

Photos: Janice Alexander, U. of California Cooperative Extension, Marin County



Can Trees Catch the Flu?

Fun, hands-on activities that enable 10-14 year olds to learn about how invasive species damage our forests and what we can do to prevent their spread

By **Janice Alexander**

INTRODUCED AND INVASIVE species can cause great harm as they disrupt ecological balances developed over thousands of years. Forests of trees that have existed for centuries can be drastically altered by a single new pathogen or insect. In the case of North American forests, we have seen that play out over the last century with chestnut blight, Dutch elm disease, emerald ash borer, and Asian long-horned beetle. Along the west coast, a new tree disease, sudden oak death, has had devastating effects on California oak populations in the past 20 years.

We used the lens of human health to develop activities explaining how sudden oak death spreads to trees and eventually kills them. In effect, can trees “catch the flu” and become sick the same way people do? These activities can be adapted to fit other tree diseases, such as chestnut blight or Dutch elm disease, or other plant diseases caused by invasive pathogens. In addition, an activity that highlights how moving firewood can accidentally spread these new pests emphasizes individual responsibility for protecting our forests.

Grade Levels: All activities were initially developed for a middle-school level audience but may easily be adapted to other ages and levels.

Microbial multiplication activity

Overview: Some microorganisms can cause disease, both in humans, other animals, and plants, but these pathogens are

too small to see with the naked eye. Where can we find these invisible pests and how fast can they grow?

Time: As long as the session lasts

Materials: Sealable plastic storage bags in various sizes, a multitude of small items e.g., plastic beads, jelly beans, gummy worms, kitchen timer, display board, tape or staples, pre-made moldy bread or photos, extra plastic bags, extra bread, permanent marker, pencils and scratch paper, slide or laminated photo of multiplication question

Procedure:

At least two weeks ahead of the session, collect two slices of white sandwich bread. Wipe one “dirty” hand (you may want to rub your hand through the soil in your garden), against one slice of bread, sprinkling water on the slice afterwards to accelerate the growth of the mold. Thoroughly wash your hands and place a clean hand on the other slice of bread. Seal each bread slice in a plastic bag and mark “dirty” and “clean.” Keep in a cool, dark spot for maximum mold growth.

Microorganisms can multiply very quickly, to the point that they can cause disease in otherwise healthy humans, animals, and plants. Use small objects like jelly beans or plastic beads to represent a germ population that doubles its population size every 20 minutes. Begin with one or more germs in a single plastic bag or container, and set the kitchen timer for 20 minutes. Every 20 minutes, double the population (4, 8, 16, 32, 64, 128, etc.) in another plastic bag and

re-set the timer. Continue for the length of the session, taping or stapling the separate bags to a wall or display board for the group to view.

Germs on our hands might not be visible, but given the right environment, they can grow to levels large enough for us to see with our naked eyes. Present the actual aged slices (or photos of) moldy bread at the session. If you have time, and especially if you will see students again after a set period of time, each student may do this same activity and see their own results.

For participants with multiplication skills, have them use the pencils and scratch paper to figure out the following multiplication question: If the germ population, beginning with just one individual, doubles every 20 minutes, how many germs will you have after 7 hours? (Answer: 2,097,152)

How do germs spread?

Overview: What invisible menaces might lurk in clear fluids? This activity compares a human sneeze infested with flu virus to wind-blown rain infested with *Phytophthora ramorum*, the pathogen responsible for sudden oak death.

Time: 10 minutes

Materials: 2 aerosol bottles, water, salt, two dark-colored trays or plates, video of sneezes/pathogen spread, A/V equipment to play video

Procedure:

Mix a solution of water with salt (exact measurements are not necessary but dissolve enough salt to create a very salty solution). Pour salty solution into one spray bottle; fill the other spray bottle with plain water. Download videos of sneeze and spores, if using.

The plant pathogen *Phytophthora ramorum*, as well as other molds and fungi, can spread in cool, wet weather – particularly during windy rain events. How does this microscopic organism get from the leaves of one tree onto the trunk of an oak to cause an infection?

Show the video or other visual of a human sneeze versus *P. ramorum* sporulating in water. Ask what these two enactments have in common (Answer: water).

Spray the surface of the tray/plate or the back of a hand. Wait until the water evaporates and look at the surface sprayed and/or taste what is left on the surface. You should see a film left on the surface, or taste a salty solution. The spray of salt water is an example of an aerosol. The salt crystals represent the microscopic pathogen that can be carried invisibly in drops of water from leaf to leaf and tree to tree, or in a sneeze from person to person.

Here are some questions to ask students at the end of this activity: How does this compare to a flu virus that travels from person to person? Does distance matter? Does weather matter? What sanitation measures might you take to stop a flu virus from spreading? What could you do to keep *P. ramorum* from spreading?

Tree cookie examination

Overview: Identify the different internal structures of a tree trunk to see how it relates to the human body's circulatory system and what may lead to tree diseases.

Time: 10 minutes

Materials: Tree cookies, magnifying glasses, slides or laminated photos of tree structures

Procedure:

What is a tree made of? Identify the different parts of the tree visible on the tree cookie (bark, cambium, phloem, xylem, wood, etc.) and note their specific functions. What parts of the trunk do we use and how? (Answer: wood for building, paper, etc.; bark for corks or tanning.) Are these uses sustainable? (Answer: Yes, if the trees are allowed to re-grow at a fast enough rate.) When trees are diseased or we don't use them sustainably, what benefits and services do we lose? (Answer: Wildlife habitat, soil stability, shade, natural beauty, etc.)

Straw activity

Overview: This activity allows participants to experience the way a tree moves water from its roots to its leaves, and what happens when that flow of water is impeded by the growth of a pathogen.

Time: 15 minutes

Materials: straws, ping-pong balls, clay, paper clips

Procedure:

When the microscopic pathogen *Phytophthora ramorum* lands on the trunk of certain trees, it uses tiny openings in the bark to enter the tree and consume its tissues. Given that this is a fungus-like organism that loves moisture, where in the tree do you think it prefers to live? (Answer: xylem tubes that take water from roots up to leaves.)

Take a straw and place it over a Ping-Pong ball laying on a table. With some force, you can suck the ball up with the straw and pick it up off the table. Next, completely pack the end of a second straw with a bean-sized lump of clay. Unbend a paperclip and use it to poke a small hole through the clay plug. Now try to suck through the straw and lift the ball off the table.

Here are some questions to ask students at the end of this activity: What do the straw and ball represent? (Answer: Xylem tubes and water molecules.) What does the clay represent? (Answer: A pathogen growing in the xylem.) What happens when the clay constricts the flow of air? Water cannot move as easily within the tree. When a pathogen grows in those tissues, what do you think happens to the tree?

You may also make an additional connection between the tree moving water and sugars in the tubes and a human circulatory system moving blood. What happens when human arteries are clogged?

Sanitation activity

Overview: These activities make clear how visible cleanliness does not always mean true sanitation; both for hands unclean with human germs, and shoes with forest pathogens clinging to the soles.

Time: 10 minutes



clean the bottom of the shoes with a brush, removing all the dirt you can see. Check shoes again by stomping on a clean sheet of paper; you should see less clumps of soil where microscopic pathogens might be hiding.

Firewood passport activity

Overview: Many forest pests (invasive insects and diseases) can be moved into new forests by hitchhiking on firewood. This activity highlights the role that individual campers can have on the health of the whole forest.

Time: 20 minutes

Materials: paper for creating passports, large sheets of paper (minimum three) for campground locations, stamps (minimum three), stickers (minimum three per participant)

Materials: Black light, glow-in-the-dark powder or lotion, hand-washing station or wipes & hand sanitizer gel, white paper, brushes for cleaning shoes

Procedure:

Our hands can easily spread germs. What sanitation measures might you take to stop a flu virus from spreading? In a forest, dirty shoes might spread pathogens to new areas. What could you do to keep a pathogen like *Phytophthora ramorum* from spreading? You can do one or both of these sanitation activities to highlight the role of thorough cleaning in the effort to stop disease spread.

Part I: Hand-washing

Have students wash their hands. Once hands are washed and dried, rub a bit of glow-in-the-dark powder or lotion over their hands and wrists. Turn down the room lights or go to a dark place and look at hands under a black light. The powder will stick to all areas with dirt or bacteria remaining on the hands and will glow under the black light. You should see the missed dirt spots, particularly under fingernails, at the base between fingers, and the wrists. If there is time, have students wash their hands again, emphasizing using warm soapy water for at least 20 seconds. Then repeat the black light activity. Chances are good that fewer dirt spots will glow.

Part II: Shoe sanitation

Visibly inspect the bottoms of shoes and note how clean they appear to be. Stomp on a clean, white sheet of paper on the ground. Does any dirt or other debris come loose? Now

Procedure:

Using the large sheets of paper, create at least three different locations to “visit” — these should be well-known or local campground locations — and place around the area. You can create the passports ahead of time or have the students do so at the beginning of the activity.

Each student will visit the “campgrounds” placed around the area, imagining they are camping and bringing with them their camping supplies — including a bundle of firewood. At each location, students will stamp their own passport to show they visited the campground. They will also leave a sticker on the poster to show the lingering pest that jumps off their firewood pile and stays at the campground.

After all of the students have visited all of the locations, examine how many pests are left at the campground. Discuss how those pests might affect the forest.

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Resources

More information and educational resources for sudden oak death can be found at www.suddenoakdeath.org. Information on other tree diseases and invasive plant pathogens can be found at www.bugwood.com. Firewood information can be found at www.dontmovefirewood.org and additional educational resources at www.firewood.ca.gov