

Plant Plague: Sudden Oak Death Educator Guide

A resource for using QUEST video and audio in the classroom

Watch it online <http://www.kqed.org/quest/television/view/250> | TV story length 8.00 minutes

Listen online <http://www.kqed.org/quest/radio/sudden-oak-death> | Radio story length 5.30 minutes

QUEST SUBJECTS

Life Science
Biology
Health
Environment

Earth Science
Geology
Weather
Astronomy

Physical Science
Physics
Chemistry
Engineering

CA SCIENCE STANDARDS

Grade 4

Life Sciences
3. Living organisms depend on one another and on their environment for survival. (a,b,c)

Grade 5

Life Sciences
3. Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials. (a,e,f)

Grades 9-12

Ecology
6. Stability in an ecosystem is a balance between competing effects. (a,b)

Evolution
8. Evolution is the result of genetic changes that occur in constantly changing environments. (b)

PROGRAM NOTES

Watch **Plant Plague: Sudden Oak Death**

In the past 10 years, sudden oak death has devastated over one million oak trees across Northern California and southern Oregon. It's a killer with no cure. But biologists now are looking to the trees' genetics for a solution.

Listen to **Sudden Oak Death**

California's plant biologists are looking at ways to stop the spread of disease that is killing trees that are vital to the ecology of the coastal hills. Researchers have found a way to inoculate individual trees from the disease, but are struggling in their search to find a more sweeping answer to the threat.



In these segments you'll find ...

- ⦿ what sudden oak death is and when it first was recognized as a problem.
- ⦿ how the pathogen *Phytophthora ramorum* affects oak trees and other plants.
- ⦿ what scientists are doing to prevent the spread of the disease.

TOPIC BACKGROUND

Sudden Oak death (SOD), also known as ramorum blight, is a canker disease that kills tanoak and oak trees and affects many other plant species. It's caused by a pathogen (*Phytophthora ramorum*) thought to have originated in Asia and been distributed through the nursery industry. Since the early 1990s, *P. ramorum* has affected one million native oak and tanoak trees in California as well as southern Oregon.



SOD causes lesions and cankers in oaks and tanoaks and can cause lesions and browning of the twigs and leaves in other plants. It's often spread during the rainy season in cool and wet climates. Once an area has been infested, SOD may spread quickly, affecting large areas of the forest. Researchers have found that ornamental plants such as camellias and rhododendrons can also be carriers for the disease and pass on the infection to surrounding oaks. In the wild, the most common carrier of the infection is the California Bay Laurel tree, which grows abundantly in large parts of California.

In California's coastal counties, SOD could have devastating ecological and cultural effects. Oaks and tanoaks are important for forest balance through their production of acorns, an important food source for many animals. The trees also contribute to soil stability and have a significant relationship with fungi. Large areas of dead trees can cause fire and safety hazards. Also, the widespread loss of tanoaks can have a devastating effect on Native Americans from a cultural and ceremonial perspective.

Researchers have had some success with inoculating individual trees using a phosphonate fungicide. The treatment is costly, labor-intensive, and works more as preventive measure rather than a cure. However, a broader solution may be found by studying the genetics of certain tanoaks that exhibit resistance to the disease.

Media Enhance Education

Video and audio can be powerful tools for meaningful learning. It all depends on you, the educator. The key to using media effectively is preparation. Make the most of learning opportunities by encouraging students to become active viewers and listeners. Pick and choose from the suggested questions and activities to offer an engaging media experience.

Questioning

Oftentimes, teachers and students become frustrated during a media segment when students can't find the answers to a long list of questions. Provide a limited number of questions or topics for students. This focuses their attention on during a media segment, helps to keep them engaged and generally results in higher quality answers. QUEST Ed. has provided a number of options for focus questions ranging from fact based to opinions, as well as "big picture" ideas. The questions are listed in order of increasing complexity of thought.

PRE-VIEWING

- Discuss some of the different types of oak trees found in the Bay Area. Look at habitat, appearance and natural history characteristics.
- What type of organisms can kill trees (fungus, water mold, insects and so on)? How?
- Which animals depend on oaks and acorns?
- Discuss the concept of extinction. What happens when one plant or animal becomes extinct? What impact does it have on other organisms?
- Review the structure and parts of trees. Which layers are living? What are the functions of all the different layers?

VIEWING FOCUS

NOTE: You may choose to watch the television segment twice with your students: once to elicit emotional responses and get an overview of the topic and again to focus on facts and draw out opinions.

- Record any facts you find interesting while you watch.
- What is a plant pathologist?
- What causes sudden oak death?
- What part of the tree does *Phytophthora ramorum* affect?
- How does sudden oak death spread?
- What are the ecological consequences of losing oaks and tanoaks?
- What are some the solutions proposed by researchers to prevent the spread of sudden oak death?

POST-VIEWING Links to activities mentioned can be found on the following page.

- **Review** students' answers to the Viewing Focus Questions.
- **Learn** about the importance of food chains and create your own food web.
- **Research** animals commonly found in oak woodlands.
- **Develop** a brochure explaining the cause and effects of sudden oak death.

“The oak is an icon of California. It is an important species for forest balance and forest health.”

— Katie Palmieri

LESSON PLANS / ACTIVITIES

Oak Woodlands Explorations Acorn Naturalists Web site

<http://www.acornnaturalists.com/store/Oak-Woodland-Explorations-C34.aspx>

- This site has activity kits, books and lots of resources about oak woodland communities.

Elementary Ecosystems National Geographic Xpeditions

<http://www.nationalgeographic.com/xpeditions/lessons/08/gk2/ecosystem.html>

- Teach students the basics of species interdependency within an ecosystem or habitat. Students perform a simple simulation to see how one species affects many others. Through the lesson they gain a basic understanding of the importance of biodiversity.

Oak Woodlands Science Lesson Developed by a UC Davis Credential Student

<http://soe.ucdavis.edu/collab0506/dunlapn/ScienceLesson.html>

- Students investigate oak woodlands and discover the past and present uses of oak woodlands, what the trees need to survive, and current threats.

ARTICLES / READING

California Oak Mortality Task Force

<http://nature.berkeley.edu/comtf/>

- Find an overview of sudden oak death along with information on its history, a photo gallery and maps, current research reports, how to diagnose a tree and treatment and management options.

Monitoring Sudden Oak Death OakMapper Web site

<http://kellylab.berkeley.edu/SODmonitoring/OakMapper.htm>

- A comprehensive list of maps, available for downloading, show where sudden oak death has been found.

California Oak Foundation

<http://www.californiaoaks.org>

- This nonprofit organization is dedicated to preserving oak ecosystems in California.

Integrated Hardwood Range Management Program University of California

<http://danr.ucop.edu/ihrmp/>

- Find resources, current research and publications on oak woodlands and sustainability of California's hardwoods.

Look for the



indicating resources from QUEST partner organizations

QUEST QUAD

FIELD NOTES




Go outside and...

- 📍 See if there are signs of sudden oak death in your area.
 - Look at the online photo gallery listed above to see symptoms.
 - Go for a hike and check out the bay laurel, tanoak, and oak trees to see if you can find the signs.
- 📍 Make oak leaf rubbings
 - Collect some fallen oak leaves. Put a piece of paper over them and with a crayon make a rubbing of the leaves. Try this with different shaped leaves and colors.

FIELD TRIP



Visit...

- 📍 Oak woodland areas 
 - Investigate the East Bay Regional Parks www.ebparks.org or Golden Gate National Parks www.nps.gov/goga
 - Draw a picture of an oak forest. What animals would you put in your picture? What other plants might be in your picture also?

FIELD RESEARCH



Find out more about...

- 📍 Acorns
 - Which animals eat them?
 - How did Native Americans use them?
 - Can they be a resource for anything else?
- 📍 The importance of oak woodlands
 - Why are oak woodlands important ecosystems?
 - What plants are usually found there?
 - Which animals depend on them?
 - Where is the closest oak woodland to your home or school?

FIELD TEST



Experiment with...

- 📍 Preparing your own acorns to eat
 - Collect fallen acorns.
 - Dry them completely, either in the sun or by putting them in an oven set on low heat.
 - Shell the acorns with a nutcracker or hard object.
 - Place acorns in a blender or food processor full of water and process to make a thick paste.
 - Line a sieve with a towel and put the acorn mush on the towel. Run water over the acorns for at least five minutes, until the water runs clear and the acorns are not bitter tasting. (This leaches out the tannic acids.)
 - Squeeze out all the excess water and dry the acorns slightly in an oven set on the lowest heat. You have made acorn meal!

VISIT OUR PARTNERS

The Bay Institute

www.bay.org

California Academy of Sciences

www.calacademy.org

Chabot Space and Science Center

www.chabotspace.org

East Bay Regional Park District

www.ebparks.org

Exploratorium

www.exploratorium.edu

Girl Scouts of Northern California

www.girlscoutsnorcal.org

Golden Gate National Parks Conservancy

www.parksconservancy.org

The J. David Gladstone Institutes

www.gladstone.ucsf.edu

Lawrence Berkeley National Laboratory

www.lbl.gov

Lawrence Hall of Science

www.lawrencehallofscience.org

Monterey Bay Aquarium

www.mbayaq.org

Monterey Bay Aquarium Research Institute

www.mbari.org

Oakland Zoo

www.oaklandzoo.org

The Tech Museum of Innovation

www.thetech.org

UC Berkeley Natural History Museums

<http://bnhm.berkeley.edu/>

U.S. Geological Survey

www.usgs.gov

MORE EDUCATIONAL RESOURCES FOR USING QUEST MULTIMEDIA TO ENHANCE 21ST CENTURY SKILLS IN TEACHING AND LEARNING

Why Use Multimedia in Science Education?

<http://www.kqed.org/quest/downloads/QUESTWhyMedia.pdf>

- Read about the importance of using multimedia in the 21st century science classroom.

How to Use Science Media for Teaching and Learning

<http://www.kqed.org/quest/downloads/QUESTMediaTips.pdf>

- A collection of tips, activities and handouts to actively engage students with multimedia.

Science Multimedia Analysis

<http://www.kqed.org/quest/downloads/QUESTMediaAnalysis.pdf>

- Give your students the tools to recognize the purposes and messages of science multimedia.

Create Online Science Hikes with Google Maps

http://www.kqed.org/quest/files/download/52/QUEST_ExplorationCreation.pdf

- Do you like the science hike Explorations on the QUEST site? Use this place-based educational guide to create similar science-based maps with youth.

OTHER WAYS TO PARTICIPATE IN QUEST



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www.kqed.org/quest



LISTEN

**KQED 88.5 FM San Francisco &
89.3 FM Sacramento
Mondays at 6:30am and 8:30am**



WATCH

**KQED Channel 9
Tuesdays at 7:30pm**



Sudden Oak Death threatens to wipe out native California trees that are both emblematic of our landscape and key to the ecology of the coastal hills. Researchers have found a way to protect individual oaks but are still searching for a more sweeping answer to the threat. David Gorn reports.

First of all, says Dave Rizzo, a plant pathologist at the University of California, Davis, there are three things you need to understand about Sudden Oak Death:

RIZZO: You know, the term sudden oak death is kind of a misnomer. It's not particularly sudden, it doesn't just infect oaks, and it doesn't always result in the death of the plant.

At least, not if volunteer Brian Gilbaugh has his way.

Gilbaugh is crunching through the ankle-high dry leaf litter in oak territory at Pepperwood Preserve, just north of Santa Rosa, where he's looking for signs of Sudden Oak Death among the trees.

GILBAUGH: That would be a perfect example. You can see there's many, many different black spots on here. This whole area, this would be perfect to take a number of leaves for, to sample.

He's one of a small army of volunteers who are trying to map the spread of the pathogen that causes Sudden Oak Death, a fungus-like spore called, bear with me here, *Phytophthora ramorum*, or *P. ramorum* for short. It is not just found on oaks.

In fact, it infests about a hundred different plants. And that's how the disease is spread to oaks. Infected rhododendrons in pots, for example, might pass *P. ramorum* on to oak trees. But the biggest culprit in the wild is the California Bay Laurel tree. It is everywhere in the coastal forests, says Matteo Garbelotto, a researcher at the University of California, Berkeley. So those Bays, he says, hold the key to limiting the spread of Sudden Oak Death.

GARBELOTTO: One of things we've been trying to work with is reducing the number of Bay Laurels, because they're the carriers. But when you actually try to do that, it's really complicated.

Thinning out Bay Laurels, says Garbelotto, is essential to keeping the pathogen away from oaks, but there are so many Bay trees around, that's almost impossible. And besides, they grow back like weeds. So it makes a lot more sense, he says, to cut back Bay Laurels in the backyard setting.

GARBELOTTO: Wow, I'm amazed every time I look at this tree.

Garbelotto is in a back yard in the town of Fairfax, in Marin County. And he's staring up at what he says is the largest live oak he's ever seen. It's in the yard of Susie Lahr, who says she measured the circumference of the tree's trunk at 38 feet around, which means this tree was growing when Christopher Columbus was a baby.

GARBELOTTO: So we'll do the injections again in the Fall...

There is no cure for Sudden Oak Death. But Garbelotto's lab tests proved that one thing does work to PREVENT it: a phosphonate fungicide, brand named Agri-Fos.



It's an expensive preventative, costing up to \$200 a tree, and lasting about two years, when it needs to be reapplied. Usually, it's applied by sticking a dozen large syringes full of the stuff right into the trunk of the oak. This labor-intensive and costly treatment is completely impractical for the millions and millions of oak trees at risk throughout California. And the risk to oaks, Garbelotto says, is going to get even higher whenever the drought eases and heavy rains return.

GARBELOTTO: There was this perception that, you know, Sudden Oak Death has run its course. But it's not so. Unfortunately, in 2005 and 2006 we had two rainy years and the infection rates went up really dramatically.

Out at Skyline Ridge Open Space Preserve, in the hills above Palo Alto, there's another possible solution being studied.

ROESSLER: And this is sapling number 78.

That's Cindy Roessler, a biologist with the Midpeninsula Regional Open Space District. This site, along with a much bigger program in the Big Sur area to the south, has a different focus, she says: Genetics.

ROESSLER: We were interested in working with the researchers to find out if there's any resistant trees. So there's some indication that there might be some genetic resistance out in the population there.

Garbelotto's lab isolated some of the tanoaks that seemed to have genetic resistance, then grew out acorns from them. And now those resistant finalists are here, all in a row at Skyline Ridge.

ROESSLER: And our hopes are, that one or two of these, 10, 15 years from now, will still be alive, will be resistant to sudden oak death, and they'll be having acorns on them. And those may be ones that are key for us to replanting in the areas that were heavily struck.

If resistant tanoaks can be found, that raises hope that the same can be done for the iconic live oak. It would need to happen soon, though, researchers say. The millions of infected oaks throughout California, they say, are found in only about 10 percent of the area that *P. ramorum* will eventually hit.

For Quest, I'm David Gorn, KQED Radio News.