Trees in Trouble

Activity 77

Like humans, trees can become weak and unhealthy, suffer injury, and die. People have learned to read the symptoms of unhealthy trees to help them. In this activity, students will examine trees for signs of damage or poor health. They will also conduct a series of experiments to determine the conditions that may cause plants to become unhealthy.

Levels

Part A: Grades 1-8
Part B: Grades 4-8

Subjects

Science, Math, Social Studies, Language Arts, Performing Arts

Concepts

- Organisms change throughout their lifetimes. Species of organisms change over long periods of time. (5.1)
- While every organism goes through a lifecycle of growth, maturity, decline, and death, its role in the ecosystem also changes. (5.3)
- Ecosystems change over time through patterns of growth and succession. They are also affected by other phenomena such as disease, insects, fire, weather, and human intervention. (5.4)

Skills

Observing, Analyzing, Researching, Comparing and Contrasting, Solving Problems

Technology Connections

Internet Resources

Materials

Part A: copies of student pages, measuring tape or rulers, optional camera
Part B: See materials list in Getting Ready. Optional: cross section of a tree; *Billy B. Sings about Trees* CD (see References); and CD player

Time Considerations

Preparation: Part A: 15 minutes
Part B: 45 minutes
Activity: Part A: One to two 50minute periods
Part B: Two 50-minute periods over several weeks and 10 minutes daily to record observations

Related Activities

How Plants Grow, Every Tree for Itself, Adopt-a-Tree, Tree Cookies, Plant a Tree, Tree Lifecycle

OBJECTIVES

- Students will recognize symptoms of unhealthy trees and describe possible causes.
- Students will perform investigations to determine the effects of crowding, acidic precipitation, or fertilizers on plant growth.

ASSESSMENT OPPORTUNITIES

- Ask the students to draw a healthy tree and then an unhealthy one. After the drawings are collected and displayed, review them with the students. Have them list the qualities of healthy trees and the causes for other trees being unhealthy, as shown in the drawings.
- Have students write a detailed report on one of the experiments. See last page of this activity for a sample assessment checklist.

BACKGROUND

Trees require some of the same things people and other animals need to grow and thrive. For example, they need plenty of water, nutrients, room to grow, and a stress-free environment. If these requirements are not met, a tree may grow slowly or even die.

When a person is ill, we look for symptoms to help us identify what is wrong. Similarly, distressed trees exhibit symptoms that can help determine the problem. Loss of vigor, discolored or misshapen leaves, insect bore holes and weeping wounds are all signs that something is wrong. The student pages provide specific information about signs you might find and what they might tell you about the tree's health.

The growth rings on a cross section of a tree reveal how well the tree's requirements have been met over the years, and they provide a record of a tree's health over its lifetime. (See Background for "Tree Factory," "Tree Cookies," and "Every Tree for Itself.")

GETTING READY

Plan a trip on the school grounds, in a park, in the woods, or along a tree-lined street. Make copies of student pages. For younger students, play "This Bark on Me" by Billy B., and discuss the meaning of the song (see Appendix 4).

For Part B you will need the following materials: half-gallon milk cartons, rigid paper plates, potting soil, white vinegar, pH test strips or litmus paper, fertilizer (liquid or granular), radish seeds, rulers or measuring tapes, graph paper, knife, paper bags, lemon juice, vinegar, baking soda.

DOING THE ACTIVITY

PART A—Neighborhood Checkup

1. As a group, discuss what causes a person to get sick or become unhealthy. Responses might include poor nutrition; unclean water; a lack of food or water; toxic substances like smoke or drugs, disease, and physical injury. Students should also think of ways to prevent or combat these things, like proper diet, regular exercise, and safe behavior. With older students, ask them to name several human diseases or illnesses and their causes, symptoms, and cures.

2. Compare elements that keep humans healthy with those that keep trees healthy.

3. Tell students that they will become "tree-tectives" (tree detectives) and search their neighborhood for healthy and unhealthy trees.

4. Students should use the "Tree-tective Trouble Guide" and "Reading Leaf Symptoms" student pages to identify symptoms of unhealthy trees. They should take additional notes and make sketches of their findings such as broken branches; unusual leaf colors or shapes; holes; trunks damaged from scratches, carvings, or graffiti; or uprooted, fallen trees that still appear to be alive.

5. Have students hypothesize about what caused the damage. Note that some problems may be more common in certain regions than in others.

PART B—Plants Under Stress

Divide students into investigation teams and tell them they will conduct a series of experiments to determine conditions that cause plants to become unhealthy.

Note: To plan your time allotment for this activity, check the estimated sprouting time for the seeds you are using.

Experiments

Explore the effects of the following on plant growth: Crowding, Acidic Precipitation, and Fertilizer.

Crowding

Trees need space to grow so they can spread their branches to collect sunlight and their roots to collect water. Discover what happens when plants are grown too close together.

1. Have students form a hypothesis about what will happen to plants that grow under crowded conditions. The hypothesis can be stated in an "if-then" form: "If plants are grown too close together, then _____."

2. Each team should cut milk cartons in half to make planting pots.

3. Punch a few holes in the bottom of each pot and set it on a rigid or coated paper plate that will catch water as it drains.

4. Fill the pot with potting soil.

5. Half of the teams should plant only one or two radish seeds in their pots. The other teams should plant a dozen or so seeds in a single hole. All the pots should have the same light and water conditions. The only variable is the amount of seeds per pot.

6. See how long it takes for the seeds to sprout. Measure the height of the plants above the soil level and record at daily intervals for several weeks. After a specified time, students can dig up the plants and observe differences in the size of the radish bulbs. Cut the radishes in half; measure and record the diameters. Discuss the findings. Which radishes appear to be healthier?

Acidic Precipitation

Many scientists believe that acidic precipitation, or acid rain, causes negative health effects on vegetation. To test this, set up a series of plants similar to those in the previous demonstration. You will use white vinegar in water to simulate acid rain.

1. Have students form a hypothesis about what will happen to plants that grow under the influence of acidic water conditions. This hypothesis can be stated in an "if-then" form: "If plants receive more acidic water, then [insert blank line]."

2. Before proceeding with the experiment, discuss the phenomenon of acid rain with your students. Discuss the differences between acidic and basic solutions. Use litmus paper and test for acid or base color reactions for substances such as tap water, lemon juice, vinegar, or a baking soda and water solution.

Safety! Be sure to take proper precautions when handling and disposing these substances, using safety goggles and gloves. Only small amounts are needed for litmus testing. For more advanced students, the concept of pH can be demonstrated using pH indicator strips, which give more precise readings of the pH value of substances.

3. Prepare solutions of varying acidic strengths. Sample solutions could include ranges from tap water to quarter, half, and three-quarter strength water-vinegar solutions to full strength vinegar.

4. Determine what happens when plants are "watered" with water-vinegar solutions of varying concentrations. Keep the light conditions and the watering schedule the same for all plants, varying only the strength of the water-vinegar solutions.

5. Keep a daily log of observations and discuss changes in the health and growth of the plants.

Fertilizer

Like people, plants need vitamins, minerals, and other nutrients in their diet to maintain good health. Most of these are supplied by the soil and water in which the plants grow, but people sometimes add fertilizer to boost these nutrients in the soil.

1. Ask students to hypothesize about the effects of fertilizer on the growth of plants.

2. Keep all variables constant, except the amount of fertilizer added to the soil on a periodic basis. Follow directions on the package or bottle of fertilizer. Make certain that one group of plants receives no fertilizer at all.

3. Check and record observations and discuss results.

4. As in all the experiments, you can show observations and results by plotting the data on a graph. (Additional tests for light, water, and soil conditions can be found in Activity 41, "How Plants Grow."

Enrichment

- If you found a "tree in trouble" on your field trip, have the class adopt the tree as a service-learning project. Invite a tree expert (from a garden center, tree trimming company, or the local urban forestry department) to talk to your group about things they can do to help the tree. Report on the progress of its health to the tree expert.

- If there's a dead or partially dead tree in your neighborhood or local park, students might investigate what is happening to it now. Is there evidence of insects at work to decompose the tree and return its remains to nature? Are there signs of woodpeckers living in the dead tree? Are any animals living in holes in the tree? Are fungi growing on the tree? Did the city remove or trim the tree for safety reasons?

- Students can use Internet and other resources to find out about acid rain, including what causes it and its effect on trees and other plants.

- If a cross section of a tree or a stump is available, "read" the annual rings – they can tell some interesting stories about the health, life, and history of the tree. Tightly spaced annual rings may mean that the tree underwent a period of stress, such as a drought, and did not grow very much in that period. Look for evidence of drought and damage from lightning, fire, or insects. (See Activity 76, "Tree Cookies.")

- Read the following story attributed to the ancient Chinese philosopher, Chuang Tzu. Have students write their own stories about the many values of trees, both healthy and unhealthy.

A sage, in rambling about the Heights of Shang, saw a large and extraordinary tree. The teams of a thousand chariots might be sheltered under it, and its shade would cover them all! He said, "What a tree this is! It must contain an extraordinary amount of timber!" When he looked up, however, at its smaller branches, they were so twisted and crooked that they could not be made into rafters and beams; when he looked down to its root, its stem was divided into so many rounded portions that neither coffin nor shell could be made from them. He licked one of its leaves, and his mouth felt torn and wounded. The smell of it would make a person frantic, as if intoxicated, for more than three whole days together. "This indeed," said he, "is a tree good for nothing, and it is thus that it has reached so great an age." ... The cinnamon tree can be eaten, and therefore it is cut down. The varnish tree is useful, and therefore incisions are made in it. Everyone knows the advantage of being useful, but no one knows the advantage of being useless.

Checklist for Assessing Experiment Reports

Title: Student gives the report a title.

Hypothesis: Student writes his or her hypothesis in a proper format, such as "If plants are grown very close together, then ...", or "If plants receive fertilizer, then..."

Materials: Student lists all the materials needed to do the experiment.

Procedure: Student uses pictures or words to give an accurate description of all the steps of the procedure, including:
- Controlled variables (such as same watering schedule, same type of plants)
- Changed or manipulated variable (such as number of seeds per plant pot, acidity of water, addition of fertilizer)
- What and how measurements were taken

Data: Students includes a data table/graph or drawing showing the growth of the plants under the various conditions.

Conclusion: Student states whether or not hypothesis was correct and uses data to explain.

Discussion: Student explains results (for example, why different conditions produced different growth of the plants). Student compares results with others in the class. Student indicates new questions resulting from the experiment.

READING CONNECTIONS

Brooks, Felicity. *Protecting Trees and Forests.* EDCP. 1991. Trees are vital to the health of the Earth. This colorful book provides a simple yet fascinating introduction to the conservation of trees and forests. Grades 1-5. ISBN: 074600656X.

Bunting, Eve. *Someday Tree.* Clarion Books 1993. Story about a child who finds out that her favorite tree is dying, and what she does to save it. Grades 3-5. ISBN: 0395764785.

Moore, Eva. *Magic Schoolbus In The Rainforest.* Scholastic. 2000. Ms. Frizzle and the kids are off on an adventure to the wet and wonderful rain forest. Their mission: to find out why Ms. Frizzle's cocoa tree has stopped growing cocoa beans. Could there be a cocoa bean thief in the rain forest? Or is there some other reason the healthy tree has suddenly lost its beans? Grades K-2. ISBN: 0613337107.

Pike, Norman. *The Peach Tree.* Stemmer House. 1994. When a little peach tree is suddenly threatened by a horde of healthy and hungry young aphids, Farmer Pomeroy calls in a horde of equally healthy and hungry young ladybugs and restores the balance of nature. This is a fine lesson in ecology, charmingly making the point in story form that all creatures, great and small, are dependent on one another for survival. Grades K-3. ISBN: 0880450142.

Student Page

Tree-tective Trouble Guide

Broken branches attached

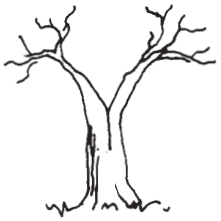
Broken branches hanging

Broken branches on ground

Trunk damaged
Hit by car or lawn mower

Branch stubs
Should be trimmed so tree can heal

Cracked trunk
From lightning or frost

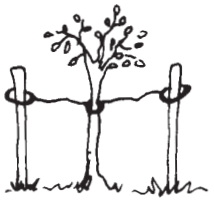


Split trunk

Tree leaning

Vandalized
Carved into or branches twisted

Tree broken off



Problems with staking
Stakes bent, wires loose, tree not secured

Insect feeding
Many leaves missing or full of holes

Leaf deformities
Rolled, crinkled, or funny shaped

Rotten spots

Dead tree

Reading Leaf Symptoms

Trees can't tell us when they are sick. Instead, we must interpret the signs trees show to determine what and how serious their health problems are.

The leaves usually show the first symptoms of disease, insect, or physical damage. By learning leaf-reading, you can diagnose your tree's condition. Here are some common leaf symptoms and their probable cause.

1. Ragged leaves with holes in them.

Suspect insect feeding, especially if it is summer and the leaves were not showing damage earlier. But if it is springtime, and the leaves never developed properly, chances are the damage is due to either low temperatures during the bud stage or being banged around by high winds as small leaves.

2. Leaves suddenly turn brown or black.

If a frost occurred a day or two earlier, that's probably the cause. Sudden high temperatures in springtime also cause problems. If no temperature extremes are noted, suspect either a leaf or a stem disease. If the symptoms show up on a branch or two at a time, trunk or branch invasion or injury is probably the cause.

3. Spots or bumps on the leaves.

Insects and mites cause most leaf swellings. Leaf spots are usually the result of disease or insect activity. Chemicals, such as sulfur dioxide from nearby coal-burning plants, or improperly applied fertilizer or pesticides, can cause leaf blotches, too.

4. Margins of leaves turn brown.

Moisture deficiencies or high temperature stresses are usually to blame. Sometimes root or trunk damage, including injury from road salt, can be involved.

Gayle Worf, UW-Extension plant pathologist
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5. Sudden leaf drop.

This may or may not be serious. If inner leaves are dropping during a dry spell, or if a few leaves fall from throughout the tree, it shouldn't be serious. Drought or squirrels may be to blame. But if leaves are dropping heavily from one branch and then another, there is a problem somewhere with the water-conducting system of the tree-probably disease, possibly insect borers.

6. Light green or yellow leaves.

Probably a "micronutrient" disorder, such as iron or manganese deficiency. Curiously, trees rarely show deficiencies of the major plant nutrients such as nitrogen and potassium.

7. Leaves twisted or malformed.

The most common cause for this is stray herbicide drift, but insects, mites, occasionally a disease, and sometimes low temperature injury can all produce similar-appearing symptoms.

8. Leaves turn fall-colored prematurely.

A serious symptom suggesting trunk or root damage of some kind.

Trees can withstand a certain amount of abuse to the leaves, but leaf injury becomes serious when: heavy losses occur two or more years in a row, early season loss causes a new flush of leaves, the tree is marginally hardy to the area, or the tree is under some form of stress, such as recent transplanting. Your county extension agent has a number of publications to help in diagnosis and treatment of tree problems, or you may need to call an arborist who is competent in tree health diagnosis.