

Who Speaks for the Trees?

Students read (or watch!) *Dr. Seuss' The Lorax* and examine the importance of the sustainable management of natural resources.

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Activity 1

Levels

Part A: Grades 2-8
Part B: Grades 6-8
Variation: Grades 4-6

Subjects

Science, Social Studies,
Language Arts

Concepts

- Our increasing knowledge of the Earth's ecosystems influences strategies used for forest management and environmental stewardship.
- Increased public knowledge of the environment and of the need for conservation of natural resources have resulted in lifestyle changes in many cultures.

Skills

Discussing, Forming Concepts,
Evaluating, Comparing and
Contrasting, Identifying Main
Ideas



Technology Connections

Graphic Organizer Software

Materials

One copy of *Dr. Seuss' The Lorax* (either the book or the movie)

Time Considerations

Preparation: 15 minutes
Activity: 50-minute period

OBJECTIVES

- Students will discuss and analyze a fictional story related to natural resources.
- Students will determine whether the main ideas of the story build a case for the conservation and wise use of natural resources.

ASSESSMENT OPPORTUNITIES

- Students' discussion question answers can be used to assess students' understanding of the environmental messages.
- Ask students to create a graphic organizer showing the main ideas presented.

BACKGROUND

A quick look around the home or school reveals how many items are made from wood and other forest resources. Trees are important to us whether they are used for products or left in their natural environment where they provide oxygen, soil protection, beauty, and a habitat for plants and animals.

Humans have always depended on trees for firewood, shelters, tools, paper, and many other needs. In many parts of the world, trees are removed from forested areas without being adequately replanted.

Dr. Seuss' The Lorax presents an opportunity to have a conversation about the inherent value of forests and importance of sustainable management. Given the many threats to America's private and public forests due to climate change, pests and pathogens, and land conversion, the story of *Dr. Seuss' The Lorax* can start a dialogue about what is being done in America to protect the health and productivity of our forests now and for the future.

GETTING READY

Obtain a copy of *Dr. Seuss' The Lorax* to read aloud to your students, or consider showing the movie. For the Variation in Part A, write each question on an index card.



DOING THE ACTIVITY

PART A—*Dr. Seuss' The Lorax*

1. Read *Dr. Seuss' The Lorax* aloud or watch the movie.
2. Ask students to list what they think the major ideas of the story are.
3. Have them think about and answer the following questions:
 - Why do you think the Once-ler did what he did?
 - What patterns of change in the environment did we observe?
 - What were environmental conditions like before the company started making "Thneeds"? What were they like afterward?
 - What was the author's message concerning what one person can do to save or destroy the environment?



Variation

1. Ask students to name things from nature (natural resources) that they use to live. Examples include trees, water, air, minerals, and so on. Read *Dr. Seuss' The Lorax* aloud or watch the movie.
2. Divide the class into six groups. Give each group a card with one of the sets of questions below written on it. Each group should discuss the questions, write down the answers, and be prepared to share them with the group.
 - How could the Once-ler have managed his company to protect natural resources and not run out of trees to manufacture "Thneeds"? Is it necessary to protect all trees "from axes that hack"?
 - What did the Once-ler mean by "UNLESS"? What responsibility does he seem to think "someone like you" needs to take? What kinds of things can we do today to ensure that trees will be available for all different purposes in the future?
 - Compare the Once-ler's attitude toward the environment at the beginning of the story with his attitude at the end.
- The Once-ler explains his actions by saying, "If I didn't do it, someone else would." Is this a good excuse for doing what he did?
- The Lorax says he speaks for the trees. What does this mean to you? What is the Lorax's attitude at the end of the story?
- What seems to be Dr. Seuss' purpose in writing this fable? (A fable is a fictional story that teaches a lesson.)

3. After groups have had time for discussion, have each group read their questions and answers to the class. Students can agree, disagree, or add to the answers given by their classmates.

PART B—The Sequel

1. Either alone or in small groups, have students write and illustrate a sequel to *Dr. Seuss' The Lorax*. The sequel might explain how the Truffula tree made a comeback through replanting and proper care. The sequel could say what the new managers of the Truffula Tree Company are going to do to maintain environmental quality and at the same time make Thneeds.

2. After the sequels are finished, ask students to consider the following questions:
 - Does either the original Dr. Seuss story or your sequel accurately portray industry?
 - Which version, the original or your sequel, appears to best describe people's attitudes in the region you live?
 - What social and economic implications will the actions suggested in your sequel have for ensuring a quality environment? For example, who will pay for the environmental protection?
 - Who will pay for the damage to the environment if these actions prove unsuccessful?
 - Who will provide Thneeds if the Truffula Tree Company doesn't?

3. Have students prepare a sequence for the key events in both *Dr. Seuss' The Lorax* and their sequel. Then, have students draw a diagram or flow chart showing the connections between characters in the story (Swomee-Swans, Bar-ba-loots, Lorax) and the natural resources (Truffula trees, clean air, clean water). Do any new characters or natural resources emerge in the sequel? If so, how do they affect the outcome of the original story?

READING CONNECTIONS

Carson, Rachel. *A Sense of Wonder*. Perennial Library. 1984. Filled with words and pictures to help keep alive the sense of wonder and delight in mysteries of earth, sea, and sky. Grades 6+. ISBN: 006757520X.

Geisel, Theodor (Dr. Seuss). *The Lorax*. Random House. 1971. In this classic story, the Once-ler describes how his greedy actions destroyed a beautiful and thriving environment. Children will enjoy the colorful characters and rhyming verse. Also available in Spanish. Grades PreK-6. ISBN: 0394823370.

Giono, Jean. *The Man Who Planted Trees*. Chelsea Green Publishing Co. 1985. Jean Giono's beautiful allegorical tale is legendary. Written in the 1950's, its message was ahead of its time, inspiring readers to rediscover the harmonies of the countryside and prevent its willful destruction. Grades 4+. ISBN: 1570625387.

Leopold, Aldo. *A Sand County Almanac*. Oxford University Press. 1989. A Sand County Almanac combines some of the finest nature writing since Thoreau with an outspoken and highly ethical regard for America's relationship to the land. Grades 6+. ISBN: 019505928X.

McClure, Michael Robert. *Acorn Alone*. A.R.E. Press. 1994. A story of dramatic effects of deforestation and how the Earth reclaims and renews itself. Grades PreK-2. ISBN: 0876043260.

Van Allsburg, Chris. *Just a Dream*. Houghton Mifflin. 1990. When he has a dream about a future Earth devastated by pollution, Walter begins to understand the importance of taking care of the environment. Grades 1-5. ISBN: 0395533082.



We All Need Trees



Students are often surprised to learn how many different products we get from trees. Use this activity to help your students learn just how much we depend on trees in our daily lives.

Activity 2

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Levels

Part A: PreK-1
Part B: Grades 2-6

Subjects

Science, Social Studies, Visual Arts, Language Arts

Concepts

- Humans use tools and technologies to adapt and alter environments and resources to meet their physical, social, and cultural needs.
- Natural beauty, as experienced in forests and other habitats, enhances the quality of human life by providing artistic and spiritual inspiration, as well as recreational and intellectual opportunities.
- All humans consume products and thereby affect the availability of renewable and nonrenewable natural resources.

Skills

Identifying Attributes and Components, Classifying and Categorizing, Researching, Evaluating



Differentiated Instruction

Realia/Hands-on Learning, Higher Order Thinking, Non-linguistic Representations



Technology Connections

Internet Resources, Graphic Organizer Software, Presentation Software

Materials

See Getting Ready

Time Considerations

Preparation: One hour
Part A: 50 minutes
Part B: 50 minutes

OBJECTIVES

- Students will examine various products and determine which ones are made from trees.
- Students will describe ways that trees are used to make products and ways that these products can be conserved.

ASSESSMENT OPPORTUNITIES

- For Part A, have students sort pictures of objects into three groups: wood, food, and paper.
- To assess their understanding of trees as a

source of products, have students find the following at school or home:

- Two things derived from the gum of trees (rubber products, chewing gum)
- Two things made directly from wood (furniture, toothpicks, spools)
- Two things made from tree resin (violin rosin, soap, varnish)
- Two things derived from fruits and nuts of trees (cider, dyes, spices)
- Two things extracted from the leaves or bark of trees (astringent lotion, cork, honey)
- Two things derived from cellulose (rayon, paper, cellophane, carpeting).

BACKGROUND

Products are derived from all parts of a tree. Wood is one of the most obvious. It provides things such as lumber for houses, furniture, doors, picture frames, clocks, paintbrush handles, counters, cabinets, floors, spools for thread, etc.

Cellulose is the major component of wood (and most other plant fiber). Paper is made from cellulose, and paper products include books, wrappers, cereal boxes, magazines, newspapers, food labels, etc. Besides being used to make paper, cellulose is an ingredient in many other products. See "Would You Believe It Comes from Trees?" on next page for a list of just some of the products that come from cellulose and other tree parts.

Internet, make a slide show of them, and give the students cards with names and images that correspond to the slide show.

In different parts of the room, display a large picture or actual product to represent each of the three categories: wood products, food products, and paper products. For example, a newspaper could represent paper products, a musical instrument could represent wood products, and an apple could represent food products.



Put up three sheets of chart paper with a label (paper, wood, food) and/or drawing and/or picture to go along with each category. Students can attach their picture under the label once it has been determined to be correct. Display charts.

GETTING READY

For Part A, cut out magazine pictures of products made from trees. You'll need at least one picture per student. You should collect pictures that fit equally into the categories wood products, food products, and paper products.



If you cannot find old magazine pictures, look for images on the

For Part B, collect as many of the following items as you can:

- Newspaper
- Toothpicks
- Candy bar with almonds
- Scrap of lumber or plywood
- Tissue paper
- Sponge (synthetic, not natural)
- Piece of rayon cloth or clothing
- Baseball



Would You Believe It Comes from Trees?

Wood Products

Fuel – wood and charcoal
Lumber for building
Furniture
Planks
Packaging
Wood panel veneers
Particle board
Plywood

Bark Products

Cork
Tannin (used for curing leather)
Dye
Drugs and oils
Cinnamon

Cellulose Products

Carpeting
Cellophane
Rayon and other fabrics
Thickening agent (in shampoo)
Suntan lotion
Shatterproof glass
Cosmetics
Paper products such as writing paper, magazines, books, toilet paper, newspaper, wrapping paper, building paper, industrial paper, and wallpaper
Fiber board
Imitation leather

Sap Products (Gums and Resins)

Cosmetics
Paint thinner
Perfumes
Soap
Rubber products
Sugar and syrup
Varnishes
Waxes
Chewing gum
Flavoring
Printing ink
Shoe polish
Crayons
Cleaning fluids
Electrical insulation
Adhesives

Fruit, Leaves, and Seed Products

Fruits (apples, mangoes, bananas)
Nuts (pine nuts, cola nuts)
Spices (bay leaves, nutmeg, mace)
Dyes
Cider

Note: Some of the products listed aren't always—or exclusively—made from trees.

- Wooden chopsticks or a wooden mixing or salad spoon
- Bottle of vanilla (flavoring)
- Book or magazine
- Cardboard box
- Pack of chewing gum
- Empty can of paint
- Bottle cork
- Rubber gloves
- Apple or other piece of fruit that comes from trees
- Plastic comb or brush
- Piece of cellophane
- Wooden chair or other piece of furniture
- **Safety!** Empty and clean can of paint thinner, turpentine, or mineral spirits.

For Part B, make enough copies of the student page for each group of four students and cut sheet in sections.

DOING THE ACTIVITY

PART A—Tree Tectives

1. Hold up a small branch and a wood-en object. Ask where each of these comes from. (Students will most likely recognize the branch as coming from a

tree but might say that the other object comes from a store, house, closet, etc.) If you have one, show students the "tree cookie," and explain that it also comes from a tree. Have students see and feel the texture of the wood. Can they identify similar texture and grain in various wood products? Do they recognize those products as coming from trees?

2. Ask the students if they know where paper comes from. Describe in simple terms the process by which trees become paper.

3. Ask students if they can think of other things that come from trees. Ask whether they've used anything today that comes from trees.

4. Explain that paper, wood, and food are three of the main kinds of products people get from trees. Hand out the pictures you cut out earlier, one per person. Explain that each picture shows one of these three important types of tree products. Tell the students to decide what type of tree product they have: wood, food, or paper.

5. Make sure the students understand the kinds of products that each category includes. Then give them time to go and stand under the picture representing the appropriate category.

6. Have each of the students name their tree product. Ask if anybody can think of other products that come from trees. Then refer to "Would You Believe It Comes from Trees?" to discuss some unusual tree products. Have students bring in some samples to pass around.

PART B—Tree Treasures

1. Place the items you collected around the room and label each one with a number.
2. Divide the group into teams of four, and tell them that team members will work together to determine which of the products are made from trees. All team members must agree with the team's decision about each product and must be able to explain why each product is on their team's list.
3. Have the students in each team number themselves from one to four.



Tell all the "1's" that it's their responsibility to record the information that everyone on their team agrees on and that they'll have to report their group's findings to the rest of the class. Tell all the "2's" that they must make sure that everyone in the group has an opportunity to speak as the team tries to reach decisions. The "3's" must make sure the group stays on track and gets everything accomplished in the time allowed. And the "4's" are the only people who may leave the group to ask you questions.


4. Have the teams move around the room and examine the products. After they have decided if one item comes from trees in some way, they should record it on a list and move on to the next one.

Safety! Do not let students open any of the product containers.

5. Once teams have established their lists, give each team a set of the readings on the student page. Each student should read the article that corresponds to his or her number and explain the contents to their team members. (For younger students, you may read the articles aloud as a class.)

6. The teams should then re-evaluate the list of products they came up with in Step 4. Are there any products they want to add to or delete from their list? Once again, remind them that everyone on their team must agree with the changes and should be able to explain why each item is on their list.

7. Have the teams share their lists with the rest of the group. Discuss the diversity of products we get from trees. Check the students' understanding of the articles by asking them to explain why they included certain products. Students should realize by the end of the discussion that all the products they looked at came from trees.

 8. Discuss how this new awareness of tree products might affect students' behavior. Talk about conservation practices where their families use a forest product but

could also (1) recycle the product, (2) reuse the product, or (3) reduce its use.

Enrichment

■ Make a Treasure Tree

Bring in a dead or pruned tree limb (with lots of branches), a used Christmas tree, or a small potted tree. Have the students decorate the limb (propped up), Christmas tree, or potted tree with pictures of tree products. They can draw their own pictures, cut pictures out of magazines, or use the pictures from the activity. They can also use actual small tree products, such as pencils, paper towel rolls, nuts, fruit, cellophane, etc., to decorate the tree.

■ Find Out the Mystery Product

Cut out tree product pictures from magazines and use clothespins to attach a picture to each student's back. Tell students they must figure out the product on their back by asking each other questions. They can ask each person only two "yes" or "no" questions. For example, "Is this product used in our school?" For more advanced students, you can make this game more challenging by not allowing these questions: "Is it made from paper?" "Is it made from wood?" "Is it used for food?"

READING CONNECTIONS

Dorros, Arthur. *A Tree is Growing*. Scholastic. 1997. Tells about the structure of trees and how they grow, as well as their uses. Grades K-3. ISBN: 0590453009.

Leavell, Chuck and Nicholas Cravotta. *The Tree Farmer*. VSP Books. 2005. A proud grandfather takes his grandson on a magical journey through his tree farm where they discover the majesty of the forest and the many benefits of trees. Grades K-5. ISBN: 1893622169.

Marshall, Pam. *From Tree to Paper*. Sundance. 2002. An exciting photo-essay book

explaining how trees are made into paper. Grades PreK-2. ISBN: 082250720X.

Mortensen, Lori. *In the Trees, Honey Bees!* Dawn Publications. 2009. This book describes amazing insects that are also critically important to humans. Simple verse engages the young child, while sidebars with fascinating information satisfy the older audience. Grades PreK-3. ISBN: 1584691158.

Neuschwander, Cindy Wayne Geehan. *Sir Cumference and the First Round Table*. Charlesbridge Publishing. 1998. When his knights get together, they sit at such a long table that everyone has to shout to be heard. Can Sir Cumference and Lady Di of Ameter measure up to the challenge of building a better table? The fallen tree

provides the perfect answer. Grades K-6. ISBN: 1570911525.

Pluckrose, Henry. *Trees*. Children's Press. 1994. Tree shapes, types of leaves, how trees are fed, why they are green, what animals they house, and the bounty trees produce are all captured in the text and photographs. Grades K-2. ISBN: 0516401211.

Silverstein, Shel. *The Giving Tree*. HarperCollins. 1964. A moving parable about the gift of giving and the capacity to love, told throughout the life of a boy who grows to manhood and a tree that selflessly gives him her bounty through the years. Grades PreK-2. ISBN: 0060256656.





Tree Readings

1. Look around you and chances are you'll see a lot of things made out of wood. People use wood to build houses and other buildings; to construct doors, floors, fences, and furniture; and to make many other products including bowls, boats, paddles, crates, baskets, and baseball bats.

To make wood products, people first harvest trees and process them into lumber. After the trees have been cut down, the branches are removed and they are cut into logs. Then, the logs are loaded onto trucks and transported to a sawmill. The first machine at the sawmill strips off the bark. The logs are then measured and then cut into lumber. Depending on how the wood will be used (whether for buildings, furniture, baseball bats, etc.), the trees will be cut in different ways.

What products a tree is used for depends on the type of tree it is. For example, hardwood trees such as oak and maple are often used for flooring and high quality furniture, while softwood (coniferous) trees are usually used for papermaking, lower quality furniture, houses, and crates. Plants contain a compound called cellulose to give them rigidity and support. Cellulose is the main component in wood and is also used to make paper.

3. It would be hard, if not impossible, to find a part of a tree that people do not use in some way. The bark of many trees, for example, is used for many different products. Most bottle corks are made from the bark of cork oak trees, which grow in Europe and Africa near the Mediterranean Sea. The spongy bark of these trees is made into bulletin boards, the inner cores of baseballs, and many other products. Quinine, the drug used to cure and prevent malaria, comes from Peruvian bark and had been used by Native Americans long before the Europeans arrived. Some tree bark has an abundance of a chemical called tannin. People use tannin to process leather.

Some trees produce saps called gums and resins that are used to make paint thinner, chewing gum, medicines, and many other products. For hundreds of years, South American Indians have extracted the sap or latex from the rubber tree to make products such as rubber-soled shoes and containers. They processed it by heating the rubber and mixing it with sulfur to improve its strength. Maple trees produce a sap that people turn into maple syrup.

Trees provide people with fruits and nuts such as apples, coconut, pecans, lemons, and olives, and spices such as all-spice and nutmeg. Tree leaves, trunks, and other parts also provide ingredients for paints, road building materials, medicines, artificial vanilla, adhesives, inks, and hundreds of other products.

2. All land plants contain a compound called cellulose, which provides them with rigidity and support. It's the number-one component in wood. People use cellulose from wood to make a variety of products besides paper. For example, cellulose can be mixed with certain chemicals and squeezed into fibers that are used to make carpets, wigs, and fabrics such as rayon for clothes and furniture.

Cellulose is also used as a key ingredient in cellophane, sausage casings, explosives, shatterproof glass, sponges, shampoo thickeners, imitation leather, and many other products. Processed with certain chemicals, cellulose may also be used to produce molded plastics for eyeglass frames, hairbrush handles, steering wheels, and so on.



4. Paper was made by hand for nearly 17 centuries following its invention in China about 100 A.D. In Asia, plant fibers were beaten into a pulp, suspended in water, and formed into sheets by draining the fibers through a screen. As knowledge of papermaking moved westward, paper makers began to use rags rather than plant fibers to furnish pulp.

Papermaking spread to Europe through the Middle East, reaching Spain from North Africa by about 1200. From Spain, the craft eventually was brought to the North and South America. The Spanish established a European-style paper mill in Mexico in about 1580.

Paper mills use cellulose from three sources: recycled paper, wood chips and sawdust leftover from making lumber, and raw logs. When raw logs arrive at the mill, machines strip the bark off and chop the trees into chips. Then the chips (and other sources of cellulose) are "cooked" with chemicals until the mixture becomes a thick pulp. Next, the pulp is "washed." During the washing stage, dirt and other impurities are filtered out, producing clean pulp and, leftover waste and solids called sludge water. The sludge is separated from the water and either landfilled, burned, or applied to the land as fertilizer. The wash water goes into a waste water treatment system. The clean pulp then goes through a series of machines where the fibers get mashed apart so that the pulp will form smooth sheets when dried.

Three Cheers for Trees



Activity 3

It's easy to take for granted both trees and the many benefits they provide. In this activity, students picture how their community would be different without trees and think about how much trees add to people's lives.

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Levels

Grades 1-4

Subjects

Science, Social Studies, Visual Arts

Concepts

- Resource management technologies interact and influence environmental quality; the acquisition, extraction and transportation of natural resources; all life forms; and each other.
- While technological advances decrease the incidence of disease and death, the ever-increasing world population is placing heavy demands on the finite resources of the Earth.

Skills

Discussing, Evaluating, Comparing and Contrasting, Identifying Attributes and Components



Technology Connections

Digital/Video Cameras, Graphics Software

Materials

Activity: drawing paper, crayons or markers
Variation: 8" x 10" (20 cm x 25 cm) white paper, 8" x 10" (20 cm x 25 cm) overhead transparencies, pencils, colored markers for drawing on transparencies

Time Considerations

Preparation: 20 minutes
Activity: 50 minutes

OBJECTIVE

- Students will describe the benefits of trees in their community.

ASSESSMENT OPPORTUNITY

- Have students create a "Three Cheers for Trees" bulletin board showing the benefits of trees. Have them develop a list of the benefits that trees provide, and then draw or cut out pictures that depict these benefits (products, shade, wildlife, beauty, fresh air, and so on). With your guidance, allow students to design and arrange the bulletin board.

BACKGROUND

Most people plant trees to provide fruit, beauty, or shade. But the benefits of trees – especially in urban settings – go far beyond those things. Trees provide social, environmental, and economic benefits as well.

Social benefits. Trees enhance the quality of life for residents of a community. They provide privacy, emphasize views, or screen out unpleasant sights. They reduce glare and reflection. They provide the urban landscape with natural elements and wildlife habitats.

Environmental Benefits. Trees provide environmental benefits by moderating temperatures and improving water and air quality. Tree leaves absorb and deflect the sun's radiant energy, reducing the "heat island" effect of buildings and paved areas in city centers. Trees also intercept rain and hail, reducing the amount of water that falls onto the ground below. Leaves absorb carbon dioxide from the air, and in the process also absorb other air pollutants – such as ozone, carbon monoxide, and sulfur dioxide – and give off oxygen.

Economic Benefits. Some trees provide wood, fruit, and nuts. Beyond these obvious economic benefits, trees also reduce energy costs. A 25-foot tree may reduce the heating and cooling costs of a typical

residence by 8 to 12 percent. Trees also enhance property values, offering another economic benefit to residential property owners.

(For more information, see the Background of Activity 6, "Plant a Tree.")

DOING THE ACTIVITY

1. Write the following list where everyone can see it:

- playground
- school grounds
- city street
- neighborhood
- park
- zoo
- highway
- picnic area
- backyard
- farm

2. Have each person or team choose and draw one of the areas on the list. Explain that students can draw the area any way they like, with one exception: They must leave trees out of the picture. (You might work on one big mural with each team drawing a different section.)

3. When students have finished their drawings, have them draw the same scene again, but this time using as many trees as they wish.

4. Display the drawings (or murals) where everyone can see them. Ask students in which environment they would rather spend their time, and if trees have anything to do with their preferences.

5. Discuss the benefits of trees in public places. Have the students brainstorm a list of benefits. For example, trees not only look nice; they also provide shade, protection from wind, and a habitat for wildlife. Trees help to improve the quality of air and to reduce noise.

Variation

1. Give each student or team an 8.5" x 11" (215 mm x 279 mm) piece of paper and an 8.5" x 11" (215 mm x 279 mm) blank overhead transparency.

2. On the piece of paper have students draw a familiar scene (their house or building, street, school, playground, downtown) without its trees, bushes, grass, flowers, or plants of any kind.


3. Have students place the transparency over the picture and tape it to one edge.

4. On the transparency, have them use colored markers to draw any trees, bushes, and plants that they remember being in the scene.

5. When they've finished, they can flip up the transparency and compare the pictures with and without trees and plants.

6. Afterward, they can continue drawing on the transparency. Maybe the added trees, plants, or flowers represent the way students would like to see the scene some day.

Enrichment

■  Have students use a digital camera to take a picture of a place they visit. Help them load the image into a graphics program and, using the eraser tool, erase all the trees. They can then compare and contrast the two images as they write about the importance of trees.

■ Many communities have programs to promote urban tree planting. Find out whether this is happening in your community and how students can get involved. Contact the local parks, natural resources, extension service, or environmental services department.

■ As a service-learning project, plan a planting event (trees, bushes, plants, flowers) for your school, group, or community. Use this opportunity to publicize all the benefits that trees and plants provide for us. (See Activity 6, "Plant a Tree.")



READING CONNECTIONS

Gackenbach, Dick. *Mighty Tree*. Harcourt. 1992. Three seeds grow into three beautiful trees, each of which serves a different function in nature and for people. Grades K-3. ISBN: 0785784209.

Lauber, Patricia. *Be A Friend To Trees*. HarperCollins. 1994. Discusses the importance of trees as sources of food, oxygen, and other things essential in life. Grades K-4. ISBN: 0064451208.

Morrison, Gordon. *Oak Tree*. Walter Lorraine Books. 2005. Describes the impact of the changing seasons on an old oak tree and the life that surrounds it. Grades 1-4. ISBN: 0618609180.

Nivola, Claire A. *Planting the Trees of Kenya: The Story of Wangari Maathai*. Farrar, Straus and Giroux. 2008. Nobel Peace Prize winner Wangari Maathai learned that Kenya's farming practices were threatening the well-being of her fellow citizens. To combat the situation, Wangari encouraged women to begin planting trees. Learn how one

person's actions can truly make a difference. Grades K-4 ISBN: 0374399182.

Ryder, Joanne. *The Goodbye Walk*. Lodestar Books. 1993. At the end of the summer, a child revisits the special places she has enjoyed on her vacation. Grades K-3. ISBN: 0525674055.

Undry, Janice May. *A Tree is Nice*. Harper Trophy. 1987. Trees are beautiful. If you have a tree, you can climb up its trunk, roll in its leaves, or hang a swing from one of its limbs. Birds can make nests in the branches. Grades PreK-2. ISBN: 0064431479.



Forest for the Trees



In this activity, students will role-play managing a Tree Farm. By using a piece of land as a Tree Farm, they will begin to understand the economic factors that influence management decisions for private forest lands.

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Activity 4

Levels

Activity: Grades 4-8
Variation: Grades 6-8

Subjects

Science, Math, Social Studies

Concepts

Conservation and management technologies, when appropriately applied to the use of preservation of natural resources, can enhance and extend the usefulness of the resources as well as the quality of the environment.

Skills

Identifying Main Ideas,
Analyzing, Solving Problems,
Synthesizing and Creating



Technology Connections

Graphic Organizer Software

Materials

Three pieces of cardboard and string to make three signs to go around the students' necks

Time Considerations

Preparation: 30 minutes
Activity: 50 minutes

OBJECTIVE

- Students will understand how forest resources are managed to provide products and other benefits.

ASSESSMENT OPPORTUNITIES

- Pass out copies of the Forest Stand puzzle on the second student page. Tell students to number Boxes A to F in a logical sequence. On the back of the page, have them describe the sequence of events and say what actions were taken in each box.

Possible answers:

- (C) A young forest seeded naturally, or planted.
- (A) Several trees are removed for firewood.
- (B) With harvesting of mature trees for lumber after 40 years, a few mature seed trees are left for regeneration.
- (F) When seed trees are harvested for lumber, young seedlings are growing.
- (E) With initial thinning after 15 years, removed trees are used for firewood or paper.
- (D) With pulpwood thinning after 20 years, removed trees are used for paper.

- Have students use graphic organizer software to create a concept map of the situations and processes they simulated in the activity.

BACKGROUND

The United States has 749 million acres (303 million ha) of forestland that make up about one-third of the total land base. Canada has 1,032 million acres or 418 million ha of forestland. To be classified as forestland, an area must be at least 1 acre (.4 ha) and contain about 10 percent tree cover. About 504 million acres (204 million ha), or two-thirds, of U.S. forestlands are also classified as commercial **timberland** (forests capable of growing merchantable crops of trees). Canada has 244 million acres (99 million ha) classified as commercial. U.S. commercial timberlands are owned by three sectors of society: family owned forests make up 58 percent; while public agencies (federal, state, county) own 29 percent; and forest industries own 13 percent.



Privately owned forests are managed for many objectives. Many private forests, most of them family owned, choose to grow trees for wood products such as paper and lumber. Like other forests, family owned forests not only produce timber and other forest commodities, but also provide homes for wildlife, produce oxygen, reduce soil erosion, help protect water quality, and offer recreation areas. Although family forest owners often have different goals for managing their lands, most have one thing in common: they want to manage their forests in an aesthetically pleasing and ecologically sound way, while growing trees for forest products. One organization, the American Tree Farm System® (ATFS), works with family forest owners through its network of foresters and other natural resource professionals to help them better understand how to sustainably manage their forest land. Since 1941, ATFS has offered family forest owners education and infor-



mation to help them enhance their forest lands. They also certify family forests as being sustainably managed. These certified forests are known as Tree Farms. To be certified, landowners must demonstrate that they are managing their forests for all its values: wood, water, wildlife, and recreation.

Silviculture is the art and practice of managing and regenerating a forest to best meet the objectives of the owner. Family forest owners apply silvicultural techniques to maintain and enhance their forestland. In doing so, they can influence forest composition, structure, and growth. Through various techniques that include harvesting (cutting and **thinning**), planting, and vegetation control (herbicide use and **prescribed burning**), a forest owner can manipulate the variety and age of tree species within a forest, the density of trees, the arrangement of different layers or stories of vegetation, and lighting and shading. Even before a forest matures, owners must consider how the next forest will be regenerated and managed. The management techniques a forest owner applies to his or her land not only affect the present forest but also influence its future characteristics.

For more specific information on silvicultural systems of management, refer to the first student page.

GETTING READY

Find a comfortable seating area indoors or outdoors where you can arrange students in rows. You'll divide your group into about five rows of roughly equal numbers. Prepare three signs that read FIREWOOD, PAPER, and LUMBER, which will go around students' necks.

DOING THE ACTIVITY

1. Ask students for the definition of a Tree Farm. Using the background information, explain that a Tree Farm, as certified by the American Tree Farm System®, is a for-

est ecosystem, often family owned, that can provide many valuable benefits, including wood, recreation, clean water, and habitat for wildlife.

2. Explain to students that in this scenario they are going to be a family owned forest. Explain that you want to manage this forest to be a productive Tree Farm, so you call ATFS or the State Forest Service for advice. For this scenario they recommend planting pine trees (for southern states) or hybrid poplars (for northern states). (Recommendations of trees to plant in these regions may vary for different scenarios or management objectives.) They also help you to develop a long-range management plan for your land.

3. Based on the ATFS and Forest Service recommendations, randomly place students within a defined area to start the simulation. After each is in place, tell students to crouch down low because they are now tree seedlings. Many of them have seeded naturally, but some have been planted. Tell the "trees" that they have now been growing for 15 years. They should now kneel and have their arms outstretched. Tell them that they need to be thinned so they can continue to grow quickly. If they are not thinned, they may become crowded and compete for food, water, and sunlight. Such competition may stunt their growth and make them more susceptible to insects and disease.

4. Next, ask students which trees should be harvested. Explain that for this thinning, you will remove those "trees" that are overcrowding others and causing too much competition for water, sunlight, and soil. Some of these "trees" will be used for firewood and some for making paper. Place a FIREWOOD sign around one student's neck and have him or her stand to one side where the others can see. Have another tree (student) that has been harvested wear a PAPER sign. You should remove approximately every other "tree" during this initial thinning operation. You can designate these "trees" as firewood or paper and then have them stand behind the respective students.

5. Tell the remaining students that they have now grown for another 10 years. Have them stand with their arms outstretched and ask them what they think you should do now. Explain that the trees need thinning again and this time you will harvest roughly half or every other pine or poplar "tree" for paper. This thinning will enable the remaining "trees" to continue growing at the maximum rate. All "trees" that are cut down will join the others already behind the PAPER sign. Explain that pulp from the trees will be used to make books, boxes, tissues, and other paper products.

6. After growing another 15 years, the remaining "trees" will be as big as they will probably get. Have them stand with their arms outstretched overhead. Ask students what they think you should do at this point. Explain that if all the trees are left as they are, they may be attacked by insects, infected by disease, or destroyed by wildfire. If any of these things happen, the "trees" will lose most, if not all, of their value as timber. Therefore, you have decided to harvest most of the remaining "trees" for lumber. Place the LUMBER sign on one student and begin to remove most of the remaining "trees." When the "trees" have been removed, explain that you will replant the land with several trees for every one that you removed in the final harvest. Leaving some mature seed trees standing will allow for natural regeneration.

7. For a second simulation, place all of the "trees" in a defined area, as in the beginning of the activity, and ask them what natural events could drastically change the forest. (Wildfire, insect infestation, or plant disease could kill many trees and plants and could greatly affect the ecosystem.) Discuss students' answers. Pretend you are a wildfire roaring through the forest and destroying many of the "trees" (all students sit down). Discuss the results: Wildlife is homeless; soil is charred; streams are choked with sediment and ash; valuable timber is lost. Explain that although you, the landowner, are

very upset, fire is a natural and sometimes vital part of the forest lifecycle (some tree species actually need fire to regenerate naturally from seed). The forest will return through natural regeneration and planting.

8. For the final simulation, replant the forest or allow for natural regeneration so that all "trees" are standing back in their places. Tell the students that you have decided to retire and move away. Before you leave, you must sell the land. You sell to someone who isn't interested in forest management. This person has decided to develop the property for housing without consulting forest managers.

9. First, the new landowner puts in a road so prospective homebuyers can see the lots. Remove a portion of the "trees" where the road will go, and put them aside to be burned. (This is often what happens.) Next, remove some "trees" next to the road so homes can be built. (Again, put them in a brush pile to be burned.) Continue cutting

down "trees" to make room for the construction of businesses, schools, and roads until all "trees" are gone. Ask the students, "Would you like to live in this community?" Point out the many benefits that trees provide for a development like this. (Beauty, shade, recreation, clean air, and homes for animals.) Discuss how the landowner could have developed this housing community with the assistance of foresters so that many of these benefits could have remained.

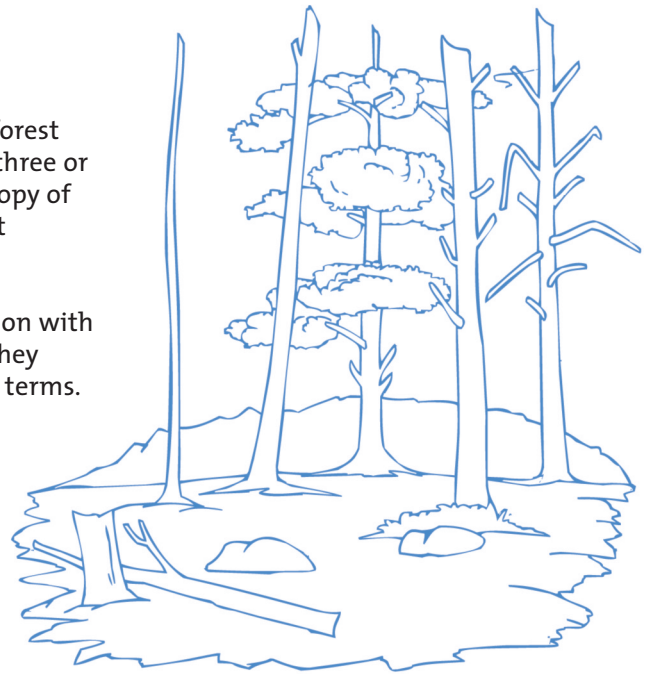
Variation— Silvicultural Simulation

1. Divide students into forest management teams of three or four. Give each team a copy of the student page "Forest Silvicultural Systems."

2. Review this information with students to make sure they understand the forestry terms.

3. Give teams about 20 minutes to plan a strategy for managing a forest in which the other students are the trees. They can choose one of the silvicultural systems described on the student page, can use a combination of systems, or can make up their own system. They must be prepared to explain each action they take.

4. Allow time for each team to lead the entire group through a simulation of its strategy.



READING CONNECTIONS

Drake, Jane. *Forestry*. Kids Can Press. 2002. Where do the wood products that we use everyday come from? Take an informational tour of the harvesting and replanting of trees and the equipment and manpower it takes to provide these products for us. Grades 3-5. ISBN: 1553374231.

Heinrich, Bernd. *The Trees in My Forest*. HarperCollins Publishers. 1997. The author takes the readers on an eye-opening journey through the hidden life of a three hundred acre forest. Each of the 24 essays explores a different aspect of the relationships among plants, animals, and people of the forest. Grades 7+. ISBN: 0060174463.

Johnson, Sylvia. *Apple Trees*. Lerner. 1983. Discusses the growth and cultivation of apple trees and the development, harvesting, and storage of apples. Grades 3-6. ISBN: 0822514796.

Jordan, Sandra. *Christmas Tree Farm*. Orchard Books. 1993. Describes the activities that take place on a Christmas tree farm in Rhode Island throughout each season of the year. Grades K-3. ISBN: 0785798978.

Pringle, Laurence. *Fire in the Forest: A Cycle of Growth and Renewal*. Simon and Schuster. 1995. Depicts, in text and illustrations, the stages of fire and regrowth in a Western lodgepole pine forest over a period of three hundred years. Also discusses the fire cycle and the role of fire in forest ecology. Grades 2-6. ISBN: 068980394X.

Shetterly, Susan Hand. *Shelterwood*. Tilbury House Publishers. 1999. This story takes the reader on a journey through the woods as an environmentally conscious forester passes on his knowledge to his granddaughter, showing her how he protects forest biodiversity by selectively cutting trees. Grades 3-7. ISBN: 0884482111.

Waldron, Kathleen Cook and Ann Walsh. *Forestry A-Z*. Orca Book Publishers. 2008. An A to Z format answers numerous questions about the history of modern forestry, from how plywood is made and what the workers do at camp to how the industry has changed over the years. Grades 3-6. ISBN: 1551435047.





Forest Silvicultural Systems

Silviculture is the art and science of managing and regenerating forests to control their composition, structure, and growth. Forests are frequently managed in smaller units called stands. A stand is a group of trees similar enough in species composition, condition, and age distribution to be considered a unit. Stands may be even-aged (trees are of relatively the same age) or uneven-aged.

A forest manager can choose among several systems of silviculture to harvest and grow new trees within a forest stand. These include the clearcutting, seed-tree, shelterwood, and single tree and group selection systems.

In the **clear-cutting system**, most trees in a stand are harvested at once, with the expectation that a new, even-aged stand becomes established. The clear-cut system works well for establishing trees that grow best in full sunlight. The new stand is most commonly developed by planting seedlings. In other cases, a clear-cut area is regenerated by seeds from nearby stands, from seeds stored in the forest floor, or from stump or root sprouts of cut trees.

The **seed-tree system** requires leaving a few good seed-producing trees on each stand when the mature stand is harvested. These trees provide the seeds needed to regenerate a new, even-aged stand. The seed trees are sometimes harvested after a crop of new, young trees has become established.

The **shelterwood system** involves a series of partial cuttings over a period of years in the mature stand. Early cuttings improve the vigor and seed production of remaining trees and prepare the site for new seedlings. The remaining trees produce seeds and shelter young seedlings. Later, cuttings will harvest



shelterwood trees and allow regeneration to develop as an even-aged stand.

The **single-tree selection system** differs from the other systems by creating and maintaining an uneven-aged stand. Foresters examine a stand and judge each tree on its individual merit. Trees are harvested as they mature. Seedlings or sprouts grow in the spaces created. Periodic thinning and harvesting results in a stand that contains trees of many ages and sizes. Because relatively few trees are harvested at any one time, and because the forest floor is generally shaded, this system favors species that thrive in low light.

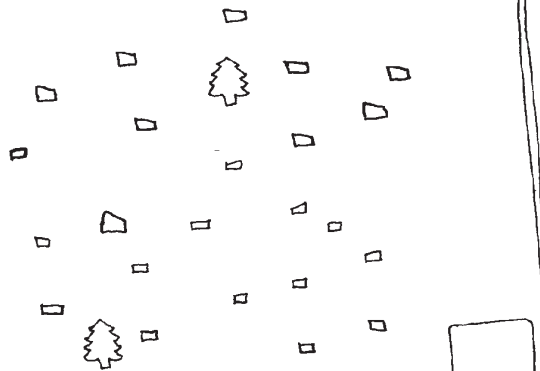
The **group selection system** requires harvest of small groups rather than individual trees. The openings created resemble miniature clear-cuts, or gaps, with the major difference being that the resulting regeneration occupies too small an area to be considered an even-aged stand. As in the single-tree system, both thinning and harvest cuttings are done at the same time. The new trees that grow in these small openings are regarded as parts of a larger stand containing trees of many ages. In either singletree or group selection systems, frequent harvests are needed to maintain a balance of tree ages, classes, and sizes.

Forest Stand Puzzle

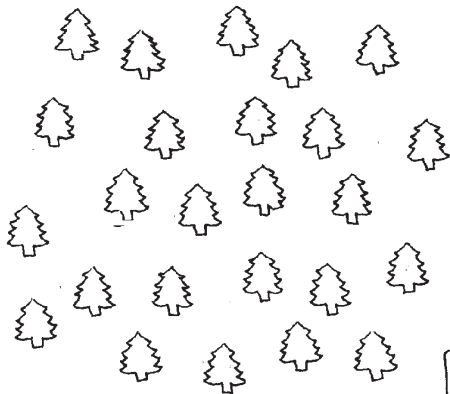
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B



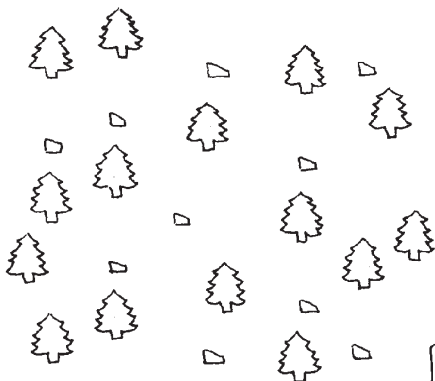
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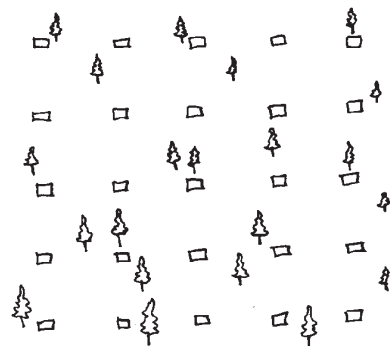
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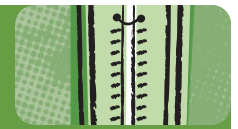
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400-Acre Wood

In this activity, students will play the role of managers of a 400-acre (162 hectare) piece of public forest. Through this role, students will begin to understand the complex considerations that influence management decisions about forest lands.

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Activity 5

Levels

Grades 7-8

Subjects

Science, Math, Social Studies

Concepts

- Resource management and technological systems help societies to meet, within limits, the needs of a growing human population.
- Conservation technology enables humans to maintain and extend the productivity of vital resources.
- Natural beauty, as experienced in forests and other habitats, enhances the quality of human life by providing artistic and spiritual inspiration, as well as recreational and intellectual opportunities.

Skills

Identifying Main Ideas,
Analyzing, Solving Problems



Technology Connections

Spreadsheet/Database Software

Materials

Copies of student pages; a yellow marker; chart paper; colored markers; calculators (optional); masking tape; transparencies and overhead projector (optional)

Time Considerations

Preparation: 60 minutes
Activity: Two to three 50-minute periods

OBJECTIVES

- Students will experience the analysis and decision-making involved in managing forest land.
- Students will understand that any land-use decision has a number of consequences for people, wildlife, and plants.

ASSESSMENT OPPORTUNITY

- Have student teams present their plan for 400-Acre Woods to a Community Council (made up of students). Give each team five minutes to explain why their plan should be accepted by the council. After all teams have presented their plans, give the council members time to choose the plan they believe is best. Use team presentations to assess how well students understand the pros and cons of their proposals.

BACKGROUND

Public and private forests cover nearly one-third of our nation's land. More than just trees, forests are made up of a wide variety of species that interact to create a thriving ecosystem. They provide habitats for many species of plants and animals as well as vital resources for people. People use forests in many ways such as harvesting timber, camping, hiking, hunting, and fishing. Forests also provide clean water by anchoring the soil and preventing soil erosion.

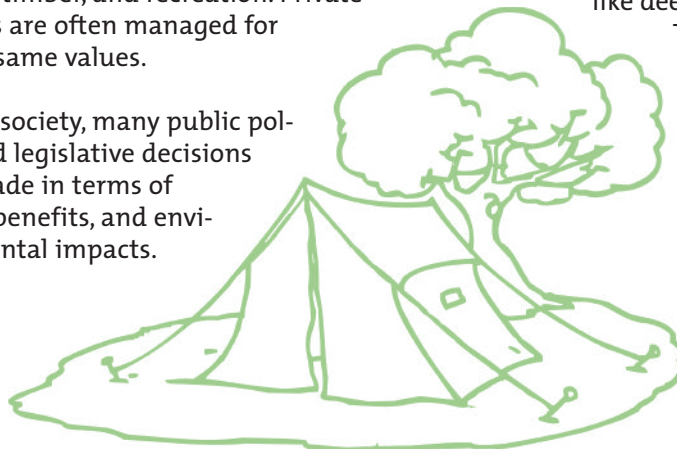
The Multiple Use and Sustained Yield Act of 1960 requires that national forests be managed "in a manner to provide the maximum benefit for the general public." Multiple use management of public lands means forest managers must consider values for fish and wildlife, soil, water, timber, and recreation. Private forests are often managed for those same values.

In our society, many public policy and legislative decisions are made in terms of costs, benefits, and environmental impacts.

Forest managers must consider the economic effects of their decisions about forest lands. But they must also consider the forest's intangible elements such as recreation, water, soil, and wildlife values, even though those items are harder to evaluate. One way to consider the value of a forest for recreational use would be to compare costs and benefits, for example, the cost of developing a campground versus the income from fees charged. Another way is to calculate the number and type of visitors a specific attraction or activity will bring to the forest in a year.

One way to determine the value of wildlife is to measure its contribution to the forest's economic value. Calculate this value by finding out the species of wildlife that live in the forest and if those animals consist of game (hunted) species like deer, turkey, or quail.

Then determine the income generated from hunters through licenses, guns, equipment, lodging, and travel.



Wildlife's economic value might include other uses that generate income such as wildlife photography and bird watching.

Another way to determine the importance of wildlife is to realize that it has intrinsic value, regardless of its economic value. With this approach, managers view the forest as a complex ecosystem in which every part of the system is important to every other part. If managers maintain each component of the ecosystem, the result will be healthy and assorted wildlife and plant communities, or biodiversity. To figure out how a specific action or non-action might impact biodiversity, forest managers look at the impact of an action on several wildlife species with different habitat needs.

One impact of human development can be **fragmentation**. Fragmentation is the process of dividing large, continuous ecosystems and habitats into smaller, isolated parcels. When humans develop a piece of land for homes, roads, businesses, agriculture, parking lots, and other developments, they change the biological community. As the size of a habitat becomes smaller and smaller, more and more animal and plant species are affected. Sometimes, the decline of a certain species can serve as an early indicator that a whole community or ecosystem is changing.

GETTING READY

Make copies of the student pages. Using a light-colored marker, draw a 20" x 20" (50.8 cm x 50.8 cm) grid map of 400-Acre Wood on a piece of chart paper for each team of four or five students. (Teams can also make their own.) The grid should have 400 1" x 1" (2.5 cm x 2.5 cm) squares, each representing 1 acre (0.4047 hectare). On another piece of chart paper, make an identical, but larger, grid to use in group discussion. If you have an overhead projector, you may want to prepare a transparency of the grid.



DOING THE ACTIVITY

1. Introduce the activity by explaining that students will look at several complex issues that face forest managers. Help students brainstorm a list of activities that take place on forest land. List their ideas on the board. Include uses like hiking, fishing, hunting, reading, taking pictures, camping, rock climbing, skiing, snowmobiling, logging, grazing, or mining. Ask the class to look at the list and decide if any activities would conflict with each other if done on the same piece of land.

2. Discuss these questions:

- Which activities would cost the most to provide on forest land?
- Which would bring the most visitors?
- Which would have the greatest impact on the forest ecosystem? On the wildlife there? Would this effect be permanent or temporary?
- Which would cause fragmentation?
- Which would provide for society's most critical needs?

3. Have students read the "If You Were the Boss" student pages. Divide the group into teams of four or five, and explain that each team will decide the


best use (or uses) of 400-Acre Wood, which has been donated to the community. Each team will develop a land management plan that will serve the best interests of the entire ecosystem. Make sure students understand that their team can use the entire 400 acres (162 ha) for one use, or can divide it up for multiple uses. For example, they may devote 200 acres (81 ha) to wilderness and hiking, 80 acres (32 ha) to a campground, and 120 acres (49 ha) for harvesting timber or hunting.

4. Before students begin, ask these questions:

- Which forest uses in "If You Were the Boss" are compatible with other uses? (for example, building a campground and hiking trail next to each other)
- Which might be incompatible with each other? (hunting near a campground)
- What could you learn by figuring out the costs, revenues, trees, wildlife populations, and number of visitors for each management plan? (how the plan affects different forest values)
- Are owls, wood rats, and salamanders the only wildlife in the forest? (no) What could you learn about the

forest ecosystem by analyzing the populations of these three species? (By looking at three animals with different habitat requirements, you get an idea of the general health of the forest ecosystem.)

5. Give each team a map (grid) of the 400-Acre Wood. Also give each team a copy of the "What's the Score?" student pages. Each team should discuss various strategies for managing the forest. When the team arrives at a consensus on how the land should be managed, direct members to use "What's the Score?" for a cost and benefit analysis of their plan. They should discuss what impact their plan would have in terms of visitors, wildlife, trees, and cost and revenue.

 See the PLT website, www.plt.org, for information about obtaining a spreadsheet or database to use in conjunction with the "What's the Score?" student pages.

6. When the teams have completed their management plans, they should use crayons or colored markers to illustrate their plans on the grids. Remind them to include a key showing what different colors and symbols mean.

7. Ask teams to present their plans to the entire group, making clear how they decided on their plans. Have them also report the findings of their "What's the Score?" student pages. Post the maps around the room.

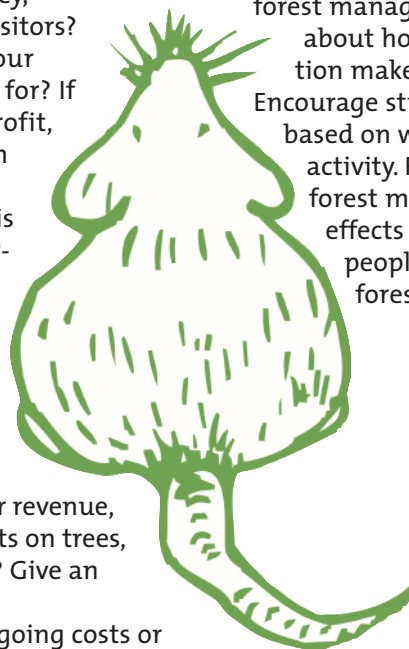
8. Use the large grid map to lead a group discussion of different plans. Ask these questions:

- Which plan enables the most people to enjoy the forest? What is the monetary cost in attracting the most visitors? Are there any other costs besides money?
- Which plan does the most to preserve the forest in its original state? What are the costs of this plan?
- Which plan has the most impact on wildlife and fragmentation? Why should we care if one animal species leaves the forest?
- Which plan seems to provide the best balance of money, trees, wildlife, and visitors?
- How do you think your plan should be paid for? If your plan made a profit, what should happen with the money?
- Which do you think is most important: having the most trees, the most wildlife, or the most visitors? What makes you think so?
- Which do you think is most important—an activity's cost or revenue, or the activity's effects on trees, wildlife, and visitors? Give an example.
- Which items are on-going costs or revenues? Which are one-time costs or revenues?

- What will be the long-term effects of each plan? How will costs or revenue change in the next year? Will the numbers of trees, wildlife, or visitors change?

Enrichment

- Repeat the activity and have each team extend its management plan into the next year, and calculate the effect on money, trees, wildlife, and visitors for the second year.
- Contact the local Forest Service office or forestry agency, and invite a forest manager to talk to your class about how his or her organization makes land-use decisions. Encourage students to ask questions based on what they learned in the activity. For example, how do forest managers weigh the effects of an action on trees, people, and animals in a forested area?



READING CONNECTIONS

Bryan, Nichol. *Los Alamos Wildfires*. Gareth Stevens. 2003. Describes the events surrounding the wildfire that raged in New Mexico in 2000, and the resulting debate over the policy of prescribed burning, or purposely setting fires as a means of forest management. Grades 4+. ISBN: 0836855078.

Camp, William G. and Thomas B. Daugherty. *Managing Our Natural Resources*. Delmar Learning. 1995. Examines the nature, history, and management of natural resources

ranging from soil and water to forests, wildlife, and marine resources. Includes suggested activities and discussion of occupations in the field. Grades 6+. ISBN: 0827367163.

Foster, David R. and John F. O'Keefe. *New England Forests Through Time: Insights from the Harvard Forest Dioramas*. Harvard University Press. 2000. The historical and environmental lessons of New England's landscape are told through the world-renowned dioramas in Harvard's Fisher Museum. This first book based on the dioramas conveys the phenomenal history

of the land, the beauty of the models, and new insights into nature. Grades 6+. ISBN: 0674003446.

Heinrich, Bernd. *The Trees in My Forest*. HarperCollins Publishers. 1997. The author takes the readers on an eye-opening journey through the hidden life of a three hundred acre forest. Each of the 24 essays explores a different aspect of the relationships among plants, animals, and people of the forest. Grades 7+. ISBN: 0060174463.





If You Were the Boss



A magnificent forest, 400-Acre Wood, has just been donated to your community. You and your team have the job of deciding what to do with this forest.

As you might have guessed, 400-Acre Wood is 400 acres (162 hectares) in size. An acre is an area of land equal to a square that is 208.7 feet on each side, and 400 acres is a little less than 1 square mile. (A hectare [ha] is 10,000 square meters and is equal to about 2.47 acres. To convert acres to hectares, multiply by 0.4047).

400-Acre Wood is made up of pine forest, with about 150 mature pine trees per acre. In addition, it contains lots of wildlife such as owls, deer, bear, woodpeckers, turkey, quails, wood rats, fish, and woodland salamanders.

Wildlife biologists use something called management indicator species (MIS) to evaluate the impact of people's actions on the environment. For 400-Acre Wood, the indicator species are barred owls, wood rats, and woodland salamanders. Wildlife biologists estimate that 400-Acre Wood currently has two barred owls per 100 acres (40 ha) of forest, and one wood rat and 25 woodland salamanders per acre (0.40 ha). That means a total of 8 barred owls, 400 wood rats, and 10,000 salamanders currently live in 400-Acre Wood.

Because the forest currently has no roads or trails, few people use or visit it.

You and your team will make a map of 400-Acre Wood and develop a management plan for it. You may decide to do one thing with the entire forest. Or you may want to divide the forest and do different things in different areas. Your goal is to find what you think is the best balance between visitor enjoyment, trees, wildlife, and money.

Below are the different forest uses you can include in your plan. The "What's the Score?" student page will help you evaluate your plan's total effect on visitors, trees, wildlife, and money.

Wilderness Preserve

The purpose of a wilderness preserve is to allow wildlife and plants to exist without humans interfering. Typically a wilderness preserve has no roads, graded trails, or campsites. Wilderness preserve areas will have the following effects.

Visitors: About 5 people per acre per year will visit the preserve.

Trees: The number of trees per acre will remain the same.

Wildlife: The numbers of owls, wood rats, and salamanders per acre will remain the same.

Money: It will cost money to manage the preserve, and each visitor will pay an entrance fee.

Trails

Graded trails allow different types of visitors to enjoy a forest area, including walkers, cyclists, families with strollers, and wheelchair users. Trails areas will have the following effects.

Visitors: About 25 visitors per acre per year will use the trails.

Trees: Some trees must be cut to build a trail.

Wildlife: The increase in visitors will disturb the wildlife. Owls will leave areas with trails (they sleep during the day when people are about), and trails are dangerous for woodland salamanders as they migrate to pools of water during breeding season. There will be no effect on the wood rat population.

Money: It costs money to build and maintain trails. Trees removed to make the trail can be sold. Each visitor will pay an entrance fee.

(continued on next page)

If You Were the Boss (continued)

Campground

A campground allows visitors to enjoy a forest area overnight or over the weekend. It typically has a number of campsites, plus picnic tables, fire pits, parking spaces, and bathrooms. A campground also needs to have a road winding through it. A campground has about 4 sites per acre. Campground areas will have the following effects.

Visitors: About 12.5 campers per site per year will come to the campground, or 50 campers per acre per year.

Trees: Trees need to be removed to build the road and the campsites.

Wildlife: A campground and campers will cause all three indicator species—owls, wood

rats, and salamanders—to disappear from the area.

Money: It costs money to build and maintain the road, to clear and level the campsites, and to build and maintain the restrooms. It also costs money to manage the campground. Trees removed for the road and campsites can be sold. Campers pay a camping fee.

Hunting

Some forest areas are managed to encourage game animals (deer, turkey, and quail) for hunters. These areas require a road for visitors. Hunting areas will have the following effects.

Visitors: About 1 hunter per acre per year will visit.

Trees: Trees will need to be removed to build the road.

Wildlife: With regulations to keep game populations constant, there should be no effect on the three indicator species—owls, wood rats, and salamanders.

Money: It will cost money to build and maintain the road. It will also cost money for management. Trees removed for the road can be sold. Hunters will pay a hunting fee.

Fishing

To encourage fish for anglers, a lake can be created by damming the forest stream. Fishing areas will have the following effects.

Visitors: About 2 anglers per acre per year will visit.



Trees: Trees will need to be removed to create the lake.

Wildlife: Creating the lake will cause all three indicator species—owls, wood rats, and salamanders—to disappear from the fishing area.

Money: It will cost money to build the dam to create the lake. It will also cost money for management. Trees removed for the lake can be sold. Anglers will pay a fishing fee.

Timber Harvest

Some forest areas are set aside for timber harvesting, which means cutting trees to sell the logs. Using a sustainable yield approach, only a portion of the trees are removed at any given time. This minimizes the effect on wildlife, while producing as many logs as possible over the long-term. For pine trees, which take 35 years to reach maturity, one-fifth of the trees are cut every 7 years. Timber harvest areas will have the following effects.

Visitors: About 5 people per acre per year will visit.

Trees: Trees will be removed to build the road, plus one-fifth of remaining mature trees will be removed.

Wildlife: The timber harvest will have a minimal impact on the three indicator species.

Money: It will cost money to build and maintain the road and for management. The harvested trees can be sold. Visitors will pay a fee.



What's the Score?

Step 1.

Determine how many acres you plan for each **land use**. The total should be 400 acres.

(____ acres Wilderness) + (____ acres Trails) + (____ acres Campground) + (____ acres Hunting) + (____ acres Fishing) + (____ acres Timber Harvest) = ____ Total Acres

Step 2.

Calculate how many **visitors** per year this plan will attract to your community.

(____ acres Wilderness x 5 visitors/acre) + (____ acres Trails x 25 visitors/acre) + (____ acres Campground x 50 campers/acre) + (____ acres Hunting x 1 hunters/acre) + (____ acres Fishing x 2 anglers/acre) + (____ acres Timber Harvest x 5 visitors/acre) = ____ Total Visitors per Year

Step 3.

Calculate how this plan will affect the **wildlife** management indicator species. Compare the totals you get to the original population of 8 owls, 400 wood rats, and 10,000 salamanders.

Owls: (____ acres Wilderness) + (____ acres Hunting) + (____ acres Timber Harvest) = ____ acres that will support owls x 0.02 owls/acre = ____ Total Owls (Note: Round down to the nearest whole owl.)

Wood Rats: (____ acres Wilderness) + (____ acres Trails) + (____ acres Hunting) + (____ acres Timber Harvest) = ____ acres that will support wood rats x 1 wood rat/acre = ____ Total Wood Rats

Salamanders: (____ acres Wilderness) + (____ acres Hunting) + (____ acres Timber Harvest) = ____ acres that will support salamanders x 25 salamanders/acre = ____ Total Salamanders

Step 4.

Calculate how many **miles of trail or road** are needed for your plan.

(____ acres Trails) ÷ 6 acres/mile = ____ Total Miles of Trail
(____ acres Campground x 250 ft/acre) ÷ 5,280 ft/mile = ____ miles of road for Campground
(____ acres Hunting x 100 ft/acre) ÷ 5280 ft/mile = ____ miles of road for Hunting
(____ acres Timber Harvest x 100ft/acre) ÷ 5280 ft/mile = ____ miles of road for Timber Harvest

Step 5.

Calculate how many mature **trees** remain based on your plan.

(____ miles of Trail x 0.36 acres/mile) x 150 trees/acre = ____
(____ miles Campground road x 1.45 acres/mile) x 150 trees/acre = ____
(____ miles Hunting road x 1.45 acres/mile) x 150 trees/acre = ____
(____ acres of Fishing) x 150 trees/acre = ____
(____ miles Timber Harvest road x 1.45 acres/mile) x 150 trees/acre = ____
(____ acres Timber Harvest x 1/35 harvested) x 150 trees/acre = ____
Total trees removed ____

60,000 mature trees in 400-Acre Wood – trees removed = trees remaining ____

(continued on next page)



What's the Score? (continued)

Step 6.

Calculate the **revenue** and **costs** associated with your plan, and determine the net profit or loss.

Revenue

Fees (per year)

_____ Wilderness visitors x \$2 fee per visitor = \$ _____
_____ Trails visitors x \$2 fee per visitor = \$ _____
_____ Campground campers x \$20 fee per site ÷ 2 campers per site = \$ _____
_____ hunters x \$5 fee per hunter = \$ _____
_____ anglers x \$2.50 fee per angler = \$ _____
_____ Timber Harvest visitors x \$2 fee per visitor = \$ _____

Sale of Trees

_____ trees removed for Trails x \$50 per tree = \$ _____
_____ trees removed for Campground road x \$50 per tree = \$ _____
_____ trees removed for Hunting road x \$50 per tree = \$ _____
_____ trees removed for Fishing x \$50 per tree = \$ _____
_____ trees removed for Timber Harvest x \$50 per tree = \$ _____

Total Revenue \$ _____

Costs

Management Costs (per year)

_____ acres Wilderness x \$2.50 per acre = \$ _____
_____ acres Trails x \$50 per acre = \$ _____
_____ acres Campground x \$200 per acre = \$ _____
_____ acres Hunting x \$5 per acre = \$ _____
_____ acres Fishing x \$2.50 per acre = \$ _____
_____ acres Timber Harvest x \$5 per acre = \$ _____

Construction Costs

_____ miles of Trail x \$100 per mile = \$ _____
_____ miles Campground road x \$600 per mile = \$ _____
_____ acres Campground x 4 sites per acre x \$1000 per site = \$ _____
_____ miles Hunting road x \$600 per mile = \$ _____
_____ acres Fishing x \$3000 per acre = \$ _____
_____ miles Timber Harvest road x \$600 per mile = \$ _____

Total Costs \$ _____

Profit or Loss

(Total Revenue \$ _____) – (Total Costs \$ _____) = \$ _____ Net

If the Net amount is positive, it is a profit; if it is negative, it is a loss.

Plant a Tree

Never underestimate the power of a tree! Besides giving us an amazing array of paper and wood products, trees provide a host of other benefits – from shading our backyards to assisting in the maintenance of the global climate. Students can express their appreciation of trees by planning and carrying out their own tree-planting project.



Activity 6

Levels

Grades 1-8

Subjects

Science, Social Studies

Concepts

- Organisms are interdependent: they all depend on non-living components of the Earth.
- Altering the environment affects all life forms—including humans and the interrelationships that link them.
- Resource management technologies interact and influence environmental quality; the acquisition, extraction and transportation of natural resources; all life forms; and each other.

Skills

Researching, Defining Problems, Formulating Questions, Making Decisions, Evaluating



Technology Connections

Internet Resources, Digital/Video Cameras, Presentation Software

Materials

Paper and pencils, copies of “Plant a Tree” student page
Optional: *Billy B Sings About Trees* CD

Time Considerations

Preparation: 60 minutes
Activity: Two to five 50-minute periods

OBJECTIVES

- Students will identify ways that urban trees enrich our lives.
- Students will determine how people care for urban trees and identify areas in the community that would benefit from having more trees.
- Students will organize and execute a class tree-planting project in a local area.

ASSESSMENT OPPORTUNITY

- Have your students put together an information booklet that other groups could use to plan, execute, and publicize a community tree-planting project. Teams of students can work on different sections of the booklet such as the benefits of tree planting, selecting a site in your community, getting permission and advice for planting on a site, finding volunteer help and funding, determining what species to plant, planting and caring for the trees, and arranging for publicity. Students can include photos, diagrams, drawings, and videos.

BACKGROUND

Trees are invaluable assets to our communities. They give us flowers, fall colors, and lovely scents. They provide homes for birds, squirrels, butterflies, and other wildlife. Their branches create beautiful shapes that soften the urban landscape and even hold tree houses. They shade and cool our streets and buildings and insulate home from cold winds. They contribute to a community's sense of place.

Trees, particularly those planted in urban or residential areas:

- Help settle out, trap, and hold small particles (dust, ash, smoke) that can damage lungs
- Absorb sulfur dioxide and other pollutants
- Store carbon, helping to reduce atmospheric carbon dioxide
- Hold soil with roots, preventing erosion
- Provide homes and food for birds and other animals
- Serve as a windbreak, keeping buildings warmer
- Provide shade, keeping buildings cooler
- Muffle traffic noise
- Provide beauty and enjoyment

By planting a tree, students can contribute positively to their neighborhood and community. As the founder of TreePeople in Los Angeles writes, “When

we plant and care for trees, alone or together, we begin to build an internal place of peace, beauty, safety, joy, simplicity, caring, and satisfaction. The results encourage us to take on larger challenges. After a while, we discover that we've established a richer inner and outer world for ourselves, our families, our neighborhoods, our cities, and our world.”

GETTING READY

Find out which agencies or organizations are responsible for tree planting and maintenance in your community. Parks departments, urban forestry departments, and independent garden clubs are possibilities. Students can write to those agencies or organizations for tree-planting information.

DOING THE ACTIVITY

1. Ask students to name some areas in the community (such as along city streets and in other public areas, including the school grounds) where trees have been planted. Then have them work in small groups to list the benefits trees provide to people and wildlife in those areas.

2. Use the groups' lists to develop a class list, and add any other benefits you can think of (see Background). Have everyone make a copy of the list.

3. Tell the students that planting trees is a great way to do something good for the community – and for the planet as a whole. Have them work in small groups over the next week or so to identify areas in the community (or on the school grounds) that would be improved by the presence of one or more trees. Remind students to refer to their lists of tree benefits as they consider different planting sites. If you're working with younger students, take them on a walk around the school to locate an area or areas that would be improved by adding a tree.

4. After the students have identified possible sites, have a group discussion about the feasibility of each site. Have students decide which site (or sites) should be the focus for their tree-planting campaign. With proper supervision, teams can work on different sites.

5. If you're working with older students, ask them whom they think they should contact to get permission to plant in the area(s) they've chosen. Help them learn about tree planting in your community, finding answers to questions such as:


- How much money is spent annually on tree care in the community? How many trees are planted, and where?
- Which species are most often chosen for planting?
- Do any criteria exist for selecting the species that will be planted? If so, what are they? Whether or not such

criteria exist, you may want to suggest to students that they consider many different factors before deciding on which trees to plant. For example, depending on where they'll be planting, they may want to consider native species and species that are resistant to air pollution, drought, and so forth.

- What are some hardships that urban trees face? What is the average life span of a city tree?
- How can citizens become involved in planting and maintaining trees on public property?


Help students use this information to compose a letter to the appropriate people, agencies, or organizations for permission to plant.

6. After the students have received permission to plant, help them detail plans for their tree-planting project. For instance, they may decide to raise money to buy trees from a local nursery, or they might ask people to donate trees. You may contact local foresters or nurseries to get help with planning and carrying out the planting.

 Students can do Internet research to find out what kind of tree to plant and the specific requirements for that tree.

7. Have students plant trees and take care of them. See the planting recom-

mendations on the student page, and get directions from the nursery on how to plant and care for the particular species of tree.

 The students can take digital pictures before and after planting the tree. Using presentation software they can keep a scrapbook of the tree over time.

Enrichment

- Students could arrange for a special tree-planting ceremony, possibly in conjunction with a special occasion such as Earth Day or Arbor Day. Students should plan the event and send out news releases to publicize it, including the benefits of planting trees.
- Have students make a map of the planting site using graph paper. The map should show the site as it is now and the area the tree canopy will cover when the tree reaches maturity. Have students use garden books or on-line resources to determine the mature size of the tree. Students calculate and compare the areas of the two canopies.
- Use selected music ("My Roots Run Deep" and "These Trees") from the *Billy B Sings About Trees* CD to enhance the concepts covered in this activity.

READING CONNECTIONS

Aliki. *Story of Johnny Appleseed*. Prentice-Hall. 1963. Retells the wandering of John Chapman whose devotion to planting apple trees made him a legendary figure in American history. Also available in Spanish. Grades K-3. ISBN: 0671667467.

Giono, Jean. *The Man Who Planted Trees*. Chelsea Green Publishing Co. 1985. Jean Giono's beautiful allegorical tale is legendary. Written in the 1950's, its message was ahead of its time, inspiring readers to rediscover the harmonies of the countryside and prevent its willful destruction. Grades 4+. ISBN: 1570625387.

Locker, Thomas. *Sky Tree: Seeing Science Through Art*. HarperCollins. 1995. A tree stands on a hill by a river. As the sky changes, so does the tree, its branches filling with clouds, stars, snow, birds, mists, and the golden spring sun. One tree can mean many things. Grades K-4. ISBN: 0064437507.

Manson, Christopher. *The Tree in the Wood: An Old Nursery Song*. North-South Books. 1993. A cumulative folk song that traces a tree back to the acorn planted by a boy whose bed was feathered by a bird nesting in a similar tree. Grades K-3. ISBN: 1558581928.

Mellet, Peter. *Trees: Fantastic Facts*. Anness Publishing, Ltd. 2000. Reveals for young readers the secret life of trees – what really goes on inside the trunk, how leaves make food, when trees first grew on the earth, and

more. Includes 19 information sections on the different parts of a tree and their functions, 23 practical projects that help you discover the life-cycle of a tree, and more than 250 illustrations, photos, and explanatory artwork. Grades 3-6. ISBN: 1842150944.

Winter, Jeanette. *Wangari's Trees of Peace: A True Story from Africa*. Houghton Mifflin Harcourt. 2008. This book depicts Wangari Maathai's inspirational story in brief words and colorful images. It offers a welcome introduction to Wangari's awe-inspiring work and to the subject of activism in general. Grades K-4. ISBN: 0152065458.



Plant a Tree

Choose Your Site Carefully.

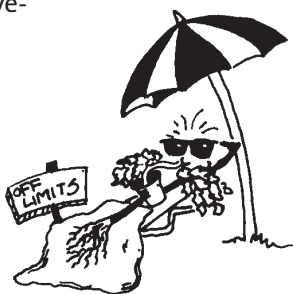
Look up, around, and down. The tree you plant today could eventually reach 40 to 100 feet (12 to 30 meters) in height, depending on the tree type. Give your tree plenty of room – its roots will grow wide and deep.

Plant it well away from buildings and power lines, so that it won't do any damage, or need harmful pruning later in its life. Plant the tree where its roots will not grow into sewers and pipelines, or under driveways and sidewalks.

Look at the tree. Make sure it's suited to the environment you are planting it in, so that it has the best chance of surviving.

Take Care Before and During Planting.

Keep the tree cool and shaded, and keep its roots moist until planting. During planting, try not to handle the tree's roots. Tamp the dirt firmly, but don't pack it too tightly or the roots won't be able to either reach out for water and nutrients, or anchor the tree. Soak the soil around the tree with water to encourage deep rooting.



If you're planting a sapling...

Dig a hole twice as wide and as deep as the rootball. Build a mound of soil, and place the sapling on top of the mound so that it is two inches (five cm) above the hole's bottom. If the roots are wrapped, remove the burlap. Fill the hole with dirt, tamping it down with your foot and wetting it with water as you fill the hole.

If you're planting a seedling...

Dig a hole a little deeper than the roots' length. Fill the hole around the seedling with dirt. Then gently pull the trunk of the seedling up slightly to straighten the roots.

Give Special Care During the Early, Developmental Years.

A tree is most vulnerable during the first years of its life. Protect it from pests and animals. Water it as appropriate for the tree type. Add a 3- to 4-inch (8 to 10 cm) layer of mulch around the base of the tree to help keep the soil moist and improve soil aeration (mulch should not touch trunk).

Then sit back and enjoy! If cared for properly, each tree you plant will grow and flourish, providing you and all of us with benefits and beauty for generations.