

Overview

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.

Background

Trees require some of the same things people and other animals need to grow and thrive. For example, they need plenty of water, food, and room to grow. If these requirements are not met, a tree may grow slowly or die. The growth rings on a cross section of a tree reveal whether 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 296-298. For younger students, play "This Bark on Me" by Billy B, and discuss the meaning of the song (see References).

**PART A
NEIGHBORHOOD CHECKUP****Doing the Activity**

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. Take measuring tapes or rulers to record the size of wounds and diameters of trees that have been affected. As an option, students can use a camera to photograph damaged trees.

5. Have students hypothesize about what caused the damage. Note that some problems may be more common in certain regions than in others. Older students can read and discuss the article "Trees May Tell Each Other of Attacks," on page 298. This article describes research that seems to indicate that trees can send alarm signals to each other about certain unhealthy factors in the environment.

6. After your field trip, combine all the information the class collected and make a "Tree Damage Report." Then find the people or agency in your area that cares for unhealthy trees (many city, county, or state forestry and park agencies have urban foresters). Send a copy of your report to the agency (or person) in charge of trees in your area. Follow up a couple of weeks later to find out if the agency is going to take action. Ask if you can be informed of any planned tree work so that your class can be at the location to observe. You can also visit a garden center, nursery, or tree-trimming company in your area to find out what they do to keep trees healthy.

LEVELS

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

SUBJECTS

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

CONCEPTS

- Organisms change throughout their lifetimes. Stages of organism change over long periods of time.
- While every organism goes through a life cycle of growth, maturity, decline, and death, it is able to regenerate water and nutrients.
- Organisms change over time through patterns of growth and survival. They are also affected by other organisms, such as disease, insects, fire, weather, and human intervention.

SKILLS

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

OBJECTIVES

Students will be able to: identify causes trees can become unhealthy; describe symptoms of unhealthy trees; evaluate environmental conditions that affect human health and plant health; and identify people or agencies that care for trees and forests.

MATERIALS

Part A: copies of student pages 296-298; measuring tape; ruler; optional camera
Part B: half-gallon milk jugs; hot paper plate; 100-gram weight; 100-gram plate; 100-gram weight; 100-gram plate; fertilizer; 100-gram weight; seeds; ruler; measuring tape; graph paper; grid; paper bags; bleach; lemon juice; ammonia
Optional: cross section of a tree; Billy B Sing's "Bark on Me" CD; reference; and cassette player

TIME CONSIDERATIONS

Preparation: Part A: 45 minutes
Part B: 45 minutes
Activity: Part A: one to two six-trial periods
Part B: two 50-minute periods over several weeks and 10 minutes daily to record observations

PART B

PLANTS UNDER STRESS

Doing the Activity

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, 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 acid 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 _____."

2. Before proceeding with the experiment, discuss the phenomenon of acid rain with your students. Ask them to research acid rain in a library or media center. 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, household bleach, and household ammonia. (Be sure to take proper precautions when handling these substances.)

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.

1. With a set-up similar to past experiments, hypothesize about the effects of fertilizer, or "plant food," on the growth of plants.
2. Keep all variables constant, except the amount of fertilizer (i.e., Miracle-Gro) 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 "How Plants Grow" on page 135.)

Enrichment 1 Adopt a Sick Tree

Perhaps on your field trip you found a "tree in trouble" that could use some help. Maybe it had been damaged; or, maybe it appeared to be healthy and you want to help it stay that way. Have the class adopt the tree. If you choose a tree close to the school, you can report on the progress of its health. Contact the appropriate municipal agencies (see Step 6 in Part A, Doing the Activity) to find out ways to help a sick tree.

Enrichment 2 Dead Tree of Life

Trees, like humans, eventually become sick and die. If you found a dead or partially dead tree on your field trip, you may want to return to see what activity is taking place. 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?

Enrichment 3 Useful to Be Useless

Consider the following story attributed to the ancient Chinese philosopher, Chuang Tzu:

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.

Have each student write his or her own story about the many values of trees, both healthy and unhealthy.

Enrichment 4 Look Inside a Tree

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 "Tree Cookies" on page 135.)

END NOTES...

ASSESSMENT OPPORTUNITY

Ask the students to draw a healthy tree and leaf and an unhealthy one. After the drawings are collected and made, 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.

RELATED ACTIVITIES

How Plants Grow, Every Tree for Itself, Adopt a Tree, Tree Cookies, Plant a Tree, Tree Life Cycle

REFERENCES

Billy B. Sing's About Trees cassette

TREE-TECTIVE TROUBLE GUIDE



BROKEN BRANCHES ATTACHED



BROKEN BRANCHES HANGING



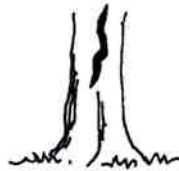
BROKEN BRANCHES ON GROUND



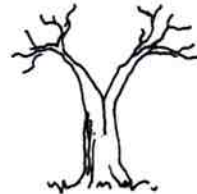
TRUNK DAMAGED
HIT BY CAR OR LAWN MOWER



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



BROKEN OFF TREES



PROBLEMS WITH STAKED TREES
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 TREES

READING LEAF SYMPTOMS

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

The leaves usually communicate the first symptoms of disease, insect or physical damage, so 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's summer and the leaves were not showing damage earlier. But if it's springtime, and the leaves never developed properly, chances are the damage is due to low temperatures during the bud stage.

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.

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.

Leaves twisted or malformed.

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

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.

*Gayle Worf, UW-Extension plant pathologist
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