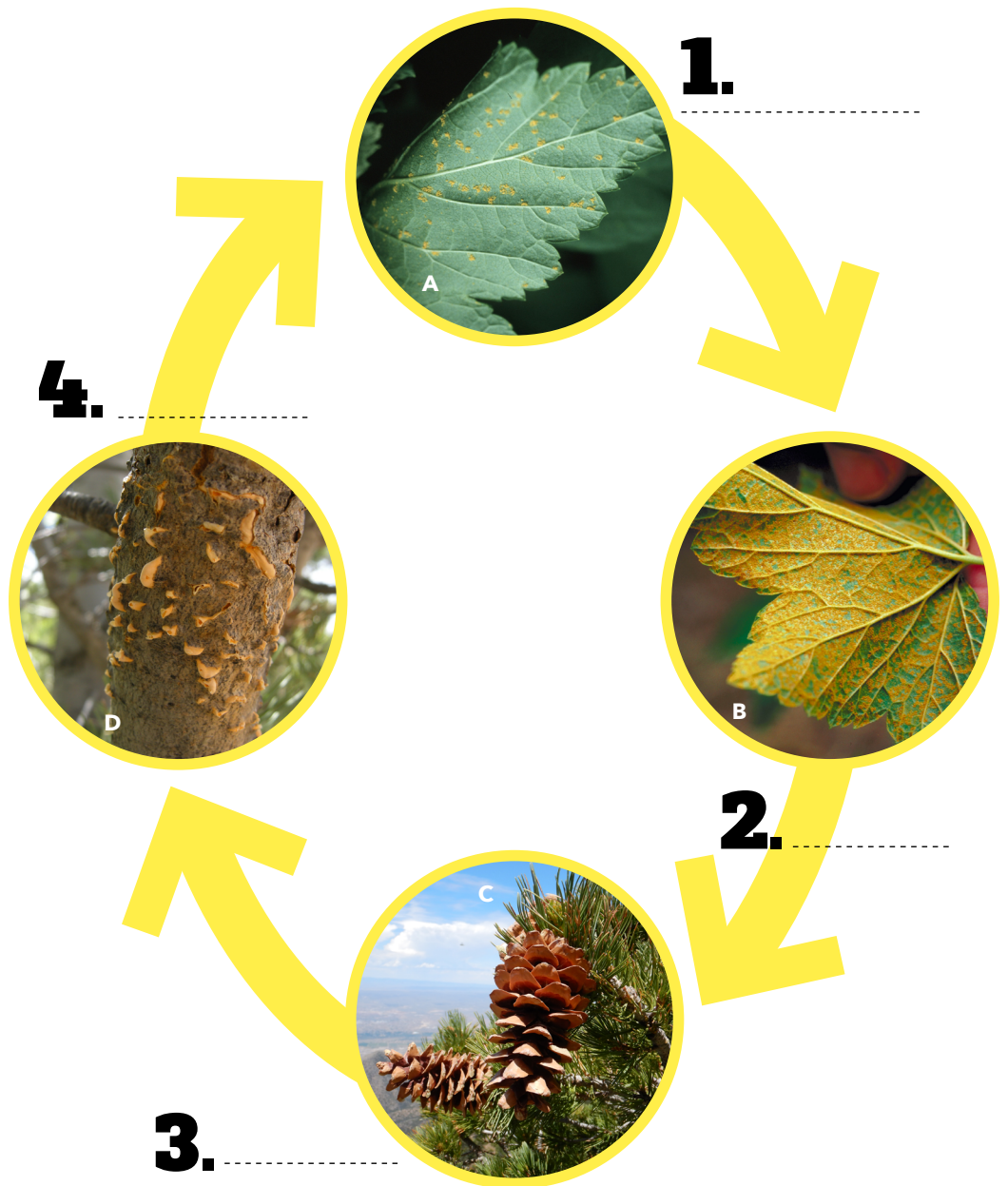


A. When conditions are right in the springtime, an infected tree produces whitish-yellow bumps on its trunk containing spores of the fungus, which are released into the air.

B. In late summer, fuzzy rust-colored patches on the undersides of the currant's leaves release spores.

C. Spores are airborne and float through the air until they land on a white pine tree. As the fungus grows on the pine tree, it kills the food and water transport cells (phloem and xylem) of the tree. The fungus grows within the tree for one to two years.

D. Spores from the fungus land on currant leaves in the spring. Throughout the spring and summer, yellow spots develop on the leaves.



Meet the Trees!

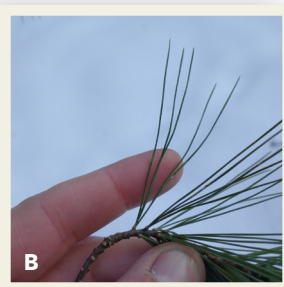
White pine blister rust is named after the damage it does to white pine species. White pines are considered “hosts” because the fungi are the “guests” that feed on them. There are several different species of white pine trees.



Pine trees have leaves called “needles.” The needles grow together in groups called “bundles.” You can tell white pines from other pine species (like Virginia pine or loblolly pine) by counting the number of needles in the bundle. Count the needles in the picture.

Is it a white pine?

Search in a garden or park near you and see if you can find any pine trees. Draw a picture of the needles below, paying close attention to the number of needles in the bundle. (If you can't find a pine tree, use your field guide or this activity book to draw a pine.) How many needles does it have in a group? Is it a white pine?



Meet the Other Hosts!



To complete its life cycle, white pine blister rust must also infect another host. Most commonly, the rust infects a currant, but it can also infect Indian paintbrushes and louseworts. Learn more about two currant species below. Search in a garden or park near you and see if you can find one of these plants. Draw or describe what each leaf looks like.

Large dashed-line box for drawing or describing the American Black Currant leaf.

AMERICAN BLACK CURRANT

This shrub grows to be between 3 and 5 feet tall. It has leaves that look almost like a hand with 5 finger shapes called “lobes” that come to a point. In the spring it has yellow flowers, and in the summer the plant produces small black berries that you can eat!



Large dashed-line box for drawing or describing the Mountain Gooseberry leaf.

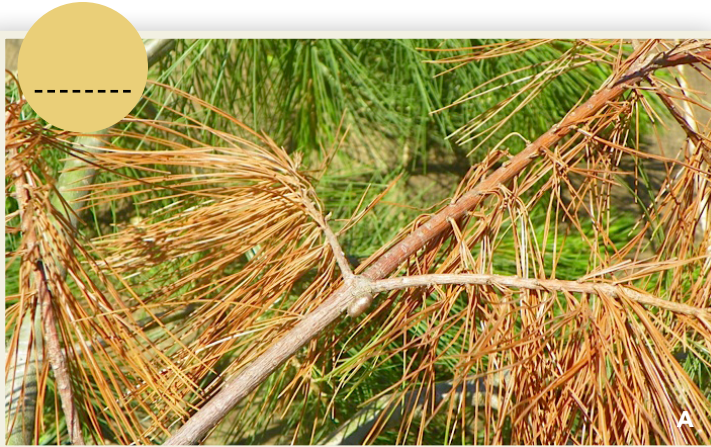
MOUNTAIN GOOSEBERRY

This shrub grows to be between 3 and 5 feet tall. Like the American black currant, the leaves of the mountain gooseberry also have five lobes, but they are rounded instead of coming to a point. In the spring it has pink flowers, and in the summer the plant produces red berries with hairs that you can eat. Watch out! This plant is also armed with thorns.



Plants in Trouble

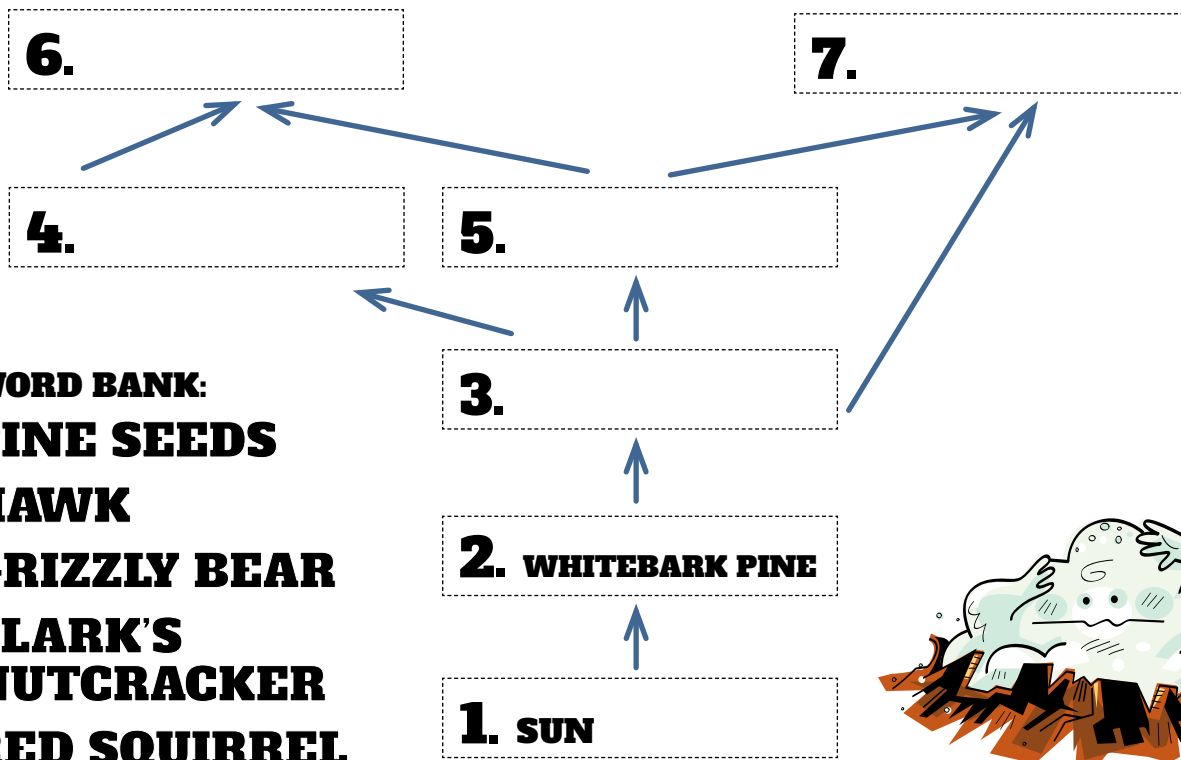
There are several different ways to spot potential signs or symptoms of white pine blister rust. Learn more about the signs and symptoms by labeling each photo with the right description. Hint: Use page 2 of your field guide for help.



- 1.** The undersides of the currant leaves have fuzzy rust-colored patches.
- 2.** As the fungus kills the white pine's food transport cells, pine branches may turn yellow and die.
- 3.** The fungus produces whitish-yellow blisters that break through the bark of the white pine.

Everything Is Connected

White pine blister rust can impact many different pine species, including the whitebark pine. Without the whitebark pine, the ecology in the high mountains of the Western US might look different. **Ecology** is the study of how living things (fungi, animals, plants) interact with one another and with the environment they live in. An **ecologist** is someone who studies ecology to understand the connections between different living and nonliving things. Try your hand at being an ecologist by putting this food web together and then thinking about what might happen if elements of the food web changed. A food web is like a food chain but includes more living beings and the interactions among them. To build the food web, start at #3 with what gets food or energy from the whitebark pine, then add the animals that eat from the whitebark pine followed by the animals that prey on those animals.



WORD BANK:
PINE SEEDS
HAWK
GRIZZLY BEAR
CLARK'S NUTCRACKER
RED SQUIRREL

ANSWER KEY

A Complicated Life: 1. D, 2. B, 3. C, 4. A

Meet the Trees: Yes, eastern white pine (*Pinus strobus*)

Plants in Trouble: 1. C, 2. A, 3. B.

Everything Is Connected: 3. Pine Seeds, 4. Clark's Nutcracker, 5. Red Squirrel, 6. Hawk, 7. Grizzly Bear





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

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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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