Resources

About These Resources

These pages have been specially selected to give teachers and group leaders:

- **Activities and games** that cross grade levels and subject lines.
- **Background information** on selected tree-related topics.
- **Quotes, poems, songs,** etc., that can be used for Arbor Day celebrations or anytime.
- **Books and community resources** for more information.

These materials are ideal environmental education curriculum enhancements. The subject areas listed are suggestions; many of the materials are also appropriate in other subject areas. The pages are valuable, independent learning projects, too.

Most pages can be copied directly for use with students. Those activities that have both teacher guide information and student activity sheets are labeled.

Activities and Games

Background Information

Collections (For Arbor Day or Anytime)

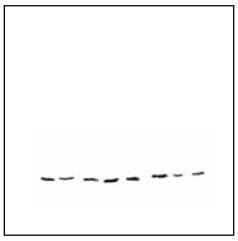
Books and More

Drawing Trees

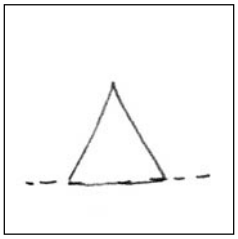
Drawing trees is fun and easy. Draw them your way, or try these step-by-step hints for drawing trees the way artists do! Use light lines when you draw crown shapes. The branches will be your final tree shape.

NAME: _____

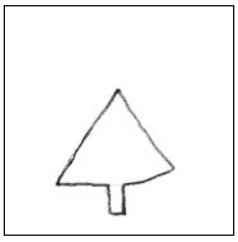
Needleleaf Trees



1. Draw a very light dotted line to mark your space.



2. Draw the crown shape.

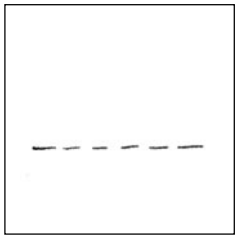


3. Draw in the trunk.

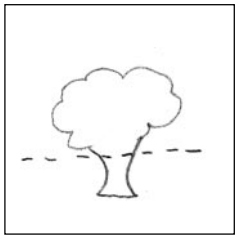
4. Shade in the shape using the side of a sharp pencil.

5. Finish the tree in the same way.

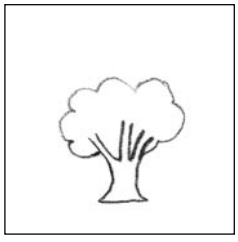
Broadleaf Trees



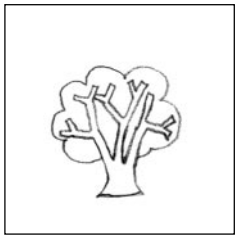
1. Draw a very light dotted line to mark your space.



2. Draw the crown shape and trunk.



3. Make branches. Draw a "V" inside each branch.



4. Continue drawing branches to fill in the tree.

5. Shade in the leaves using the side of a sharp pencil.

Drawing Trees

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Basic Shapes

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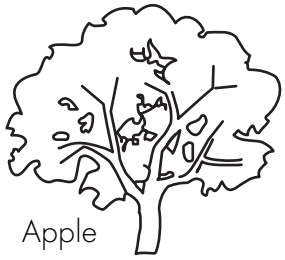
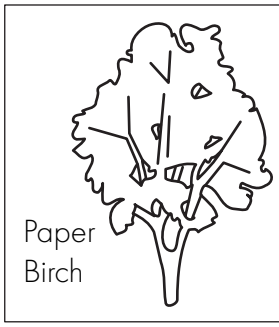


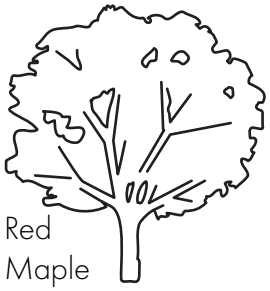
Broadly globe-shaped

Try to draw it!



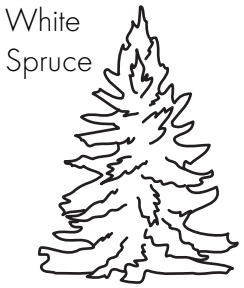
Moderately oval-shaped

Try to draw it!



Broadly globe-shaped

Try to draw it!



Pyramid-shaped

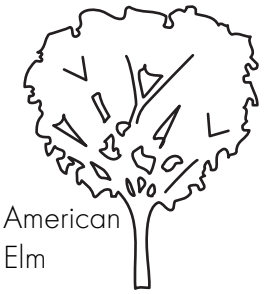
Try to draw it!

Broadly oval-shaped

Try to draw it!

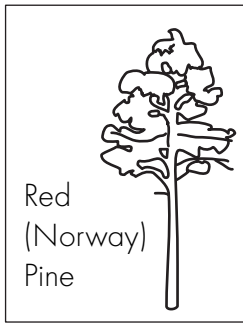
Broadly dome-shaped

Try to draw it!



Broadly vase-shaped

Try to draw it!



Pyramid-shaped

Try to draw it!

From Paper to Plastic

Teacher Guide for Student Activity: Resources, page 84

It's hard to imagine life without trees. We use them to make everything from cardboard to chewing gum. In this activity your students can discover just how big a role trees play in their everyday lives.

First pass out a copy of "From Paper to Plastic" (Resources, page 84) to each student. Tell them there are more than 40 things in the picture made, in some way, from trees. Have them circle all the "tree objects" they can find. Then discuss their answers using the following information.

Putting Trees to Work

Building With Wood

People build a lot of different things with wood. When logs are brought to the sawmill, their bark is removed and they are carefully measured and cut into lumber. Most lumber is used to construct houses and other buildings. Some is used to make athletic equipment, crates, furniture, tool handles, wooden toys, works of art, and many other things. Even waste from the sawmill (small pieces of lumber, chips, and sawdust) can be mixed with special glues and pressed into "engineered" boards and other products.

Wood products in the picture: banister, baseball bat, blocks, bookshelf, broom handle, bulletin-board frame, cabinets, chairs, clock, counter, door, fence (see through open door), fruit bowl, molding (on walls), paintbrush handle, picture frames, sofa, stairs, stereo cabinet and speakers, stools, tables, tennis racket, umbrella handle, window frame, wood inside walls.

Making Paper

Paper is made from *cellulose,* the major component of cell walls in most plants. Most paper in the United States is made with cellulose that comes from trees. To turn a tree into paper, the bark is first stripped off and the trunk is chopped into small pieces, or *chips.* The chips are usually cooked with chemicals until they form an oatmeal-like *pulp.* (In many paper plants, the bark is also chipped and burned to produce energy so nothing is wasted.)

Next the pulp is washed and the impurities (such as dirt) are filtered out, leaving a pulp of cellulose fibers and water. This "clean" pulp is then sent through a series of machines where the fibers are flattened and broken apart so they will form a smooth sheet when the paper is dried.

Eventually the pulp is run onto screens and the water is drained off. Finally, the newly made paper is compressed and dried. Depending upon the chemical process used to make the pulp and the amount of refining the pulp goes through, different kinds of paper can be made. Coffee filter paper and heavy writing paper are examples.

Paper products in the picture: books, candy wrapper, cereal box, gift (wrapping and box), magazines, milk container, newspaper, notes on bulletin board, paper towels, CD cover inserts and record album covers.

Cellulose is Everywhere

Besides being used to make paper, cellulose is one of the ingredients of many other products. For example, it can be mixed with certain chemicals, turned into a thick liquid, and then squeezed through small holes or slits to form fibers. The fibers can be used to make carpeting or conveyor belts, or they might be spun into fabric (rayon and some others) for making clothes or furniture. Different kinds of plastic films, such as cellophane and photographic film, are also made from cellulose.

Cellulose is also added to certain substances that are used to make car steering wheels, toothbrush handles, Ping-Pong balls, and other plastic products. Depending on how it's processed, cellulose can be used in making explosives, thickeners in shampoo and salad dressing, and wallpaper paste.

Cellulose products in the picture: buttons, comb, curtains, eyeglasses frame, hairbrush handle, luggage, pillows, rug, upholstery on sofa, spools for thread.

About Bark

Tree bark has lots of different uses. For example, the spongy bark of the cork oak tree, which grows in the Mediterranean countries of Europe and Africa, is stripped off and made into bottle-cap liners, bottle stoppers, floats, and even heat shields for space vehicles.

Special chemicals in the bark of some trees also have a lot of different uses. For example, some trees produce *tannin,* which is used to cure leather.

Bark products in the picture: baseball (has a cork center), bulletin board.

Using the Ooze

Some trees ooze special saps called *gums* and *resins.* Gums and resins can be used to make many things including cosmetics, mouthwash, paint thinner, perfumes, soap, and coatings for vitamins and other pills. Other trees produce a special juice called *latex* that can be used to make conveyor belts, hoses, rubber tires, and other rubber products.

Gum, resin, and rubber products in the picture: paint, rubber gloves.

Eating Tree Food

People eat the fruit, nuts, roots, and bark (cinnamon for example) of many different trees. Most fruit and nuts can be eaten right off of the tree. But other tree "parts" must be cooked, dried, or processed in some way before people can eat them.

Ask students: Do peanuts come from trees? (No. They are a legume and are harvested from the ground.) Are coconuts a tree product? (No. A palm, which produces coconuts, is not a tree but a *monocotyledon,* a class of plants including lilies, orchids, and grasses.)

Tree foods in the picture: apples, chocolate bar (cocoa tree beans are used to make chocolate), orange.

Besides the products we've listed, substances from trees can also be used in making adhesives, asphalt, baby food, cleaners, inks, and medicines. Many trees are sources of natural fibers that can be made into clothes, furniture, and stuffing material for cushions and life jackets.

Adapted from *Ranger Rick's Naturescope, "Trees are Terrific."* Used with permission.

From Paper to Plastic

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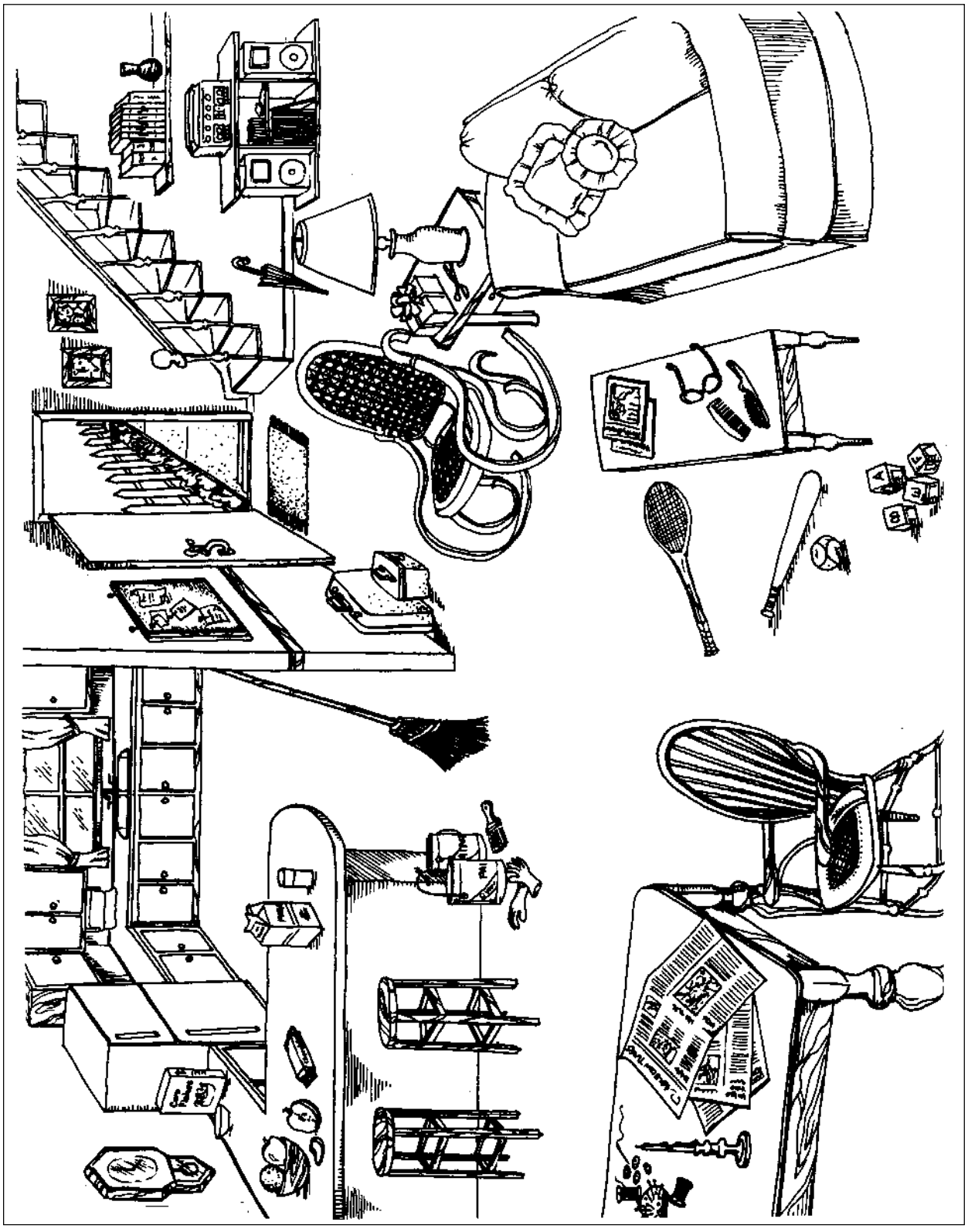
NAME: _____



From *Ranger Rick's Naturescope, "Trees are Terrific."* Used with permission.

Minnesota Tree Products

Teacher Guide for Student Activity: Resources, pages 86 and 87

Minnesota Tree Products

Minnesota's rich soils and variety of climates make an ideal home for many different kinds of trees. What are some of the forest products these different trees bring us? Read on...

Minnesota tree types are either *coniferous* or *deciduous.* Coniferous trees, also called conifers or evergreens, bear their seeds in cones and have thin, needlelike leaves that earn them the name needleleaf. They shed only a portion of their needles each year and people in the wood products industry often refer to them as softwoods. Minnesota's native conifers include white pine, red pine, balsam fir, black spruce, white spruce, white cedar, and tamarack.

Deciduous or broadleaf trees have covered seeds and drop their leaves each autumn. These trees are sometimes called hardwoods, although their wood is not necessarily harder than that of softwoods. Minnesota's native deciduous trees include elm, oak, aspen, cottonwood, birch, basswood, ash, and maple.

Read-to-Kids Listening Activity

You'll need: "Minnesota Tree Products" activity sheets, Resources, pages 86 and 87.

Read slowly so students can write their answers.

Here are just a few of the many products trees bring to our lives:

Paper birch: This tree has a white, papery bark that stands out against the dark bark of other forest trees. Its wood is used for firewood, furniture, and decorative items like baskets.

Ash: Strong, hard wood. Green ash is used for baseball bats, hockey sticks, handles, and firewood. Strips of black ash are used to make woven baskets.

Aspen: Once considered rather useless, the aspen is now the most commercially used tree species in the state. It's used in panel boards, construction materials, and to make paper.

Basswood: Light, soft wood. Used for carving, inexpensive furniture, even inner parts of shoes.

Maples: Beautifully grained wood popular for furniture and moldings. Sugar maples provide sap for maple syrup and are some of fall's most colorful trees.

Oak: Heavy, hard, strong wood. Used for heavy construction, beams and support braces, floors, and furniture.

Tamarack: Hard, heavy wood. Used for telephone poles, railroad ties, and posts.

White spruce: Used for paper, furniture, and canoe paddles. This is also a popular Christmas tree.

Red pine: Coarse-grained, hard wood good for building and construction. Minnesota's state tree.

Balsam fir: Used for paper and is one of the most popular Christmas trees.

White pine: Wood for lumber, building, and construction.

White cedar: Fragrant wood with "outdoors" scent that repels moths. Used for posts, poles, and cedar closets.

Cottonwood: Soft, light wood. Used for making paper.

Elm: Heavy, hard wood. A favorite for furniture and boat building.

Black spruce: Soft wood used mostly for pulp to make paper.

Answers to Read-to-Kids Listening Activity:

Paper birch: firewood, furniture, decorative items.
Green ash: baseball bats, hockey sticks, tool handles, firewood.
Quaking aspen: panel board, construction, paper.
Basswood: carving wood, inexpensive furniture, inner parts of shoes.
Sugar maple: syrup, furniture, colors to enjoy in autumn.
Bur oak: heavy construction beams, floors, furniture.
Tamarack: posts, telephone poles, railroad ties.
White spruce: canoe paddles, paper, furniture, Christmas trees.
Red pine: building, construction.
Balsam fir: paper, Christmas trees.
White pine: lumber, building, construction.
White cedar: posts, poles, cedar closets.

Minnesota Tree Products

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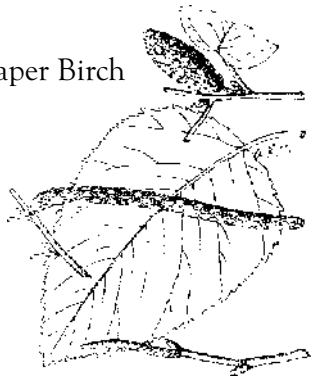
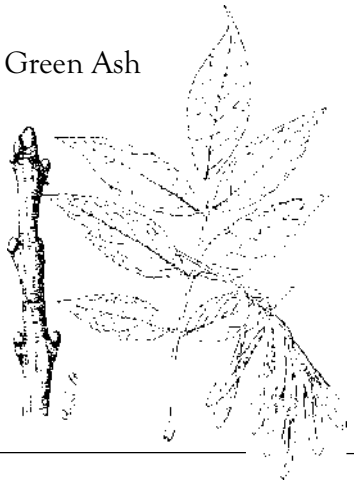
Listening Exercise: Listen as someone reads to you about Minnesota tree products (Resources, page 85). Make a list of the products for each tree as you hear them. Most, but not all of the trees you hear about, are shown on these pages. After the reading, go back and draw pictures of these products.

NAME: _____

Paper Birch

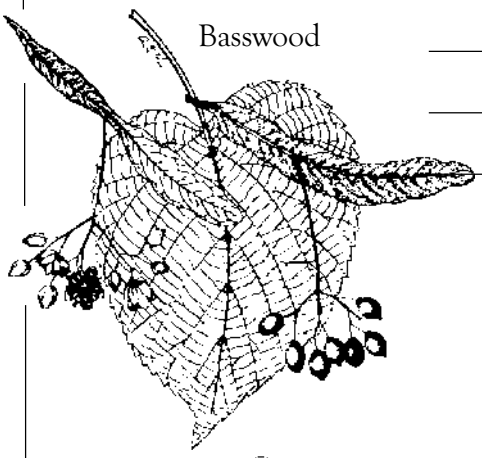


Green Ash

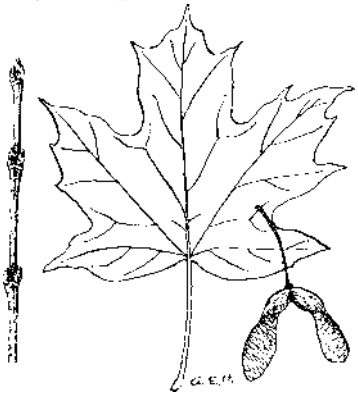


Quaking Aspen

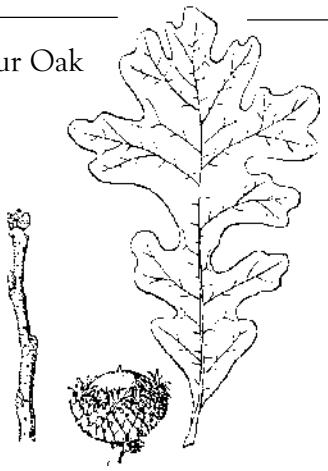
Basswood



Sugar Maple



Bur Oak



Answers on Resources, page 85. Read-to-Kids Listening Activity.

Minnesota Tree Products

KID'S COPY

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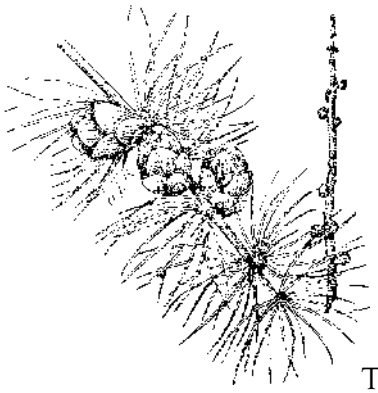
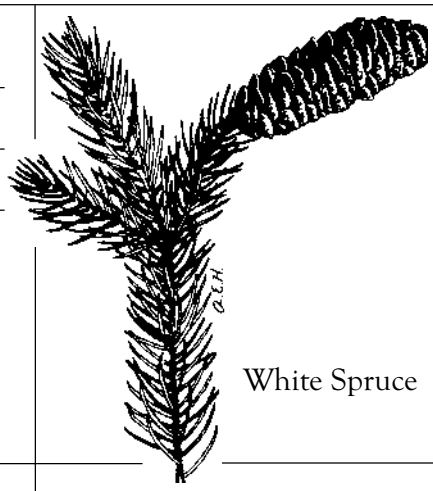
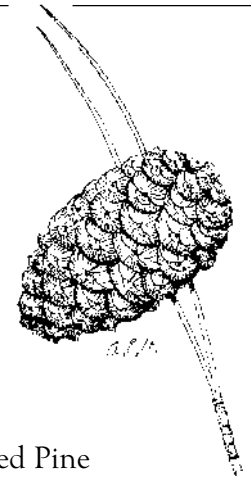


Tamarack

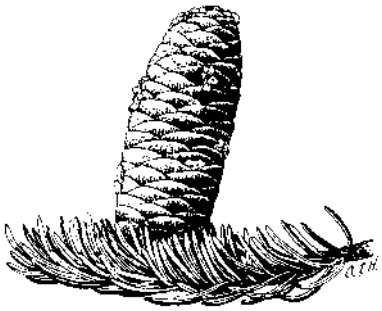


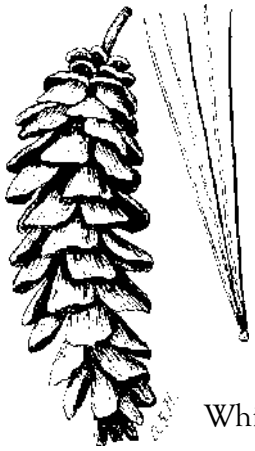
White Spruce

Balsam Fir



Red Pine





White Pine

White Cedar

Answers on Resources, page 85. Read-to-Kids Listening Activity.

Named After Trees (A Charting Activity)

Teacher Guide

You'll need: Chart paper, chart-starter captions on Resources, page 89, and "Trees, Trees" list on Resources, page 90. Put a header at the top of each of six sheets of chart paper; students do the rest!

Invite students to work in pairs to name and list as many trees as they can. Next, they review the "Trees, Trees" list (Resources, page 90). Finally, they try to add examples of tree names on each "Named After Trees" chart. They will know some from the local community. Do you have an Elm Street, an Applebee's Restaurant, an Oak Grove School? Ask students to suggest places to look to find tree names. You may want to carry on your name search over several days. In the process, your students can become better acquainted with a host of ready reference materials as they look for the tree names. How about checking out:

Day 1: The white and yellow pages of the telephone book.

Day 2: Maps and atlases.

Day 3: Encyclopedias, dictionaries, library materials.

Day 4: Newspapers and magazines.

Partners can work out-of-school, too. Encourage everyone to keep an eagle eye out for names in the news and signs in the community for the next few days. Here are a few samples of names your charts might show—

Towns and Cities Named After Trees

Pine City, MN	Pine Bend, OR
Elmwood, WI	Cedar Rapids, IA
Maple Grove, MN	Aspen, CO
Oakdale, MN	Birchwood, WI
Forest Lake, MN	Redwood City, CA
Maplewood, MN	Ironwood, MI

Rivers and Lakes Named After Trees

Willow River, MN	Forest Lake, MN
Apple River, WI	Birch Lake, MN
Pine Lake, MN/WI	Cottonwood River, MN
Cedar Lake, WI	

Businesses/Schools/Streets/Parks Named After Trees

Oak Grove Elementary
Maplewood Mall
Birch Run
Cedar Avenue
Learning Tree Child Care Centers
Willow Lane School

Songs, Stories/Poems, Movies Named After Trees

Tie a Yellow Ribbon 'Round the Old Oak Tree
Don't Sit Under the Apple Tree
Here We Go 'Round the Mulberry Bush
The Giving Tree
Maple Leaf Forever
Steel Magnolias
Oh Christmas Tree

People Named After Trees

Willow
Johnny Appleseed
Jack Lemmon
Nathaniel Hawthorne
Forest Gump
John Birch

Landforms Named After Trees

Cypress swamps
Redwood forests
Evergreen forests
Oak savannas

Discussion Prompters:

1. Which chart was the easiest to fill? Why do you think this is so?
2. How do things such as towns, rivers, lakes, businesses, etc., get their names? What besides trees are popular "themes" for naming things?

Chart Starter Captions

Towns and Cities Named After Trees

Rivers and Lakes Named After Trees

Businesses/Schools/Streets/Parks Named After Trees

Songs, Stories/Poems, Movies Named After Trees

People Named After Trees

Landforms Named After Trees

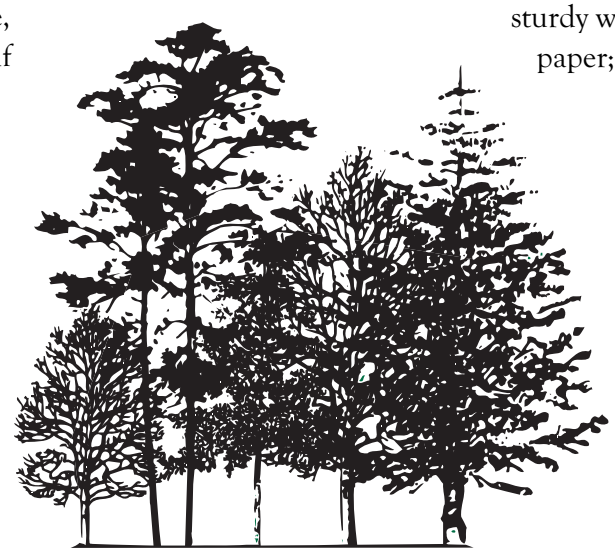
"Trees, Trees"

Reference List for "Named After Trees" Chart Activity

Alder
Almond
Apple
Apricot
Ash
Aspen
Avocado
Balsa
Balsam Fir
Banana
Banyan
Basswood
Bayberry
Beech
Birch
Bonsai
Box Elder
Brazil Nut
Bristlecone Pine
Butternut
Cacao
Cashew
Catalpa
Cedar
Cherry
Chestnut
Cinnamon
Coffee
Cork
Cottonwood
Crab Apple
Cypress
Date
Dogwood
Elm
Eucalyptus
Evergreen
Fig
Filbert
Fir
Grapefruit
Gum
Hackberry
Hawthorn
Hemlock
Hickory
Holly
Horse Chestnut
Ironwood
Juniper
Kumquat
Laurel
Lemon
Lime
Linden
Live Oak
Locust
Magnolia
Mahogany
Mango
Maple
Mimosa
Mountain Ash
Mulberry
Myrtle
Nectarine
Nutmeg
Oak
Olive
Orange
Papaya
Peach
Pear
Pecan
Pepper Tree
Persimmon
Pine
Pistachio Nut
Plum
Poplar
Prickly Ash
Redwood
Rhododendron
Rubber
Sassafras
Sequoia
Soapberry
Spruce
Sweet Gum
Sycamore
Tamarack
Teak
Tulip Tree
Walnut
Willow
Witch Hazel

Tips for Safe and Successful Nature Hikes and Field Trips

1. Choose a place that has as many trees as possible and is within walking distance or a short bus ride from your school. In the ideal situation, each student pair has one tree to study, but groups may be larger if necessary. Get permission from parents, landowners, and others as necessary before leaving the school grounds.
2. Many of the activities suggested in this *Teachers' Guide* may be used with bushes if trees are not plentiful in your area.
3. Before the trip, ask students to join you in deciding on a set of rules. Try to set "do" rules rather than "do not" rules. Usual rules include:
   - Always keep the teacher or adult group leader in sight.
   - Leave places in nature as you find them.
   - Avoid stepping on plants as much as possible.
   - Don't pick plants, pull off plant parts, or harm living things in any way.
   - Don't eat plant parts or anything else found in the forest.
   - Stay on paths and trails.
   - Choose nonliving things or only things in great abundance, like leaves or pine cones, if samples are collected to take back to the classroom.
   - Be quiet and move slowly so you don't disturb creatures living near the trees.
4. Encourage students to prepare a list of questions, or things they hope to discover. At all times, invite them to ask their own questions, and to compare and discuss their ideas freely with others. Gauge your questions, activities, and level of guidance to the attention span, interests, outdoor experience, and "personality" of the group.
5. Throughout the hike or trip, encourage students' observation skills and their sense of beauty.
6. Encourage students to use all their senses in experiencing trees.
7. Your role as teacher is important in helping students think about and observe their environment. Ask inquiry questions, have children compare and contrast, evaluate, find similarities and differences, estimate, predict, experiment, demonstrate, and chart.
8. Visit the same trees frequently and watch for changes. See "Trees Through the Seasons," Resources, page 123 for a variety of questions and activities appropriate for each season.
9. Some things you might want to take along to enhance the trip: a camera; video camera; cassette recorder; field guide to local trees, plants, and animal wildlife; binoculars; magnifying glasses; small bags for collecting samples; rulers and tape measures; clipboards and paper or notebooks with a sturdy writing surface; drawing paper; pencils; and markers.



Tree Bingo

Grades 1-3

Photocopy the word squares and a Bingo grid for each student. **Student Instructions:** Cut out the word squares and paste them anywhere on the Bingo card. Cut the scraps of paper around the edges into markers. **Caller or Leader Instructions:** Read the questions. Students place markers on the answers. Four in a row—down, across, or diagonally—is a "Bingo!"

Questions:	**Answers:**
1. What month is Arbor Month in Minnesota?	May
2. What part of the tree protects it from injuries?	bark
3. What is Minnesota's state tree?	red (Norway) pine
4. What type of tree drops its leaves every fall?	broadleaf tree
5. What are Minnesota's largest plants?	trees
6. What is one way people hurt trees?	carving on bark
7. Trees give off something we breathe in. What is it?	oxygen
8. What is the underground part of the tree called?	roots
9. What parts of the tree are in the crown?	branches and leaves
10. Another name for an animal's home is its...	habitat
11. What makes leaves look green?	chlorophyll
12. What do we call trees that usually hold their leaves (needles) over winter and have seeds inside cones?	needleleaf trees
13. What can be as large as a baseball or as small as the head of a pin?	seeds
14. Which Minnesota tree provides the most food for wildlife?	oak
15. What is one large, wild animal that is attracted to a young forest with new aspen trees?	deer

Tree Bingo

KID'S COPY

Grades 1-3

NAME: _____

B	I	N	G	O

May	trees	branches and leaves	needleleaf trees
bark	carving on bark	FREE SPACE	seeds
red (Norway) pine	oxygen	habitat	oak
broadleaf tree	roots	chlorophyll	deer

Tree Bingo

Grades 4-6

Photocopy the word squares and a Bingo grid for each student. **Student Instructions:** Cut out the word squares and paste them anywhere on the Bingo card. Cut the scraps of paper around the edges into markers. **Choose a leader.** The leader reads the questions. Each student places a marker when he or she has the correct answer. Four in a row—down, across, or diagonally—is a "Bingo!"

Questions:	**Answers:**
1. What is the center part of a tree called?	inner wood
2. What part of the tree protects it from injuries and pests?	bark
3. Who wrote, "I think that I shall never see a poem as lovely as a tree"?	Joyce Kilmer
4. Minnesota's state tree is...	red (Norway) pine
5. What kind of tree drops its leaves every fall?	deciduous
6. How much of the land surface of the earth is covered by trees?	one-third
7. What are the three R's?	reduce, reuse, recycle
8. What do we call businesses that produce a continuous crop of trees for harvesting?	tree farms
9. What type of person is responsible for planning and producing healthy forests?	forester
10. Three well-placed trees planted near a home can cut air conditioning by how much?	10 percent to 50 percent
11. During photosynthesis, trees take in carbon dioxide and give off what?	oxygen
12. Two important ways urban trees save energy is by cutting the need for what?	air conditioning and heating
13. What do we call tree rows planted to conserve heat or reduce soil erosion?	windbreaks
14. Throughout the world humans destroy an acre of forest (about the size of a football field) every...	second
15. One large, wild animal that is attracted to a young forest with new aspen growth is the...	deer

Tree Bingo

Grades 4-6

NAME: _____

B	I	N	G	O

inner wood	deciduous	forester	air conditioning and heating
bark	one-third	FREE SPACE	windbreaks
Joyce Kilmer	reduce, reuse, recycle	10 percent to 50 percent	second
red (Norway) pine	tree farms	oxygen	deer

Twelve For the Trees

Interview people to find someone to match each box. When you find a match, have him or her sign that box.

NAME: _____

Here's a person who:

1. Has planted more than five trees. _____	2. Knows what a city "heat island" or "concrete hot spot" is and can explain how trees could help cool these areas. _____	3. Can tell you where to call to reach a city, county, or state forester. _____
4. Has trees shading the south and west sides of his or her home that cut down the cost of air conditioning. _____	5. Has trees on the north or west sides of his or her home to block the wind and save heat. _____	6. Has taken a picture of a beautiful tree. _____
7. Uses city parks for fun and recreation. _____	8. Has planted one or more trees in the last year. _____	9. Has a bird feeder or has fed birds in another way. _____
10. Can explain how trees fight air pollution. _____	11. Uses leaves or wood chips as mulch for trees, lawns, and gardens. _____	*12. Bonus: Can name Minnesota's official state tree. _____

* The red (or Norway) pine is Minnesota's state tree.

We All Need Forests

Teacher Guide for Student Activity: Resources, page 99

What would your group do if they were in charge of 20,000 acres (8,000 hectares) of forest? If they owned a paper company, they would probably plant a species of fast-growing pine or other "paper tree" and manage as much of the forest as possible for pulpwood. If they were wildlife biologists, they would try to manage the forest in ways that keep the best habitat for different species of wildlife. And if they were recreational planners, they might manage the forest to provide good campsites, hiking trails, ski paths, fishing streams, bike paths, and wildlife study areas.

Most of the forests in this country are managed. How a forest is managed depends on what it will be used for. In the past, most forests were managed for only one type of use, such as for raising pulpwood trees. But today, many more are being managed for several different uses at the same time.

In this activity, your students get a chance to discuss different forest uses and how some of these uses compete. They'll also learn why managing for different uses is so important.

Ask students: What are some ways you or your family use forests? (For hiking, birding, hunting, fishing, camping, and so on.) List the uses on the chalkboard or a large sheet of easel paper. Ask students: How are forests important to wildlife? What important natural resources come from the forest? Next ask if someone can define the word *manage.* Ask students: In order for people to use forests in different ways, how must foresters manage forests in different ways?

Next pass out "We All Need Forests," Resources, page 99. Ask students to look at the three rows on the page. Start with the first row labeled "wildlife." How would this scene look to a rabbit, a bird, a squirrel? How would it look if it were "all cleaned up"? Discuss some of the ways forests are managed to help protect different species of wildlife. Then go on to the second row labeled "recreation" and discuss how forests are managed for different types of recreation. Move to the third row labeled "products" and discuss how forests also provide many products for us to use.

Use the following information to help start your student discussions.

Wildlife

Saving Snags: One way people manage for wildlife in a forest is by leaving dead trees, or snags, standing instead of cutting them down. Snags provide nesting cavities for many birds and mammals, such as owls, woodpeckers, wood ducks, bluebirds, raccoons, and squirrels.

Building Brush Piles: By building brush piles in a forest and along forest edges, forest managers help provide hiding and nesting sites for many animals that live on the ground such as foxes, rabbits, wood thrushes, and chipmunks.

Letting Logs Lie: Many types of animals use logs for nesting and hiding places. By not removing logs, managers help provide homes and feeding areas for many kinds of wildlife.

Building Feeders and Nesting Boxes: Putting nesting boxes in forests that have limited nesting sites helps attract wildlife. So can setting up feeding stations for birds and mammals.

Burning: For some species, the only way to maintain the right kind of habitat is to burn the area on a regular basis to get rid of undergrowth.

Picking the Right Plants: By planting certain types of trees and shrubs in a forest area, wildlife managers can provide habitat for specific types of wildlife.

Recreation

Compare the recreational activities shown on the "We All Need Forests" sheet with the list students came up with. Discuss how the forest is an important place for people to relax, enjoy nature, and exercise.

Some of the ways people use forests for recreation compete with the needs of wildlife and can also disrupt the plants that grow there. What are some examples? (To build ski slopes in a forest,

heavy equipment must come in and cut down trees to make the runs. Roads and parking lots, ski lodges, and other facilities are also built.)

Ask students: What are other ways recreational uses of the forest can harm the wildlife? The role of many forest managers is to balance the uses of a forest so wildlife can be protected and people can use it for recreation, too. Discuss ways this can be done such as making trails in areas where the least amount of natural vegetation needs to be removed, reinforcing trails where heavy foot traffic can cause soil to erode, having specific areas where campfires can be built to reduce the chances of these "recreational" fires escaping into the surrounding forest, or designing trails for multiple uses (skiing, hiking).

Products

Many forests are used for commercial purposes. Some forest areas are managed for lumber, some are managed for pulpwood, and some are opened up for oil, gas, and mineral uses. These uses can upset the forest community and compete with wildlife and recreational uses. For example, you probably wouldn't want to camp near a strip mine in a forest or hike along an area that is being harvested. Why is it important to have commercial uses in a forest? (People need forest products.) How would our lives change if we did not have the products shown in "We All Need Forests"?

Adapted from *Ranger Rick's Naturescope, "Trees are Terrific."* Used with permission.

For Creative Fun: Make Forest Collages

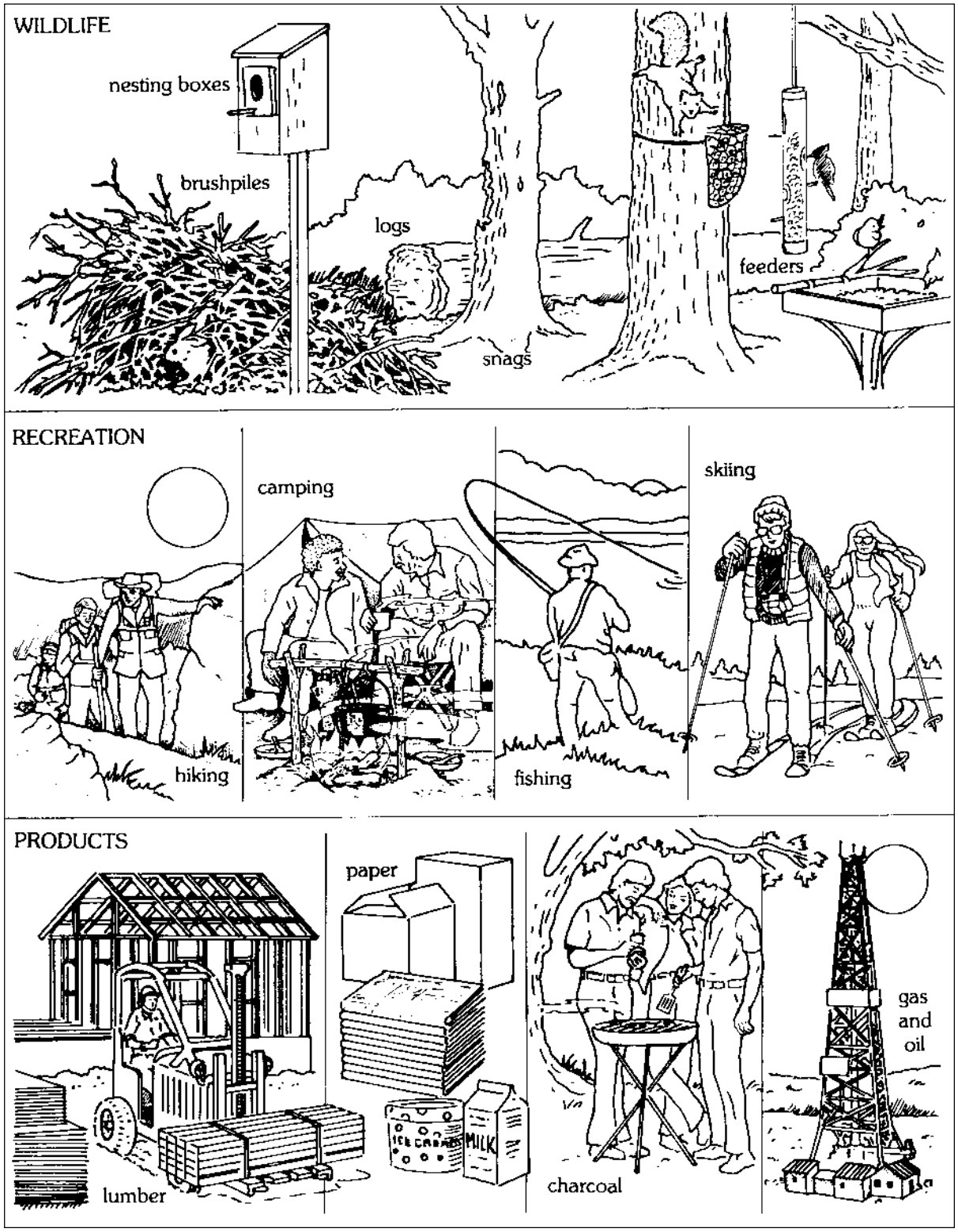
You'll need: Real forest products or magazines, drawing paper, and markers.

Invite students to make forest collages showing all the different uses of a forest. They can cut pictures from magazines, draw their own pictures, and tape or glue on pieces of real forest items such as toothpicks, paper, seeds, and roots. Have each person write a short paragraph explaining his or her collage, then hang the collages around the room.

We All Need Forests

KID'S COPY

NAME: _____



From *Ranger Rick's Naturescope, "Trees are Terrific."* Used with permission.

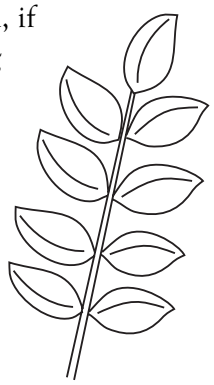
Collecting Leaves and Other Tree Treasures

KID'S COPY

Collecting leaves and other things from trees can be an interesting hobby. It is usually more satisfying to collect midsummer and fall leaves than the new leaves of spring because more mature leaves are tougher, stiffer, and more colorful than new leaves. Still, noticing and collecting leaves and other tree parts can be fun any time of the year.

Tips for Collecting Leaves

1. Take a newspaper or large magazine along when you collect leaves. You can slip the leaves between the pages to protect them from damage and from drying out too fast. Be sure the leaves are flat inside your pages.
2. Take leaves from the ground, if possible, rather than pulling them off trees.
3. Choose only good, undamaged leaves.
4. Make sure you take a whole leaf section and not just one leaflet when you are collecting leaves from trees that have compound leaves.



Compound leaf

Pressing Leaves Like a Pro

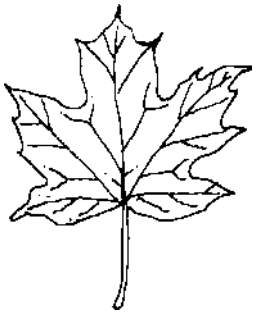
1. When you get home or into the school building with your leaves, press the leaves flat between layers of newspaper or other porous paper.
2. Set heavy weights such as books, bricks or blocks of wood on the paper to press the leaves.
3. Change the papers every couple of days. Dry paper absorbs water from the leaves and helps prevent mildew.
4. Keep your leaf collection in a place where there is good air circulation.
5. Press the leaves between waxed paper with a warm iron if desired, for long-lasting beauty. Or, if you wish to make a formal display to share with others, mount your leaves on cardboard. Label them to show their common and scientific names, where they were found, the date collected, and special notes. Use rubber cement to fasten the leaves on the cardboard.

Common Name:
Sugar Maple

Scientific Name:
Acer saccharum

Location Found:
Schoolyard

Date Collected:
9/18/03

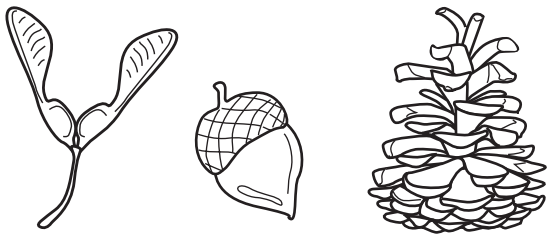


Collecting Other Tree Treasures

Collect fruits, nuts, unique seeds or blossoms, twigs, buds, cones, acorns, berries, etc. These may also be dried and mounted on cardboard for display.

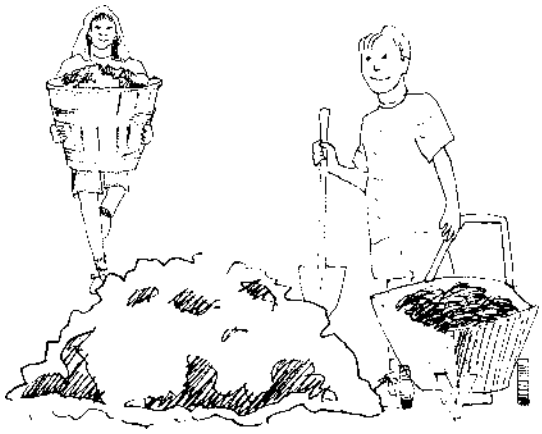
Tree treasures vary throughout the year. While some fruits and nuts won't be around until fall, spring is a good time to begin a collection. Unique buds, twigs, and seeds can be found in spring. If you're building a collection over several months, here are some treasures too good to miss: pods (honeylocust, black locust), winged seeds (maple, Norway spruce, white ash), hairy seeds (weeping willow, poplar), acorns (oaks—cup sizes vary), cones (many species of evergreens).

My Collection



winged seed acorn cone

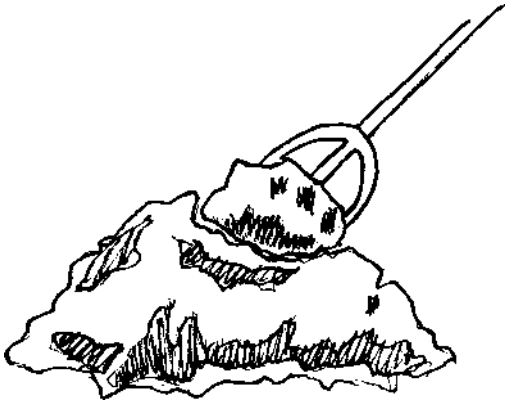
Compost Anyone?



1. Make a compost pile. Gather a big bunch of leaves and put them in a pile. Put layers of soil or manure between layers of leaves.

2. Put a brick in the center of the pile. (The brick absorbs heat, which helps to break down the compost material faster.)

3. Over the winter, add organic kitchen scraps, coffee grounds, and vegetable scraps. Don't use meat, bones, or eggshells.



4. Turn the pile over once in a while.

In the spring, dig to the bottom of the pile. Feel the brick. What do you notice? Use the compost to make your lawn and garden soil richer.

Examine Roots!

You'll need: Sharp sticks or forks and magnifying glasses.

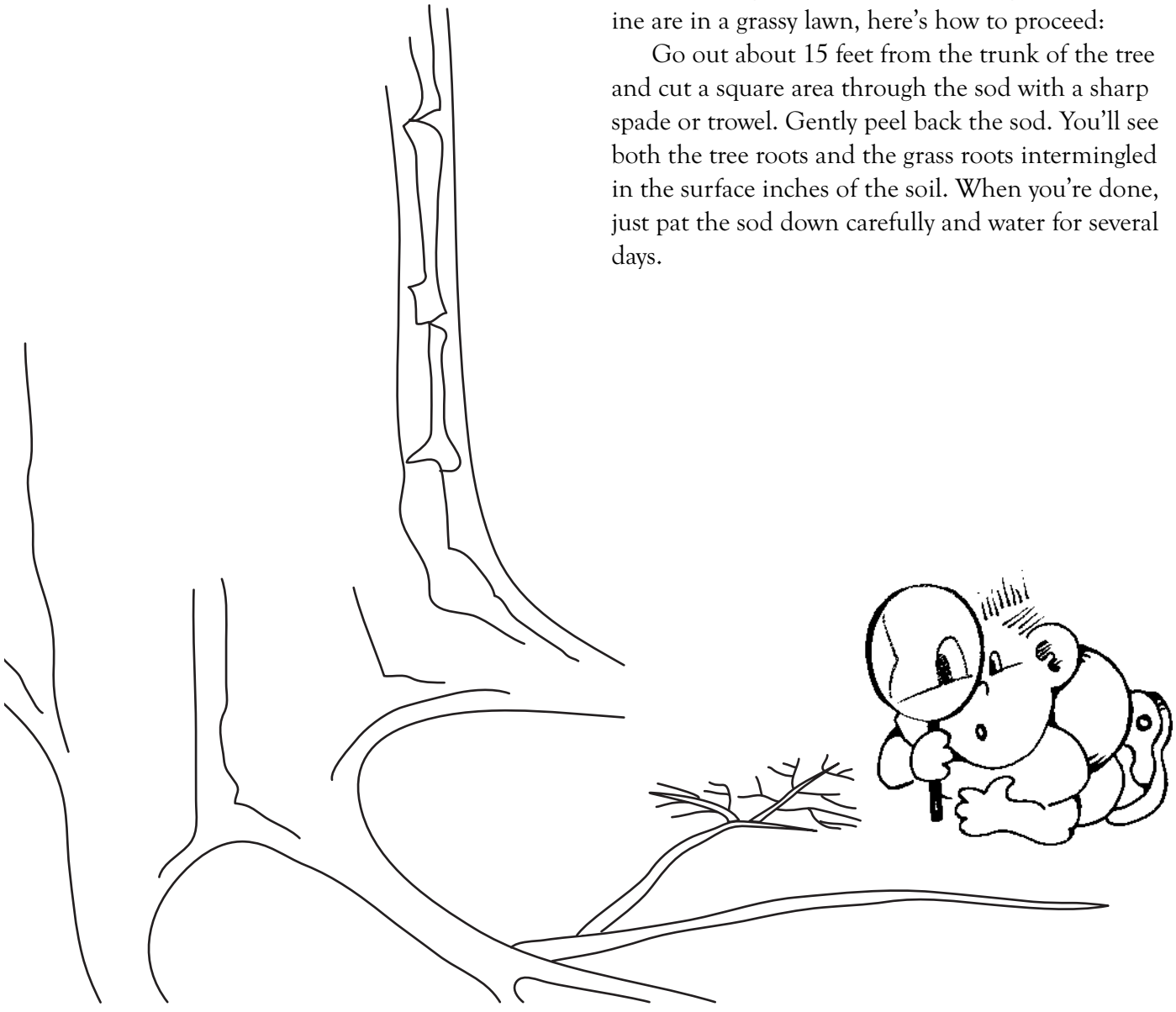
Most of the small absorbing roots of trees are in the forest litter layer and top inches of the soil. They are often smaller across than the lead in a pencil. You can easily expose them.

Carefully sweep away surface litter and soil with fingers and dig gently with a sharp stick or fork. These small roots are constantly growing, dying, and regrowing throughout the season, and can be examined with the eye or with a magnifying glass. A healthy root tip usually has a creamy white, pink, or light tan interior and will snap like a fresh garden bean. It has a pleasant odor that can be masked by the odor of good, clean earth. Unhealthy root tips are limp and dull in color, and sometimes stained blue or black by disease fungi. They often smell of rotting things. Have you uncovered healthy roots?

Dig (gently, please!) more deeply into the soil, and you'll see that most of the fine roots have grown upward into the surface layers of soil from larger roots growing horizontally. These horizontal roots are usually located 4 to 11 inches below the surface. Remember to replace soil and gently "pat" into place.

If the only tree roots available for you to examine are in a grassy lawn, here's how to proceed:

Go out about 15 feet from the trunk of the tree and cut a square area through the sod with a sharp spade or trowel. Gently peel back the sod. You'll see both the tree roots and the grass roots intermingled in the surface inches of the soil. When you're done, just pat the sod down carefully and water for several days.



Leaf Arrangements

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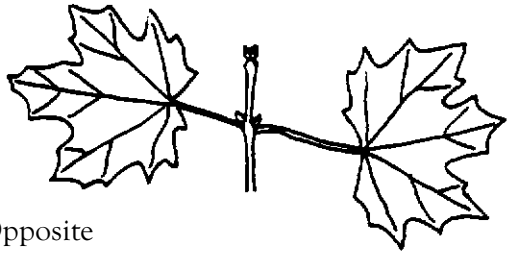
Most deciduous trees have leaves that follow one of these arrangements. Use this page as a guide and search your community for examples of each leaf type. How many of the arrangements can you find in your own community? What species of tree are they from?

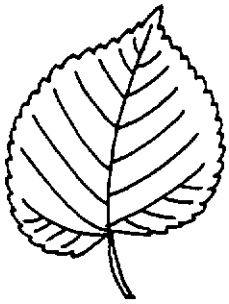
Leaf Placement on Branch



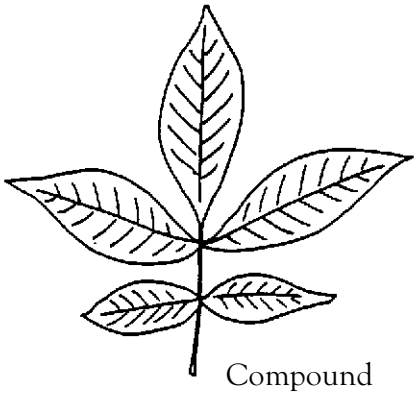
Opposite
Example: Maple

Alternate
Example: Oak

Type of Leaf



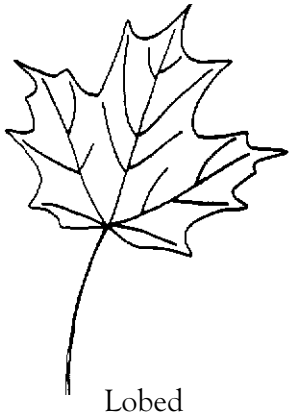
Simple
Example: Birch



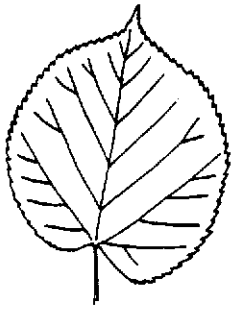
Compound
Example: Green Ash

Doubly compound
Example: Honeylocust

Margin on Leaf Edge

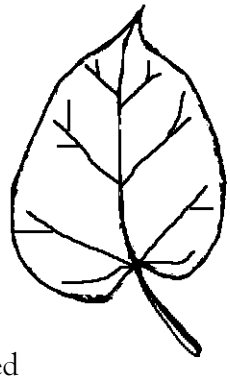


Lobed
Example: Maple



Singly toothed
Example: Poplar

Doubly toothed
Example: Elm

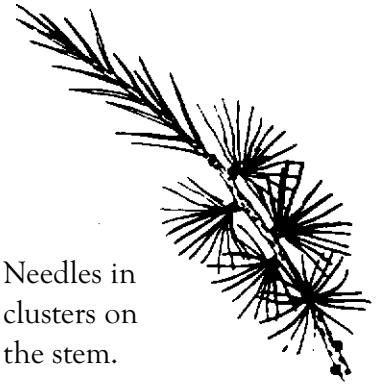


Smooth (leaves not toothed or lobed)
Example: Catalpa

Leaf Arrangements

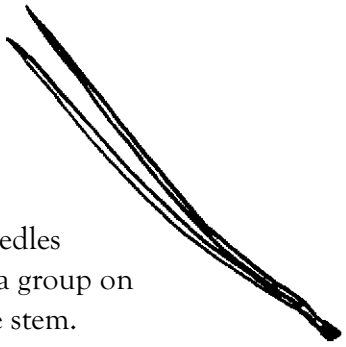
KID'S COPY

Needle Characteristics of Conifers



Needles in clusters on the stem.

Example: Tamarack



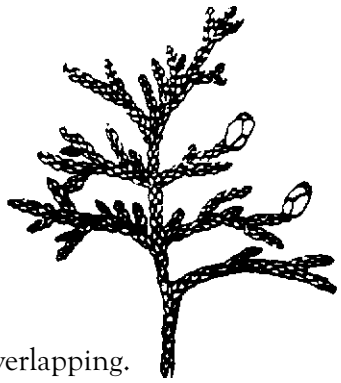
Needles in a group on the stem.

Example: Red (Norway) Pine

Needles are single on the stem.

Example: Balsam Fir

Needles overlapping on the stem.



Scalelike overlapping.

Example: Northern White Cedar

Awl-like overlapping.

Example: Red Cedar

Minnesota's Forests

Background

The history of Minnesota forests is much like that of forests throughout the United States. Forests have been exploited; many are now being rebuilt. Most are now managed so both our generation and future generations can enjoy things that only the forests can give us.

Minnesota's Biomes

The forests of Minnesota developed after the glaciers retreated about 10 to 12 thousand years ago. Those great ice sheets left soils and land features that were well suited for certain types of vegetation. With the warming of the climate after the glacial period, plants gradually built up on these soils. By the time humans arrived on the scene, there were three distinct biomes (biological communities of similar plants and their related animals) in what would later become Minnesota: the coniferous forest biome in the northeast, the deciduous forest of the east central and southeast, and the prairie grassland biome in the west and southwest. (See the Minnesota Biomes map, Resources, page 108.)

Coniferous Forest

The northeastern coniferous forest was the largest region of forest. The original forest included white, red (also known as Norway), and jack pines; black and white spruce; balsam fir, tamarack, northern white cedar; and some deciduous trees (notably the aspens and paper birch) that grow with coniferous trees. These trees did not grow in one big mixture, but tended to appear in definite areas. Soil and moisture conditions and the fire history of the area all affected which trees grew where.

After the first cutting of the coniferous forests, many forest fires swept the regions. These fires destroyed seed trees and young conifers. They helped the growth of some deciduous trees. Today most coniferous forests include a mixture of aspen and birch, and in places, oaks and other deciduous trees. They stand together with young pine, spruce, and fir.

Some conifers, such as balsam fir, are now gradually moving into aspen and birch forests. Balsam can grow in the shade and compete with these trees. If fire is kept out, part of the aspen-birch forests will in time be replaced by fir and spruce. Unfortunately, the pines are not successful in aspen and birch stands because these seedlings do not grow well in shade. This process of one species replaced by another over time as conditions change is called *succession.*

Deciduous Forest

The original deciduous forest region of southeast and east-central Minnesota had stands of tree species such as oak, elm, ash, black walnut, basswood, butternut, maple, cottonwood, willow, aspen, and many others. But these trees grew on soils that were good for growing agricultural crops.

As the settlers moved into the area, much of the deciduous forest land was cleared for agriculture. From 1820 to about 1920, many of the trees of the original forests were used to build homestead and farm buildings. The trees not used were often just cut, gathered into piles, and burned. Today, remnants of this deciduous forest still stand along the rivers and in many small woodlands. Today's trees are the same types of trees that originally covered the area.

Prairie Grassland

In the prairie grassland of western and southwestern Minnesota, the original forests grew along the valleys and flood plains of rivers and streams. The trees included willow, cottonwood, ash, box elder, elm, and occasionally oak, maple, basswood, or other deciduous trees. This area of Minnesota receives less moisture than the coniferous and deciduous forest regions. That's the main reason the land in western and southwestern Minnesota was not covered by forests. There was very little cutting of trees in this area, and today's forest is much like the original forest. Much of the prairie grassland, however, was converted into agricultural lands.

Forest Uses—Then And Now

The forests of Minnesota were used by American Indians long before European explorers discovered

the area. The forest was a place for shelter and medicine, and for forest products such as birch bark, poles, firewood, and foods (maple syrup, wild plums, berries, etc.). It was a place to hunt game. The forest was also sometimes a hindrance to American Indians. Occasionally, they burned areas to create open space. This space meant more browsing room for game and better hunting grounds.

As more and more settlers arrived, the forests were exploited for timber products and cleared to grow agricultural crops. The first big cutting of trees was probably by army troops stationed at Fort Snelling, where the state's first sawmill was built in 1821. The first commercial sawmill was built in 1839 at Marine On Saint Croix. The white pine lumber industry grew quickly in Minnesota from 1890 to 1930. For many years, Minneapolis-St. Paul was the largest sawmill center in the United States.

Wood was in great demand for all types of building and for fuelwood, so tree cutting was encouraged. Agriculturists believed practically all of Minnesota would "go under the plow" and that farming would be the main activity in all areas of the state. To make way for farming, those trees had to go! Logging became big business. After logging, the stumps and logging leftovers were burned. This burning to clear lands for agriculture led to some huge forest fires.

Fires play a big part in the history of forestry in Minnesota. In 1894, the Hinckley Fire, which covered a large area in Pine County, killed 418 people. The Chisholm Fire in 1908 and the Baudette-Spooner Fire in 1910 swept through huge parts of northern Minnesota and caused much suffering and loss. The last big forest fire in Minnesota was in the Cloquet-Moose Lake area in 1918. It caused the deaths of 438 people.

People tried to clear land and farm what was not very productive land until about 1930. By that time, only a few places of the original coniferous forest had escaped the ax or the flame. One of these areas became our first state park (Itasca) in 1891. The protection of this beautiful area of old-growth white and red (Norway) pine was a cooperative effort by state agencies, university professors, and the forest industries. This park, which includes the headwaters of the Mississippi River, is today one of the finest parks of its size in our nation. It is also a reminder to us of the original forest of northern Minnesota.

Minnesota's Forest Types Today

Today, aspen and birch forests cover more than one-third of the commercial forested area of Minnesota. The spruce-fir forest covers about 15 percent. Moving down in percentages are the lowland hardwoods, northern hardwoods, oaks, pines, cedars, and tamaracks. Minnesota now grows more wood than it is harvesting. Public agencies, Minnesota's forest industries, and small woodland owners have planted over 550 million trees, mostly conifers, to reforest areas where trees once grew.

Minnesota Forests Products Today

Minnesota's largest forest products industry is the pulp and paper industry followed by the structural board (oriented strandboard) industry. Over 70 percent of the wood harvested in the state is used for pulp, paper, and structural board.

Minnesota pulp and paper mills produce and sell products that bring over $1.2 billion into the state each year. Nine mills employ more than 5,000 men and women.

Each year we also harvest about 330 million board feet of lumber and logs; over 2.5 million Christmas trees and wreaths; 28,000 cords of matchwood and veneer logs; 50,000 posts and poles; and 1 million cords of fuelwood. These forest products (excluding pulpwood) are worth over $460 million. Other products include wild berries, nuts, fruits, maple syrup, cones, and birch bark.

About 61,000 people are employed by Minnesota's forest industries. Our forest products and their distribution are worth $8 billion each year. Forestry is Minnesota's third largest manufacturing industry.

The value of the forest goes far beyond its products. Think about its use in recreation, in protecting our soils and water, and in creating wildlife habitat. And there's no way to measure the great beauty and peace forests bring to our lives.

The Future of Minnesota's Forests

In years to come, we expect even greater use of our forests for products, recreation, and environmental protection. People will want more products from our trees. This will mean using tree parts previously thought of as unsalable, such as branches and leaves. Scientists in many research laboratories around the country are studying how we can best manage our rich forest resources. Environmental quality of our soil, water, and air must be protected.

The future of the forests of Minnesota is in the hands of our citizens. Minnesotans have an important role. We are guardians and stewards of a wonderful forest heritage!

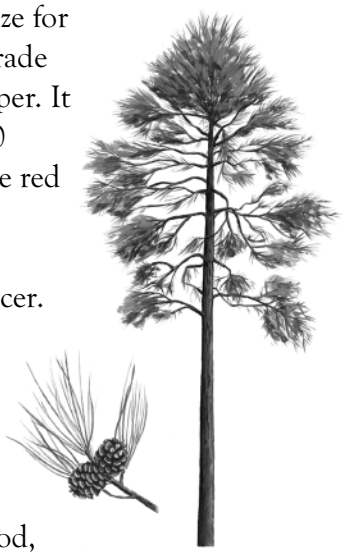
Special Minnesota Trees

Over 50 tree species are native to Minnesota (see Resources, page 109). Three of them are described below. Are any of them near your school, your home, or in your community?

Red (Norway) Pine

This beauty was named Minnesota's official state tree in 1953. The inner wood and bark are reddish. In the Lake States (Minnesota, Wisconsin, and Michigan), the tree is called Norway pine, but to others, it's the red pine. "Norway" may have been used by early English explorers who thought the red pine was the scotch pine of Norway.

The red pine is the most commonly planted tree species in Minnesota. In 30 years, a red pine is a marketable size for pulpwood to make high-grade printing and wrapping paper. It can also be grown 100-150 years for large sawlogs. The red pine is quite resistant to disease and fire, and is an outstanding timber producer. It's planted for erosion control, shelterbelts, windbreaks, Christmas trees, and wood for lumber, poles, cabin logs, railroad ties, pulpwood, and fuel.

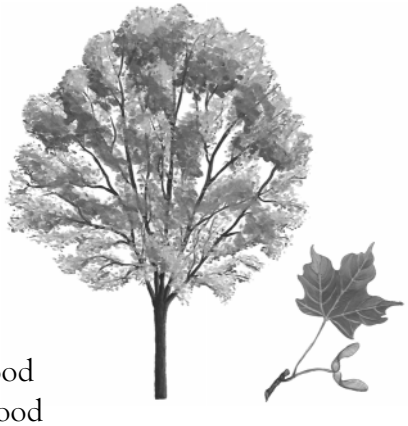


Tamarack

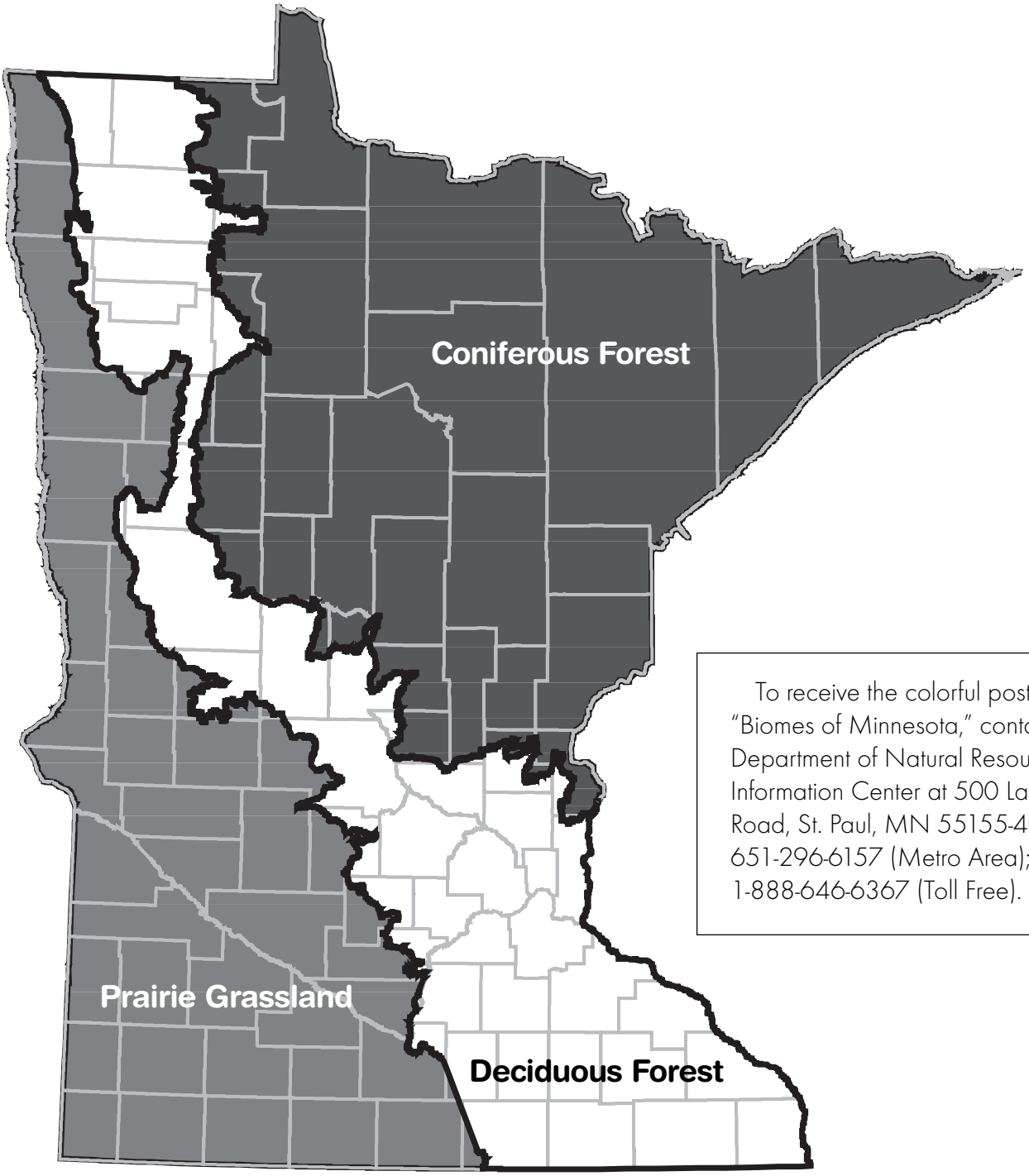
Tamaracks are also called eastern or American larch. They are Minnesota's only native conifer to have all its needles turn deep yellow and drop in autumn. The tamarack grows slowly and naturally on stagnant bogs like those of northern Minnesota. Change its soil and location, though, and it grows rapidly. Tamaracks may be 50-100 years old before reaching pulpwood size. Tamarack wood is durable and strong, but difficult to work with tools. It's used for posts, poles, ties, and pulp for making strong, tough papers and fiberboard.

Sugar Maple

This is the prized tree that produces the breath-taking crimsons and golds of autumn. One of Minnesota's finest trees, a sugar maple grows to heights of 80 feet or more. The trunk may reach a diameter of more than 3 feet. It grows slowly but isn't troubled by insects. It is called sugar maple because its sap has much sugar in the spring of the year. People bore a hole in the trunk, put a spout into the hole, and collect the sap in a bucket hung on the spout. The sap is boiled ... and boiled and boiled! Finally, it thickens and becomes syrup. It takes about 40 gallons of maple sap to make one gallon of syrup. Cook it even longer until all the water has boiled away, and it turns into maple sugar. If a maple tree is bored carefully, it may be tapped for many years. The wood from maples is a special forest treasure, too. It makes great firewood and beautiful hardwood flooring and furniture.



Minnesota's Biomes Map



To receive the colorful poster, "Biomes of Minnesota," contact the Department of Natural Resources' Information Center at 500 Lafayette Road, St. Paul, MN 55155-4040; 651-296-6157 (Metro Area); 1-888-646-6367 (Toll Free).

Minnesota's Native Trees

Many of the kinds of trees that grow in Minnesota today came from other places. As settlers arrived from other countries and states, they often brought with them precious seeds or cuttings from "back home." Eventually, many new species of trees took root and flourished in Minnesota.

But to 52 species of trees, Minnesota has always been home. These are our native trees, trees that grew naturally in the state. How many of them grow in your community? How many can you identify?

Conifers:

Cedar, eastern red (also called juniper) *Juniperus virginiana*
Cedar, northern white *Thuja occidentalis*
Fir, balsam *Abies balsamea*
Hemlock *Tsuga canadensis*
Pine, eastern white *Pinus strobus*
Pine, jack *Pinus banksiana*
Pine, red (also called Norway pine) *Pinus resinosa*
Spruce, black *Picea mariana*
Spruce, white *Picea glauca*
Tamarack (also called eastern or American larch) *Larix laricina*

Deciduous:

Ash, American mountain *Sorbus americana*
Ash, black *Fraxinus nigra*
Ash, green (also called red ash) *Fraxinus pennsylvanica*
Ash, northern mountain *Sorbus decora*
Ash, white *Fraxinus americana*
Aspen, bigtooth (also called largetooth aspen, poplar, popple) *Populus grandidentata*
Aspen, quaking (also called trembling aspen, poplar, popple) *Populus tremuloides*
Basswood, American *Tilia americana*
Birch, paper *Betula papyrifera*
Birch, river *Betula nigra*
Birch, yellow *Betula alleghaniensis*
Box Elder *Acer negundo*
Butternut *Juglans cinerea*
Cherry, black *Prunus serotina*
Cherry, pin *Prunus pensylvanica*
Coffeetree, Kentucky *Gymnocladus dioica*
Cottonwood, eastern *Populus deltoides*
Elm, American *Ulmus americana*
Elm, rock *Ulmus thomasii*
Elm, slippery (also called red elm) *Ulmus rubra*
Hackberry *Celtis occidentalis*
Hickory, bitternut *Carya cordiformis*
Hickory, shagbark *Carya ovata*
Honeylocust *Gleditsia triacanthos*
Hophornbeam, eastern (also called ironwood) *Ostrya virginiana*
Hornbeam, American (also called blue beech) *Carpinus caroliniana*
Maple, black *Acer nigrum*
Maple, mountain *Acer spicatum*
Maple, red *Acer rubrum*
Maple, silver *Acer saccharinum*
Maple, sugar *Acer saccharum*
Mulberry, red *Morus rubra*
Oak, black *Quercus velutina*
Oak, bur *Quercus macrocarpa*
Oak, chinkapin (also called yellow chestnut oak) *Quercus muehlenbergii*
Oak, northern pin (also called Jack oak, Hill oak) *Quercus ellipsoidalis*
Oak, northern red *Quercus rubra*
Oak, swamp white *Quercus bicolor*
Oak, white *Quercus alba*
Poplar, balsam (also called balm-of-gilead) *Populus balsamifera*
Walnut, black *Juglans nigra*
Willow *Salix species*
Many of Minnesota's native willows are shrublike; they do not reach tree-size. Distinguishing one willow from another is often difficult, even for a professional botanist.

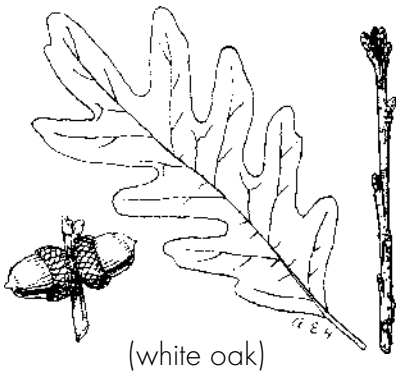
What determines why certain trees are "native" to an area? (Vegetation and landforms left after the glaciers plus the right climate, type of soil, moisture, access to sunlight, and other growing conditions for each species.)

To receive "Minnesota's Forest Treasures," a poster illustrating 35 of Minnesota's native trees, call the Department of Natural Resources' Information Center at 651-296-6157.

Name That Tree

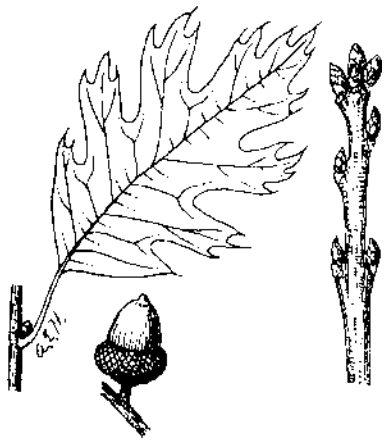
Deciduous (Broadleaf) Trees

Here's a leaf guide to some of Minnesota's common deciduous trees. How many of them can you find in your own community? It's a little harder to spot leaf differences in the spring, but as soon as the weather has been warm for several days, new leaves begin to emerge from their buds.



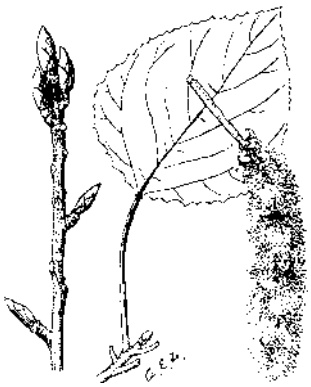
(white oak)

Oak: Distinct multi-lobed leaf shape. Turns many different colors in fall: brown, yellow, red, purple-red. White oaks have rounded leaf lobes. Red oaks have pointed lobes. Found mostly in central and southern Minnesota.



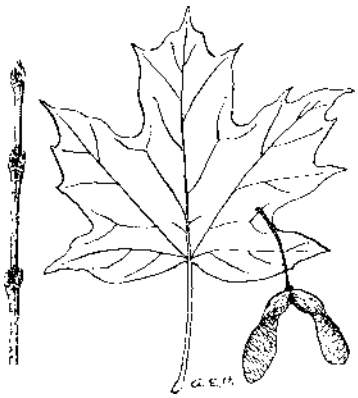
(red oak)

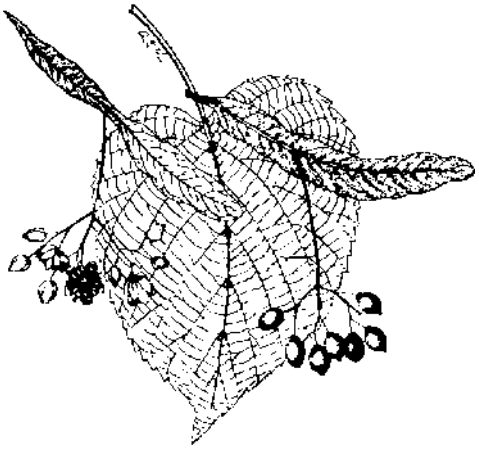
Paper Birch: The tree itself has white papery, peeling bark. Rounded leaf turns yellow and gold in fall. Has droopy flowering clusters called catkins in spring. Grows throughout Minnesota.



Quaking Aspen: Tree trunk is off-white or light grayish green. Heart-shaped leaf turns yellow in fall and "quakes" in the wind, so the tree is called "quaking" aspen. Wood mainly used in producing pulp for paper in Minnesota.

Sugar Maple: Three- to five-lobed, pointed leaves turn bright red, orange, yellow, gold in fall. Found in all of Minnesota, but most dense in central part of the state. A maple leaf is featured on the flag of Canada.





Basswood: Huge leaves turn gold and light brown in fall. Trees are known for fast growth and soft wood.

Coniferous (Needleleaf) Trees

Pines

Pines are cone-bearing evergreen trees with slender needles occurring in groups of two to five along the twigs. The needle groups are bound in bundles at the base. Only the white pine has five needles per bundle. All the remaining species have two or three needles per bundle.

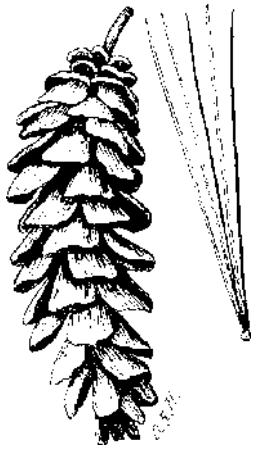
The pines are probably the most important timber trees in the world. Growing mostly on dry, sandy soils of little value, they yield not only lumber, but also turpentine, tar, pitch, and a medicinal oil. Seeds of many species rank high among the foods of nearly all game birds, rabbits, hares, squirrels, and chipmunks, and are also eaten by coyote and black bear.

Identifying some Minnesota pines:

Eastern white pine

Needles are 2" to 5" long; slender, soft, and flexible; bluish-green; occur in bundles of five.

Cones are 4" to 8" long; cylindrical with thin and often gummy scales.



Jack pine

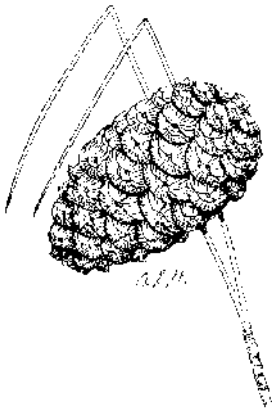
Needles are ¾" to 1½" long; ridged; sharply pointed; two in a bundle and slightly twisted.

Cones are 1¼" to 2" long; often strongly curved; brown when ripe.

Red (Norway) pine

Needles are 4" to 6" long; slender, straight, soft, and flexible; dark green; occur in bundles of two; break cleanly when bent.

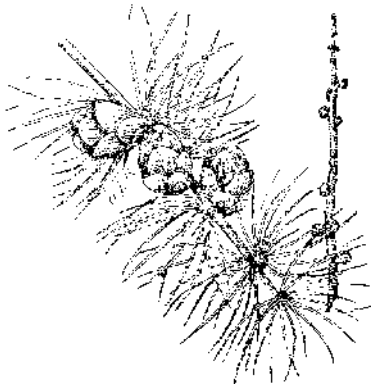
Cones are 2" long; light brown fading to gray; without spines or prickles and free from resin.



Tamaracks

The tamarack is Minnesota's only conifer that drops all or most of its leaves (needles) in autumn, leaving conspicuous warty "spurs" on the twigs. Needles are clustered at the ends of these spurs. The wood of the tamarack is very heavy, hard, strong, and durable. Its chief uses are for telephone poles, fence posts, railroad ties, and in ship building. The white-tailed deer seems to casually browse on it, and it is occasionally eaten by the varying hare. The seeds are eaten by a few species of birds and by the red squirrel.

Identifying the tamarack:



Tamarack (also called eastern or American larch)

Needles are ⅜" to 1" long; slender, and on short spurs; bluish-green; soft to touch; turn yellow in the fall.

Cones are ½" to ¾" long; oblong-ovoid in shape; stand erect on the twigs.

Spruces

Spruces are ornamental, sharply steeple-shaped evergreen trees of cold climates whose needlelike leaves are somewhat four-angled, short, stiff, and sharp. The needles grow individually from the twig, not in bundles, and are found all around the twig. When these needles are removed, the twigs and branchlets remain rough from the persistent needle bases.

Spruces often are used as Christmas trees, but their needles fall quickly upon drying out. The wood is soft, light, resinous, and straight-grained. It provides a principal source of pulp for paper and is valuable in construction work, interior finishing, and boat building. Some spruces are of great value in landscaping.

Identifying some Minnesota spruces:

Black spruce

Needles are ½" long; short, pointed, 4-sided; bluish-green; pleasantly aromatic in odor.

Cones are ½" to 1½" long; oval shaped; purple when young, dark brown when mature; scale edges ragged.

White spruce

Needles are ½" to ¾" long; 4-sided and crowded along branchlets; sharply pointed, having a slightly disagreeable odor when crushed; bluish-green when mature.

Cones are 1" to 2" long; scales thin and flexible when mature.

Firs

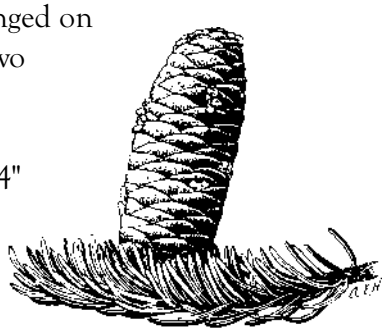
The balsam is the only "native" fir found in Minnesota. It has flat, individual needles arranged on the twigs in flat foliage sprays. It is a good Christmas tree that holds its needles. The balsam has soft, perishable wood that is often mixed with that of spruce to make paper pulp. Seeds are eaten by grouse; twigs are eaten by snowshoe hare, white-tailed deer, and moose; bark is gnawed by porcupine.

Identifying the balsam fir:

Balsam fir

Needles are ½" to 1" long; flat with rounded point; dark green and lustrous above and silvery white beneath; arranged on twig apparently in two ranks; resinous and fragrant.

Cones are 2" to 4" long; purplish to green; upright on branches.

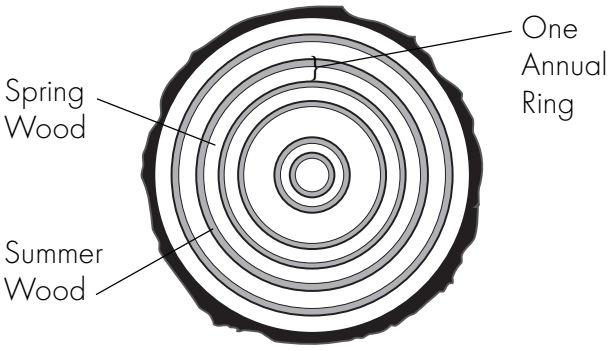


Nature's Timeline: Read the Rings!

How do trees keep growing wood every year? It's a fascinating story. Most trees in North America add new wood to their girth each year in a regular, predictable way. The new tissue is added right inside the bark by a thin layer of cells called the cambium. (See Resources, page 116.) With the warmth of spring, cambium cells begin to divide. The cambium cells on the outside become part of the tree's phloem, a band of inner bark through which the tree's food supply moves. The cambium cells on the inside become the xylem, a system of tiny tubelike cells that carry the tree's water supply. These xylem layers give us the annual rings.

As spring begins, new cells are added quickly, and the tree increases in diameter. In a cross section of a stump, this growth appears as a wide, light-colored band called earlywood or spring wood. But as the season moves on into summer and fall and the soil is less moist, the cells are added more slowly. The rings—called latewood or summer wood—are narrower and darker. Finally, the cold dry days of fall and winter temporarily halt growth altogether.

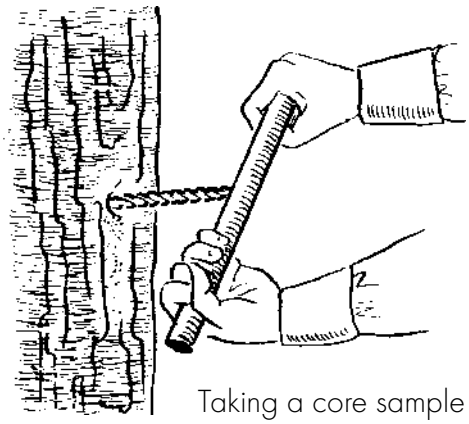
One light band and one dark band together make up a single year's growth and show as one annual ring. A new annual ring is added under the bark each year.



How Old Is This Tree?

School children everywhere are fascinated to find out the age of a tree through counting its rings. (Start at the outer (newest) ring just inside the bark and count in toward the center to know the age of the tree.) But scientists find many other fascinating bits of information tucked into the annual rings. Best known is the relationship between weather, growing conditions, and the width of the rings. Wide, light rings mean spring weather was good: warm days, lots of rain, good growing conditions. Narrower rings mean spring was probably cold or dry, and/or growing conditions were stressful. Perhaps the tree was crowded by others, shaded, or attacked by insect pests. Tree growth was limited.

The scientific study of annual growth rings even has its own name—dendrochronology. Stump study is part of this science, but core samples are often drawn from trees, too. The tree is not harmed, and the core sample, studied under a microscope, has fascinating tales to tell.



Taking a core sample

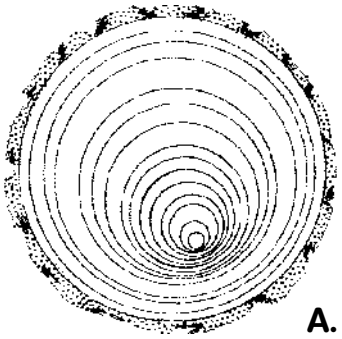
Information gleaned from tree rings helps foresters track growth rates and decide when to thin and harvest most economically. Long-covered scars are records of forest fires and other trauma. Narrow rings often coincide with historical records of insect or pest infestations. Global and environmental climate changes can also be seen. Dates of earthquakes and effects of volcanic eruptions can be read in the rings.

Tree rings are even an accurate way to figure the age of ancient buildings, boats, and other wooden things. It starts with studying the rings of a living tree, then matching those patterns with samples of older and yet older pieces of wood. The long-lived bristlecone pines of Nevada and California are an example. Some are nearly 5,000 years old themselves. By pattern matching, scientists have been able to create a historical timeline going back over 8,000 years!

Things That Affect Tree Growth.

Cross Section A:

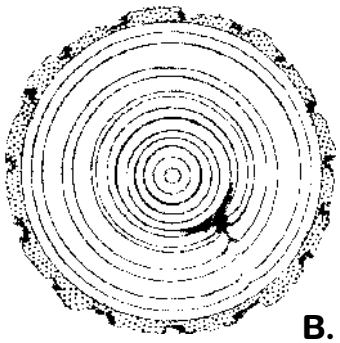
The uneven growth shown in the rings could have been caused by a fallen tree leaning against the tree (picture 1). The tree grew more on one side (wider rings) than the other, and curved up around the fallen tree. This uneven ring pattern could also belong to a tree growing on a steep slope (picture 2).



A.

Cross Section B:

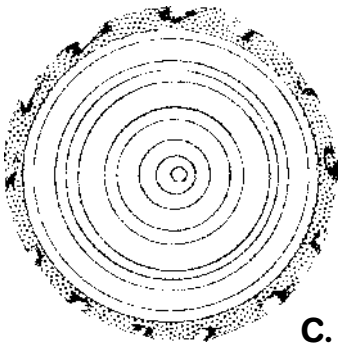
The scarring on this cross section was caused by a forest fire during the tree's sixth growing season (picture 3).



B.

Cross Section C:

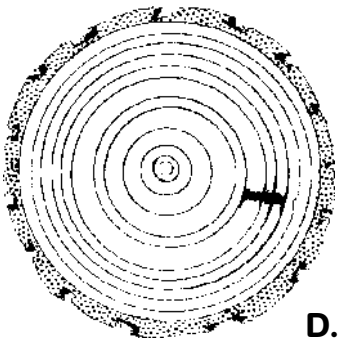
The narrow rings shown in this cross section could have been caused by several things such as drought (picture 4), heavy insect damage (picture 5), or damage from construction (picture 6). If a tree loses all or most of its leaves because of an insect attack or drought, it is not able to make food and grows very little that year. Root damage from the construction of a house or sidewalk too close to the tree reduces the water and minerals the roots can absorb.



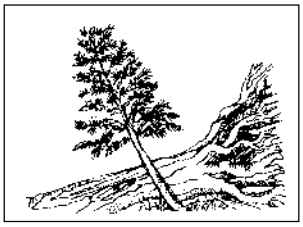
C.

Cross Section D:

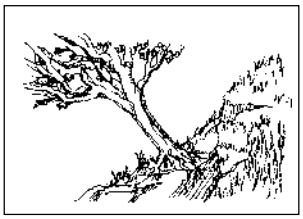
The mark beginning in year six is all that's left of a branch that died and fell off (picture 7). Eventually the tree's trunk grew around the remains of the branch and covered it. (The branch could also have been broken or cut off.)



D.

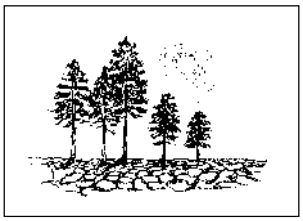


1. Fallen tree

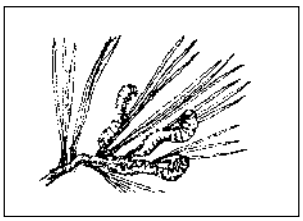


2. Growing on slope

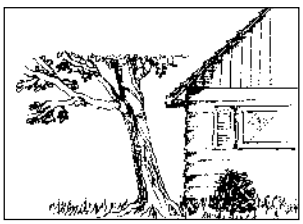
3. Fire



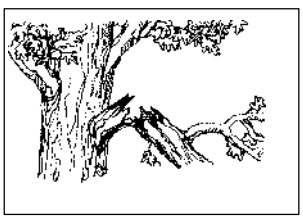
4. Drought



5. Insect attack



6. Construction



7. Dead branch

Parts of a Tree

Trees have three main parts—roots, trunks, and crowns (canopies). Each part has a special job to do in keeping the tree healthy and growing.

Roots

Explore roots and you'll discover a fascinating underground world. People who study trees are learning more each year about tree roots. They tell us the tree root system is probably the least understood part of a tree.

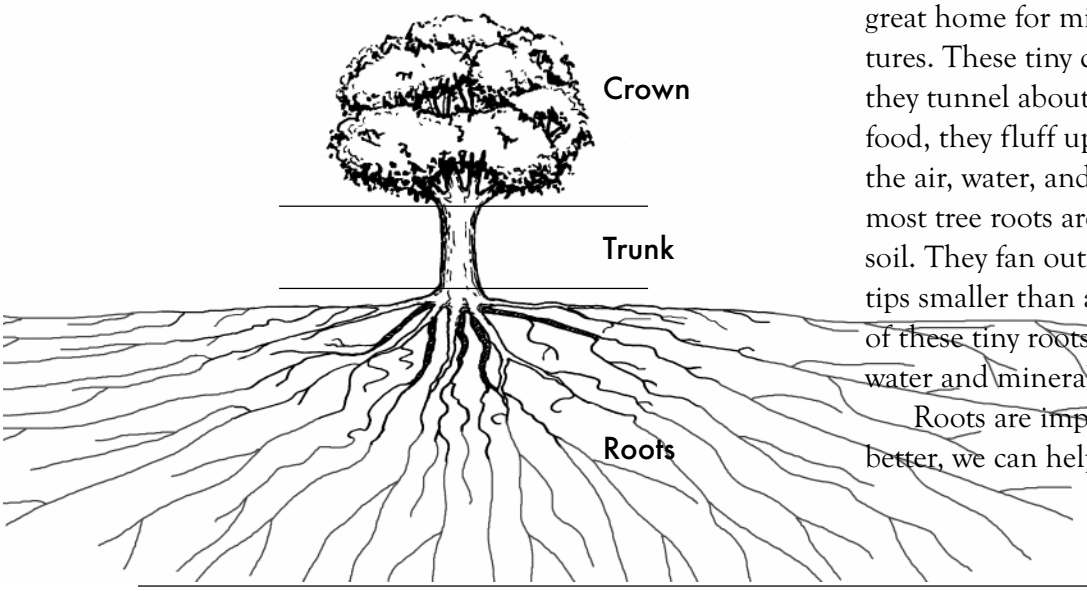
We've all seen sturdy trunks and leafy crowns of trees, and possibly tripped over the roots. But no human has ever seen a whole adult tree. Drawings in books are only part of the picture. To do it right, the page would have to be over 300 times larger than it is now!

What does a whole tree really look like? You'll have to use your imagination for what's underground, but here are some of the facts:

Almost all (about 99 percent) of the roots live and grow within three feet of the surface of the soil.

Roots don't just grow downward or toward any particular thing, but wherever they can get the moisture and minerals they need ... up, down, and sideways.

There's a connection between the root system and the rest of the tree. If part of the roots die, an equal amount of the crown may die, too.



Tree roots come in many different sizes. Some are so tiny you can only see them with a microscope. Others may be up to 12 inches or more across.

Large, woody roots grow horizontally (side to side), mainly in the top 12 inches of the soil and usually no deeper than 3 to 7 feet. They often stretch out from the trunk to take up a space four to seven times larger than the crown! These roots spread across an area that can be twice the height of the tree.

Why are roots important? To grow, all parts of the tree need to be healthy. Roots hold the tree in the ground so it can stand straight. They help the tree make food for itself. Roots absorb (soak up) water and minerals that move up through the trunk and are used by the tree to make food. They store energy (food), too.

Roots grow wherever they can get what they need: oxygen, water, minerals, and support. That means they won't grow where soil is too hard and pressed together, or where there is no oxygen. You may have seen roots of city trees follow cracks and crevices in pavements, pipelines, sewers, or cables. That's because there are air passages in these places that give oxygen and water to the trees. When roots are above ground where you can trip on them, it may be because the soil has washed away or become too packed to give them what they need underground.

The surface layers of soil, with rotting bits of leaves, are rich in organic elements. They make a great home for millions of insects and other creatures. These tiny creatures do much to help trees. As they tunnel about in the surface layers searching for food, they fluff up the soil and make pore spaces for the air, water, and minerals roots need. That's why most tree roots are found in the surface layers of the soil. They fan out in thousands of fine, short root tips smaller than a human hair. It's through the tips of these tiny roots that the tree absorbs most of its water and minerals.

Roots are important. By understanding roots better, we can help keep trees safe and healthy.

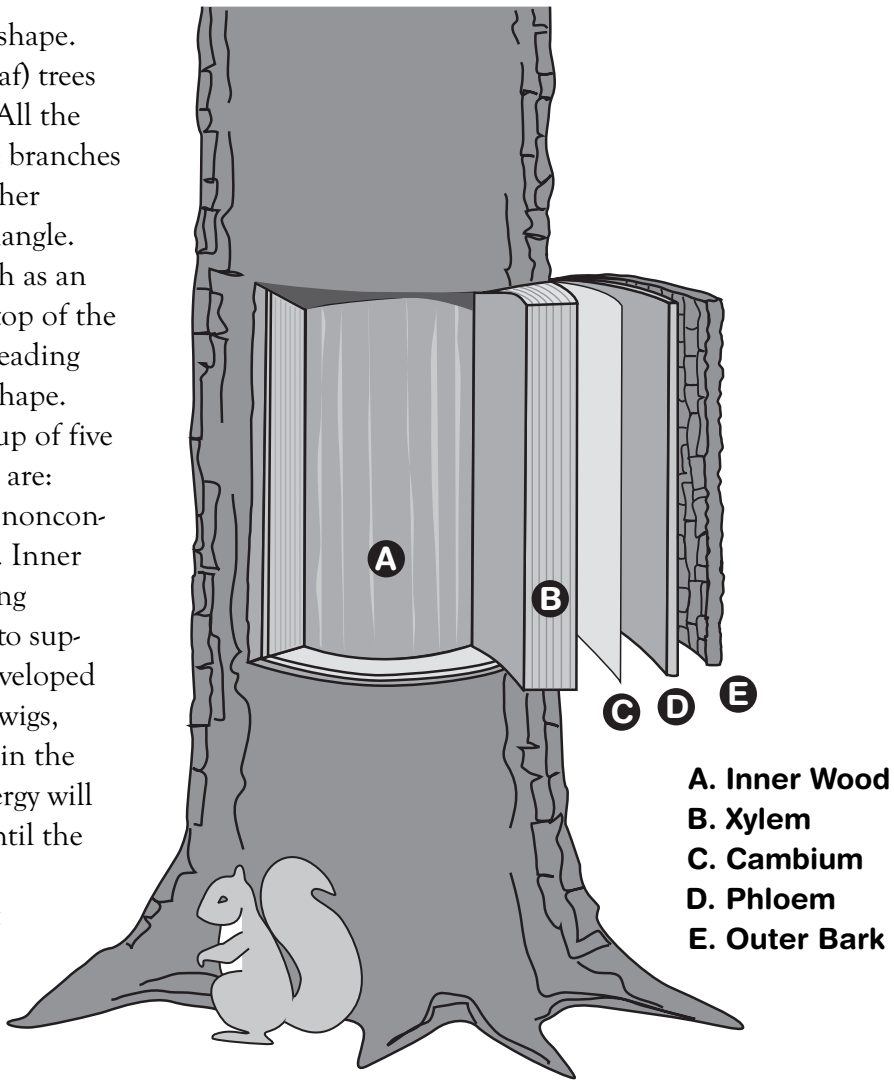
Trunks

Trunks and branches give a tree its shape. The trunks of most evergreen (needleleaf) trees grow straight up to the top of the tree. All the branches grow out from the trunk. The branches near the top are shorter than those farther down, giving the trees the shape of a triangle. The trunks of most broadleaf trees (such as an oak or maple tree) do not reach to the top of the tree. Instead, the trunk divides into spreading branches, giving the crown a rounded shape.

The trunks of most trees are made up of five layers. From inner to outer, these layers are:

A. Inner wood: This is the woody nonconducting tissues in the center of the tree. Inner wood has two main jobs: to store growing compounds and sugars (tree food) and to support the tree. After the tree has fully developed all its new parts for the season (leaves, twigs, seeds/fruits, etc.), the sugars are stored in the cells of the inner wood. This stored energy will help power next year's spring growth until the tree again fully develops its leaves.

B. Xylem: This is a band of cells at the outermost edge of the inner wood. It has tiny pipelines that carry water and small amounts of dissolved minerals from the roots to the leaves.



C. Cambium: This is a thin layer of growing tissue on the outside of the xylem. Its job is to make the trunk, branches, and roots grow thicker. The trunks and branches of most trees grow thicker as long as the tree lives. The cambium layer uses the sugar manufactured by the leaves to make new plant tissue. On its outside, the cambium makes new phloem. On its inside, it makes new xylem, which eventually becomes wood.

D. Phloem: This layer also has tiny pipelines. The food made by the leaves moves through the phloem to the other parts of the tree. This food is called sap.

E. Outer bark: This is the "skin" of hard, dead tissue that protects the living inner parts of the tree from injury. The outer bark stretches to let the trunk and branches grow thicker. The bark of a few kinds of trees, such as beeches and birches, is smooth because it stretches easily. But the bark of most other trees does not stretch well. As the trunk and branches grow thicker, they push against the bark. It finally cracks, dries, and becomes rough with large ridges. Most trees lose old bark from time to time and replace it with a new layer.

Remember: Bark needs our protection! A tree's outside bark protects it from insects, fungus, and disease. The phloem, which is on the inside of the outer bark and is often called inner bark, moves food from the leaves to the roots. Peeling, carving, or damaging a tree's bark may cause the tree to die.

Crown (Canopy)

The crown is the branches and leaves of the tree. It has the important job of making food for the tree.

Sunlight comes into a leaf through the leaf's skin, which is clear like glass. Beneath the skin are millions of tiny "bags" called cells. These cells are like little balloons filled with water and living jelly. Inside the cells are small green packages called chloroplasts. The chloroplasts are filled with green chlorophyll. The chlorophyll catches some of the sunlight that falls on a leaf.

While the chloroplasts are catching sunlight, other things are happening in the leaf. Air comes into the leaf through many tiny openings called stomata. Water, moving up from the roots far below through the xylem, flows through the leaf. The air and water mix together and flow into the cells.

These cells are like little factories. Here, the green chlorophyll works away. Using sunlight as a source for energy, it changes water and a gas from the air (called carbon dioxide) into a form of sugar. This process is called photosynthesis. The sugar made by the leaves is food or energy for the growing parts of the tree and for storage. During photosynthesis, the leaves also produce oxygen that is released into the atmosphere.

Some trees lose their leaves before winter; others do not. Why does this happen? As leaves make the food for the trees, they use water. A tree gets water from the ground. The roots take it in, then the water travels up the trunk to the leaves. In late summer, a thin layer of cork grows over the leaf-twig connecting spot. Water can no longer pass into the leaf. The days get shorter, with less sunlight energy for the chlorophyll. All spring and summer, chlorophyll has made the leaves look green, covering up the other color pigments like orange, red, and yellow. But as the leaves die in fall, chlorophyll disappears, the green is gone, and the other colors appear.

Another kind of tree, the needleaf (coniferous) tree, does things a bit differently. Its leaves are called needles and they fall off, but not all at once like the broadleaf (deciduous) trees. Needles fall off slowly over a two- to three-year period and are always replaced by new needles—just like the hair on your head!

Coniferous needles are tough and don't freeze in winter, so they don't lose water as quickly as other kinds of leaves do. By holding onto the water that's in them, they stay alive and green even in winter.

Flowers and Fruits

Other important parts of a tree include the flowers and fruits. Flowers and fruits are the ways in which most trees reproduce. The fruit is where seeds are found that will grow into new trees. Trees have many kinds of flowers. Some trees have very showy flowers. Others, such as coniferous trees, have small, plain flowers that are hardly noticeable.

The fruits of some deciduous trees (apples and cherries for example) have a tasty outer covering. The fruits of other deciduous trees like acorns and beechnuts are hard nuts. Ashes, elms, and maples have thin, winged fruits. Most coniferous trees bear their seeds in cones.

Planting a Tree

Plan Ahead

Scope out a site. Check with your parents if it's in your yard. If you are unable to plant in your yard, contact your city offices to see about planting on the boulevard or at a local park. Other possibilities might be your church, school, or parents' workplace. In any case, be sure to get approval from the person in charge. If there's any doubt about utilities, call the Gopher State utility hotline and get help from an expert to locate buried electric, gas, or other utility lines.

Call: TWIN CITIES, 651-454-0002
Greater Minnesota, 1-800-252-1166

Try to select a tree that will grow well on the site you've selected. Consider the soil type and moisture content. Is your site sandy and well drained? Or is it heavy clay, and so perhaps wet and possibly compacted? Remember, too, that there are a number of different growing regions in Minnesota. Some tree species do better in one region than another. Before choosing a tree, find out which kinds do well in your part of the state. Also make sure your site will "fit" your tree when it reaches its adult height and width. For help, check with your local nursery or garden center, city forester or tree inspector, Department of Natural Resources forester, county extension agent, or Soil and Water Conservation District specialist.

Where Can You Get Trees?

Your local nursery or garden center will have both large and small trees. Make sure the trees are Minnesota grown so you know they are acclimated to Minnesota's harsh winter weather.

Low-cost seedlings are available from the Minnesota Forestry Association. Seedlings are grown in a soil plug and are individually packaged in recyclable polybags to assure survival during transport. You can choose among several different tree species. For ordering information write or call:

Minnesota Forestry Association
P.O. Box 496
Grand Rapids, Minnesota 55744
218-326-3000 Toll Free, 1-800-821-8733

Tree planting programs may help you, too. The Soil and Water Conservation districts across Minnesota have local programs to help plant trees for soil and wind erosion control or reforestation. Seedlings are available at a low cost through this program. For more information, look for "Soil and Water Conservation District" under your county offices in the blue section of the white pages telephone book.

The Minnesota Department of Natural Resources (DNR) sells seedlings in large quantities. For more information, contact the DNR Information Center at 651-296-6157 (Metro Area) or 1-888-646-6367 (Toll Free).

Planting Your Trees

The root systems of both seedlings and saplings must be protected before the trees are planted. If the seedlings are bareroot, they must be kept moist at all times, and not exposed to wind and warm temperatures for more than three to five minutes before they are planted. Any drying damages the roots.

The roots of some saplings are already protected in containers or large clumps of dirt that are surrounded by burlap. Some saplings are purchased bareroot, however. All young trees, especially the bareroot trees, must be protected from extreme hot and cold.

It's important to plant your trees properly. Resources, page 119 shows proper planting techniques.

Trees are living things that need your care and protection. They need to be mulched and watered regularly after planting, too.

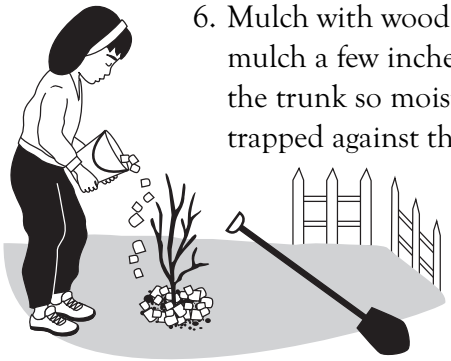
Planting a Tree

KID'S COPY

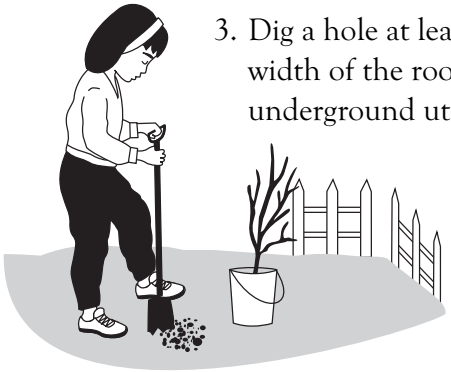
1. Choose a good spot for your tree. Don't forget to plan for its ADULT size.

5. Add more soil and lightly firm with foot.

2. Keep your roots moist all the time. Dry roots die.



6. Mulch with wood chips. Keep mulch a few inches away from the trunk so moisture isn't trapped against the trunk.

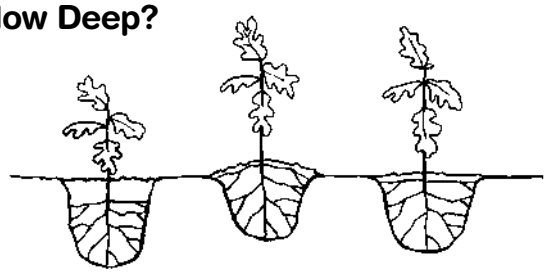


3. Dig a hole at least two times the width of the roots. Check for underground utility lines first!

7. Water regularly. Wait for shade!

4. Plant the tree at the right depth. (See "How Deep?") Gently add loose soil.

How Deep?



Too deep. Too shallow. Just right.

What care besides watering will your tree need in the months and years to come? (Protection from damage by people, animals, machines like lawn mowers, wind, disease, smothering by grass and ground cover, etc.) How will the tree get this protection?

Tree Enemies

Just like people and animals, trees can get diseases ... and it can be serious.

A fungus is a tiny organism that may be deadly to certain trees. Two diseases caused by a fungus that have had huge effects on the trees in Minnesota are Dutch elm disease and oak wilt.

Dutch Elm Disease

Dutch elm disease is caused by a fungus. It spreads from tree to tree in two ways: above ground and below ground. Above ground, elm bark beetles carry the fungus spores attached to their bodies and pass them into healthy trees when they feed on the branches. Below ground, the disease can be spread by root grafts (roots naturally growing together) when the roots of an infected tree happen to be grafted to the roots of a healthy tree.

Once in the tree, the Dutch elm disease fungus invades the water-conducting vessels of the elm. In an attempt to stop the invader, the tree forms blockages. Together with the fungus, these blockages plug the water-conducting vessels (xylem) of the tree and stop water movement within the tree. This causes the tree to wilt and die.

What are the signs of the disease?

The first sign of Dutch elm disease in a tree is wilting in one or more of the upper branches. Leaves on the branches turn dull green to yellow and curl, then become dry, brittle, and turn brown. Peeling bark from wilted branches of diseased trees shows light to dark brown streaks in the light-colored wood beneath the bark. In a cross section of the branch, you'll see a broken brown ring in the outermost wood of the wilting, dead, or dying branches, and sometimes small round patches of discoloration in the outer growth ring.

Some trees die several weeks after becoming infected, while others wilt slowly and survive for a year or longer.

How can we prevent the disease from spreading?

The best way to manage Dutch elm disease is to prevent it. The ways to prevent Dutch elm disease are described as "sanitation." This includes catching signs of the disease early, and getting rid of all weakened, dying, or dead elm trees. Stripping the bark from elm wood takes away elm bark beetle breeding places and sources of the fungus. The steps in a sanitation program include:

1. **Catch the disease early.** Foresters carefully inspect elm trees in any area where the disease has been found. This inspection turns up trees showing signs of disease.
2. **Separate the tree from others.** Foresters disrupt root grafts between infected and healthy trees. Once a tree is known to be diseased, root graft barriers are set up so the diseased tree's roots cannot spread the disease to healthy trees through root grafts. This root graft disruption can be done by trenching around infected trees.
3. **Destroy beetle-breeding sites.** Dead and dying elm wood, including standing trees and stacks of firewood logs, are breeding places for elm bark beetles. Beetles lay eggs under the bark of elm trees; the eggs hatch and produce another generation of beetles. Left to stand, an infected tree can harbor hundreds of thousands of beetles. If this tree is also infected with the fungus, each beetle carrying the fungal spores can then carry the disease to a healthy tree and introduce the spores into that tree as it feeds or establishes breeding sites. This is why removal of diseased trees is so important.

   Remove and dispose of all diseased elms and all elms killed or seriously weakened regardless of the cause. Elm wood may be chipped so none remains with sufficient bark to serve as beetle-breeding sites. If chipping is not possible, diseased elm wood should be burned (where permitted) or buried in a landfill.

   If elm wood is to be used for firewood, the woodpile should be covered and sealed with heavy plastic from April through October to destroy beetles within the wood. To prevent tears in the plastic, place old tires or burlap sacks between the wood and plastic. Seal edges of the plastic under a layer of soil. Sealing firewood under plastic is usually necessary only

the first year because the bark loosens and the wood becomes unsuitable as a breeding site.

Oak Wilt Disease

Oak wilt is a disease found from Minnesota east to Pennsylvania, south to South Carolina and Tennessee, west to northern Arkansas and southern Texas. In Minnesota it is most serious in the southeast to the east-central part of the state. It is found south of a line from St. Cloud to Taylors Falls all the way to the Iowa border, and east of a line from St. Cloud to Mankato.

How is the disease spread?

Oak wilt disease is similar to Dutch elm disease in several ways. First, oak wilt is also caused by a fungus that invades the tree's outer sapwood (outer xylem), and second, it causes the tree to wilt and die. Once in the tree, the oak wilt disease fungus invades the water-conducting vessels of the tree. In an attempt to stop the invader, the tree forms blockages. Together with the fungus, these blockages plug the water-conducting vessels (xylem) of the tree and stop water movement within the tree. This causes the tree to wilt and die.

As with Dutch elm disease, the fungus that causes oak wilt is carried from tree to tree in two ways. Below ground, it is spread through grafted roots when the roots of a diseased tree grow together with the roots of a healthy tree. Above ground, the fungus can be spread by sap-feeding beetles. After a tree is killed, the oak wilt fungus creates fruiting or spore-bearing material with a sweet odor that attracts the beetles. As the beetles crawl on the material, spores of the fungus stick to them. They then fly to other oaks that have been wounded and have exposed wood, and infect the healthy trees.

What are the signs of the disease?

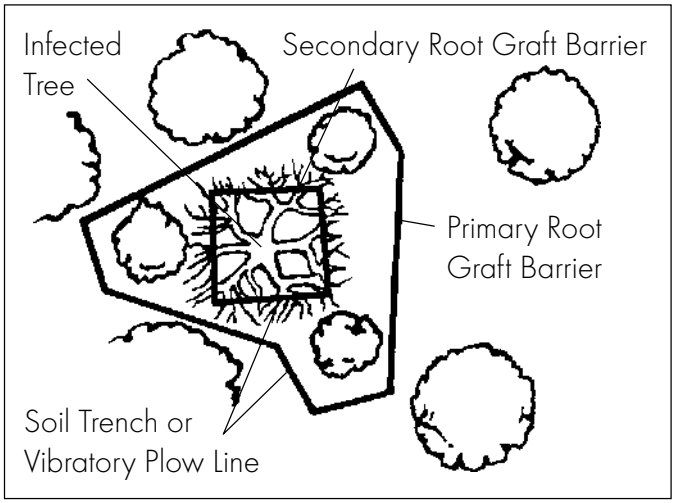
As with Dutch elm disease, the first sign of oak wilt disease in a tree is wilting. It usually starts near the top of the tree and then quickly involves the entire crown. You'll also see brown to black streaks in the outer wood of the diseased tree.

Another sign of oak wilt is changes in leaf color. The leaves of red oaks turn dull green, bronze, or tan beginning at the outer edges of the leaf.

How can we prevent the disease from spreading?

Some of the steps to prevent oak wilt disease from spreading are similar to those of Dutch elm disease. First, the disease must be found, and diseased trees isolated from healthy trees by separating the root grafts. As with Dutch elm disease, root graft separation is done by mechanically trenching around infected trees. Second, it is important to promptly remove all infected trees that still have bark attached, before the oak wilt fungus produces spore mats under the bark. If oak wood is debarked to hasten drying and to prevent spore formation, it can also be used for firewood. If the wood is not debarked, the woodpile should be covered with heavy plastic from April through October. To prevent tears in the plastic, place old tires or burlap sacks between the wood and plastic. Seal edges of the plastic under a layer of soil. Sealing firewood under plastic is usually necessary only the first year because the bark loosens and the wood becomes unsuitable as a breeding site.

Another way to prevent oak wilt from spreading is to protect oak trees from being wounded, especially during April, May, and June each year. Trees should not be pruned during this time and working around trees should be avoided if at all possible. If wounding does occur during April, May, or June due to storm damage or other causes, a wound dressing should be applied to prevent sap flow.



Trees: They're Important!

Why Do We Need Trees? Think About It!

- Trees help supply oxygen we need to breathe. Yearly, each acre of young trees can produce enough oxygen to keep 18 people alive...
- Trees help keep our air supply fresh by using up carbon dioxide that we exhale and that factories and engines emit...
- Trees use their hairy leaf surfaces to trap and filter out ash, dust, and pollen particles carried in the air...
- Trees cut down the amount of gaseous pollutants in the air as they release oxygen...
- Trees lower air temperatures by giving us shade that saves on air-conditioning costs...
- Trees increase humidity in dry climates by releasing moisture as a byproduct of food making and evaporation...
- Trees give us a constant supply of products—lumber for building, cellulose for paper and fiber, nuts, mulches, oils, gums, syrups, and fruits...
- Trees slow down forceful winds. Shelterbelts in fields protect soil, windbreaks around farm buildings protect people and animals, and living snow fences near highways help keep snow off roads...
- Trees cut noise pollution by acting as sound barriers. Each 100-foot width of trees can absorb about six to eight decibels of sound. Along busy highways, which can generate as much as 72 decibels, less noise is a relief for people living nearby...
- Trees provide food and shelter for birds and wildlife and for us...
- Trees shade us from direct sunlight. They are welcome in parking lots on hot sunny days...
- Trees camouflage ugly scenery, unsightly city dumps, auto graveyards, and mine sites...
- Tree leaves break the flow of pelting raindrops on the soil surface and give the soil a chance to soak up as much water as possible...
- Tree leaves, when fallen, cover the ground to keep the soil from drying out...
- Tree leaves, by decaying, fertilize the soil. They replace minerals and enrich the soil to grow better plants...
- Tree roots hold the soil and keep silt from washing into streams...
- Tree roots help air get beneath the soil surface...
- Trees soothe us with pleasing shapes and patterns, fragrant blossoms, and seasonal splashes of color...
- Trees break the monotony of endless sidewalks and miles of highways...
- Trees beautify our gardens and decorate our back yards...
- Trees soften the outline of the masonry, metal, and glass cityscape...
- Trees increase the value of property...
- And trees provide for America's economic growth and stability.

—Excerpted from a U.S. Forest Service booklet prepared by the Northeastern Forest Experiment Station, Upper Darby, Pennsylvania.

Trees Through the Seasons

Teacher Guide

Most of the activities in this guide are geared toward spring. They're things you can do in connection with your Arbor Day or Arbor Month celebrations.

Yet trees offer fascinating learning opportunities all year long. Don't miss out on the other seasons! The following pages take you "through the year" with trees. Another year, you may want to make trees a whole-year learning adventure. A great ongoing activity is to have students "adopt" trees that they can identify and observe through all the seasons. Each student creates a scrapbook about his or her tree and how it changes through the seasons.

If individual student scrapbooks don't fit your school program, scan and choose other activities as each season arrives. Some activities are interchangeable from season to season. Your students will develop new interests in trees along with better scientific observation skills. You'll probably discover a lot of new things about these intriguing giant plants yourself!

Trees Throughout the School Year

1. Starting in the fall, encourage each student to choose a special tree and to make a scrapbook called "My Adopted Tree." The scrapbook should have a strong cover so it will last all year. Each time a new drawing or project is completed, it goes into the scrapbook. Display the books for all to enjoy during Arbor Month. Students bring them home at the end of the year.
2. Once each season, ask: How has your tree changed? Each student draws a detailed picture of his or her tree, including all changes and at least six objects found in its environment (flowers, birds, animals, rocks, snow, seeds, grass, etc.).
3. Ask: What animals or insects can be seen near or on your tree during each season? Look in crevices of the bark, on the leaves, along the bottom of the trunk, and on branches and twigs. Make a picture list of the things you see each season.
4. On nature walks, challenge students:
   - Close your eyes. What sounds do you hear around your tree? What do you smell around your tree? What do you feel on and around your tree? Open your eyes. What do you see around your tree?
   - Choose a dead or nearly dead tree to compare with yours. How are they the same? How are they different?
   - Take seasonal photographs of three or four different kinds of trees. Put them in school-year order and compare them at the end of the school year. Make a bulletin board display of your photographs.

Autumn Questions and Activities:

1. What words would you use to describe your tree at this time of year?
2. Take a leaf from your tree back to the classroom. Examine it with a magnifying glass. What do you see? Iron it between two pieces of waxed paper and place it in your scrapbook.
3. Are there holes in some of the leaves on your tree? Why? Has something been eating them? What?
4. What is inside leaves to make them green? (Chlorophyll.)
5. Why do leaves change color in fall? (The chlorophyll disappears from the leaf as the days become shorter. The yellow, orange, red, and brown pigments that are also in the leaf now show through.)
6. Why do leaves fall off the trees in autumn? (When the leaves are not producing food, a cork layer grows over their leaf-twig connecting spot. The leaves no longer get water. They dry up and lose their hold on the branches. The wind blows them off.)

7. How much time has passed between the first color changes in the leaves of your tree and the time the tree is left bare?
8. Will a green leaf change color if it is put in a cold place? Put a green leaf in a plastic bag and put it in a refrigerator. Watch the color changes for a few days.
9. What will happen to a green leaf when we boil it? Boil a green leaf for five to 10 minutes. (Use hot burners only with adult supervision.) The water goes through a series of color changes. Collect several tablespoons of water as boiling proceeds. Include a sample of clear water. Keep the samples in order. Compare and discuss the changes. Remove the leaf from the water. What happens to the color?
10. How do the seeds from your tree differ from the seeds on other trees? How are they alike?
11. What is inside a seed from your tree? Cut it in half and look at it with a magnifying glass.
12. How do seeds from trees travel?
13. How did your tree probably begin growing?
14. What protects the buds during fall and winter?
15. Does your tree have any injuries? Who or what might have made them? (If there is a well-formed scar or if the injury is painted black, the wound is probably the result of planned pruning.)
16. Can you find holes that might have been made by woodpeckers?
17. Are there any cocoons on your tree?
18. What happens to a tree when it dies? (It rots or decays and becomes part of the soil again. This is good since it adds food to the soil.)
19. Is there "pollution" around your tree? Which litter is nature-made and which is human-made? (Dispose of all human-made litter.)
20. What geometric shapes do you see on or near your tree?

Winter Questions and Activities:

1. What words would you use to describe your tree at this time of year?
2. When does a tree stop growing? (Trees "sleep" or "rest" during the winter but never stop growing until they die.)
3. What are your tree's food or water needs during the winter? (Compare this to the hibernation of bears.)
4. Are the needles of pine trees leaves? (Yes.)
5. Do evergreens ever lose their needles? (Yes. When new ones grow, the old ones fall off, but never all at once.)
6. How do evergreen needles stay alive in the winter? Look at some through a magnifying glass. (A covering of thick wax keeps them from losing water. They do not dry out and die in the winter.)
7. Will evergreen branches change color if they are brought inside? Clip a small branch from a spruce or pine tree and bring it to school. Put the branch in a sugar-water solution such as is used for Christmas trees. Watch the changes for several days.
8. Why is the bark of most trees rough and cracked? (The bark is not elastic enough to stretch as the tree grows.)
9. Why do trees have bark? (To protect the insides, like our skin.)
10. Make bark rubbings. Place a piece of paper over the bark and rub the side of a crayon firmly against the paper. Compare your rubbing with other rubbings. Place it in your scrapbook.
11. Measure around the trunk of your tree with a string or a tape measure. Compare your tree with others.
12. How can you tell the age of a tree? (Find a stump or a log and count the age rings in it.)
13. How old is your tree? Borrow an increment borer from a forester to take small cores from the trees. Count the rings.
14. How thick is the bark of your tree?

15. Will some wood from your tree float? Which of your group's trees are made of the heaviest wood? Which of your trees are made of the lightest wood? (Use the core taken with the borer or a small twig from each tree as "floating" samples.)
16. Do the branches show signs of where the leaves used to be? (Look for "leaf scars" with a magnifying glass.)
17. Are there tracks in the snow around your tree? What made them?

Spring Questions and Activities:

1. If they haven't already done so, invite each child to "adopt" a tree to observe and learn about all year long.
2. What evidence do you see of your tree "waking up"?
3. Cut a twig from your tree in the early spring. Bring it to the classroom and put it in water. Watch the bud scales open and the leaves unfold. Keep a record of when the twigs were put in the water, when the leaves appeared, and when the bud scales dropped off.
4. What makes the buds begin to grow? (Day length is increasing, making more "sun time" available. Warming temperatures allow water movement within the tree.)
5. Take a bud from your tree back to class. Examine it with a magnifying glass. Iron it between two pieces of waxed paper and put it in your scrapbook.
6. What part of the tree makes food? (Leaves make food for the trees. They use air, water, and sunlight to make food. This process is called *photosynthesis.)*
7. When do leaves make food? (During the day. Photosynthesis takes place only in the light.)
8. Why are leaves arranged on the branches the way they are? (So they don't overlap and block sunlight to the ones below.)
9. How does water get to the leaves? (It travels through tubelike cells in the roots, trunk, and branches of the tree.)
10. Where are the roots of your tree?
11. Do some of the roots show above ground?
12. Why do the roots of the trees spread so far in the ground? (To form a strong base and to drink up minerals and moisture from the earth.)
13. Tie a plastic bag around the leaves of a small branch. Look at the branch after a few days. What do you see? (Drops of moisture should appear on the bag. Moisture is released from cells in the leaf. It moderates the air temperature and relative humidity surrounding the leaf. This is called *transpiration.)* Put another plastic bag around a dead twig and compare the two bags. (Remember to remove the bags when done.)
14. Is the whole tree growing? (Trees grow in length only near their tips, but they grow in diameter at their roots, trunk, and branches.)
15. Taste the sap from a maple tree. Is it sweet? (Trees make sugar. We use the sugar sap from maple trees to make syrup.)
16. What movements does your tree make?
17. Look for a "food chain" near your tree. (Birds eat spiders, spiders eat other insects, and insects eat leaves, etc.)
18. Take a picture of each student's tree. Mix up the pictures. Can each student find the picture of his or her own tree?
19. Make a picture list of all the things you think trees are good for. Some possibilities:
    Trees give us:
    - moisture in the air
    - beauty
    - shade
    - flowers, fruit, and nuts
    - saps and oils
    - wood pulp for making paper, plastic, and rayon
    - wood for building
    - a place to climb
    - places for birds' nests
    - food and homes for animals and insects
    - better soil

(See Resources, page 122 for more ideas.)

Summer Questions and Activities:

1. If they haven't already done so, ask each child to "adopt" a tree to observe and learn about all year.
2. How is your tree like the others? How is it different?
3. Is your tree dead or alive?
4. Are there any nests in your tree? Why is it a good place for a nest? (The branches hold the nest in place. The nest is hidden and out of reach of many enemies.)
5. Are there many plants growing under your tree?
6. Are there more leaves on one side of the tree than on the other? Why? (The tree may get more sun on one side.)
7. Do you see buds near the leaves of your tree? When are buds for the next season's leaves made? (At the same time as leaves and new shoots, during elongation in spring.) When will these buds grow into leaves?
8. Take two leaves from your tree back to class. Examine them with a magnifying glass. Try to match your leaves to the leaf pictures in a tree identification book. What kind of tree is your tree?
9. Iron one leaf from your tree between two pieces of waxed paper and place it in your "My Adopted Tree" scrapbook.
10. Make a leaf print with the other leaf from your tree. Place the leaf on newspaper. Brush the leaf with ink or paint. Move the leaf to a clean newspaper. Place a porous paper over the leaf and rub gently to transfer the ink or paint from plant to paper. Let the paint dry, and place the print in the scrapbook.
11. Gather a small piece of bark, a twig, a seed from your tree, and a small plastic bag of soil from under your tree (use a large spoon or trowel). Mount all these on a piece of heavy paper and place them in your scrapbook.
12. Take two temperature readings, one under your tree and the other away from its shade. How much do they differ? (Note: When taking a temperature in the sun, shade the bulb of the thermometer.)
13. Does there seem to be a breeze under your tree when there isn't any away from its shade? Why? (The cool air under the tree is heavy and pushes the warm air away as it sinks to the ground.)

Evaluation (If a Year-Long Project)

Your evaluation of each student's skills and conceptual developments should be guided by the contents of "My Adopted Tree" scrapbooks, responses to questions, and participation in discussions. The questions listed here are designed to help you make good subjective evaluations. You'll need to adapt the questions to meet your students' age level.

a. How well did the student follow directions?
b. How much direction did the student require?
c. Did the student formulate new questions?
d. Did the student design new experiments to answer these questions?
e. Did the student recognize cause and effect relationships?
f. Could the student state the problem to be solved?
g. Did the student arrive at conclusions by himself or herself?
h. How many characteristics of his or her tree did the student identify?
i. Could the student describe enjoyable and useful ways of using trees?
j. Did the student compare and contrast the characteristics of his or her tree with those of other trees?
k. Could the student predict the outcome of his or her investigations?
l. Could the student predict changes in his or her tree?
m. How well did the student use his or her five senses?

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Tree Holidays
(For Arbor Day Ceremonies or Anytime)

People throughout the United States and the world have set aside special days and times of the year to celebrate their appreciation of trees. Here are just a few of those holidays. Challenge your group to research and discover others. *Chase's Calendar of Annual Events* and other books that list holidays are available at the Reference Desk of many libraries and media centers. They offer a good place to start the search. Surfing the Internet may also yield more events.

The holidays listed below without specific dates are those that occur on moveable days. Check library reference materials for their specific dates in any given year.

January-February
Tu B'shivat—the New Year of the Trees. Arbor Day of the Jewish people observed on the 15th day of Shivat on the Jewish calendar. (Also spelled B'Shevat.)

February
Baika-Sai—Plum Blossom Festival in Japan. Time for appreciating flowering trees.

March 14
Johnny Appleseed Day.

March 24
Maple Syrup Festival in Vermont.

March-April
Cherry Blossom Festival in Japan.

April
Kalpa Vruksha—Spring festival and tree planting time in India. Children often celebrate and receive gifts as they are seated around a tree getting its new leaves for the year.

April 21
John Muir's Birthday (1838). This naturalist and writer did much to preserve trees and wilderness areas.

April 22
International Earth Day, first observed in 1970.

Last Friday in April
U.S. National Arbor Day. Twenty-two states including Minnesota also celebrate on this day.

April-May
Cherry Blossom Festival in Washington, D.C. Cherry trees presented to the United States by Japan and planted in the Potomac River Tidal Basin are in full bloom.

May
Arbor Month in Minnesota.

May-June
Poinciana Festival in Miami, Florida, centers around the royal poinciana trees of the area.

June 5
World Environment Day, established by the United Nations in 1972.

August 11
Gifford Pinchot's Birthday (1865). A conservation leader, Mr. Pinchot was the first chief of the U.S. Forest Service and founder of the Society of American Foresters.

November 14
Tree Fest in Tunisia.

November
Arbor Day in Western Samoa.

December 22
International Arbor Day. Encourages tree planting in the southern hemisphere and winter tree planting in other areas where the climate is suitable.

Quotes and Reflections

Trees inspire us. Throughout the ages, poets, writers, and painters have praised the forest as a place of great beauty. For American Indians and many other indigenous peoples, trees are a sacred gift from Mother Earth. People of all ages, in all walks of life, often find strength, wonder, and a sense of peace in trees.

With trees bringing about such strong feelings, it is no wonder hundreds of people have been moved to write about them or about preserving the earth upon which they grow. Stories, poems, and songs are all part of the lore.

Here is a collection of some favorite quotes about trees and about the natural world. Use it for "quote of the day" activities, as inspirations for learning about particular authors, as environmental education enhancements, and more.

A people without children would face a hopeless future; a country without trees is almost as hopeless.
—Teddy Roosevelt, Arbor Day, 1907

For mine is the old belief ... There is a soul in every leaf.
—M. M. Ballou

Did you know that trees talk? Well they do. They talk to each other, and they'll talk to you if you listen. I have learned a lot from trees: sometimes about the weather, sometimes about animals, sometimes about the Great Spirit.
—Tatanga Mani, a Stoney Indian

No shade tree? Blame not the sun, but yourself.
—Old Chinese Proverb

An old tree is hard to straighten.
—French Proverb

Today I have grown taller from walking with the trees.
—Karle Wilson Baker

The mountains, I become part of it
The herbs, the fir tree, I become part of it
The morning mists, the clouds, the gathering waters, I become part of it,
The wilderness, the dew drop, the pollen...
I become part of it.
—Navajo Chant

If you would know strength and patience, welcome the company of trees.
—Hal Borland

Where I sit is holy,
Holy is the ground.
Forest, mountain, river,
Listen to the sound.
Great Spirit circle
All around me.
—Author Unknown

One generation plants the trees; another gets the shade.
—Old Chinese Proverb

He that plants trees loves others beside himself.
—English Proverb

The woods are lovely, dark and deep.
But I have promises to keep
And miles to go before I sleep,
And miles to go before I sleep.
—Robert Frost

Two roads diverged in a wood, and I—
I took the one less traveled by,
And that has made all the difference.
—Robert Frost

I would not move to Minnesota; you cannot grow apples there!
—Horace Greeley

Trees are sanctuaries.
Whoever knows how to speak to them,
Whoever knows how to listen to them, can learn the truth.
—Herman Hesse

Character is like a tree and reputation like its shadow. The shadow is what we think of it; the tree is the real thing.
—Abraham Lincoln

Though a tree grow ever so high, the falling leaves return to root.
—Malay Proverb

There is a certain respect, and a general duty to humanity that ties us to trees and plants.

—Michel de Montaigne

Woodman, spare that tree!
Touch not a single bough!
In youth it sheltered me
And I'll protect it now...

—George P. Morris

Although we depend on nature for our survival, most of us lack understanding of the ways in which living plants support our life and can improve its condition.

—Rogers C. B. Morton

You can gauge a country's wealth, its real wealth, by its tree cover.

—Dr. Richard St. Barbe Baker

The planting of a tree shows faith in the future.

—Charles Schultz

Like the trees we are visitors, guests of the earth.

—Kim R. Stafford

A man has at least a start at discovering the real meaning of human life when he plants a shade tree under which he will never sit.

—Eldon Trueblood

If a tree dies, plant another in its place.

—Linnaeus

If you want to be happy for a year ... plant a garden. If you want to be happy for a lifetime, plant a tree.

—Author Unknown

We have not inherited this earth from our parents; we are borrowing it from our children.

—American Indian Saying

I never saw a disconcerted tree. They grip the ground as though they liked it, and though fast rooted, they travel about as we do. They go wandering forth in all directions with every wind, going and coming like ourselves, traveling with us around the sun two million miles a day.

—John Muir

Man did not weave the web of life. He is merely a strand in it. Whatever he does to the web, he does to himself.

—Chief Sealth (Seattle)

If men spit upon the ground, they spit upon themselves. This we know—the earth does not belong to man; man belongs to the earth.

—Chief Sealth (Seattle)

Be like a tree in pursuit of your cause. Stand firm, grip hard, thrust upward, bend to the winds of heaven, and learn tranquility.

—Dedication to Dr. Richard St. Barbe Baker, Father of the Trees

The trees in the streets are old trees, used to living with people, family trees that remember your grandfather's name.

—Stephen Vincent Benet

My Own Favorite Quotes

Tree Poems
(Select Age Appropriate)

What Do We Plant When We Plant the Tree?

What do we plant when we plant the tree
We plant the ship which will cross the sea,
We plant the mast to carry the sails,
We plant the planks to withstand the gales—
The keel, the keelson, the beam and knee—
We plant the ship when we plant the tree.
What do we plant when we plant the tree?
We plant the houses for you and me.
We plant the rafters, the shingles, the floors,
We plant the studding, the lath, the doors,
The beams and siding, all parts that be,
We plant the house when we plant the tree.

What do we plant when we plant the tree?
A thousand things that we daily see.
We plant the spire that out-towers the crag,
We plant the staff for our country's flag,
We plant the shade from the hot sun free:
We plant all these when we plant the tree.
—Henry Abbey

Trees

I think that I shall never see
A poem as lovely as a tree;

A tree whose hungry mouth is pressed
Against the earth's sweet flowing breast;

A tree that looks at God all day
And lifts her leafy arms to pray;

A tree that may in summer wear
A nest of robins in her hair;

Upon whose bosom snow has lain
Who intimately lives with rain;

Poems are made by fools like me,
But only God can make a tree.
—Joyce Kilmer

Trees of the Fragrant Forest

(For six children. As they take their places on the stage, those in seats recite the first stanza.)

Trees of the fragrant forest,
With leaves of green unfurled,
Through summer's heat, through winter's cold
What do you do for our world?

First: Our green leaves catch the raindrops
That fall with soothing sound,
Then drop them slowly, slowly down;
it's better for the ground.

Second: When, rushing down the hillside,
A mighty fresh stream foams,
Our giant trunks and spreading roots
Defend your happy homes.

Third: From burning heat in summer
We offer cool retreat,
Protect the land in winter's storm
From cold, and wind, and sleet.

Fourth: Our falling leaves in autumn,
By breezes turned and tossed,
Will rake a deep sponge-carpet warm,
Which saves the ground from frost.

Fifth: We give you pulp for paper,
Our fuel gives you heat;
We furnish lumber for your homes,
And nuts and fruit to eat.

Sixth: With strong and graceful outline,
With branches green and bare,
We fill the land through all the year,
With beauty everywhere.

All: So listen! From the forest
Each one a message sends
To children on this Arbor Day:
"We trees are your best friends!"
—Unknown

Trees

Trees are the kindest things I know,
They do no harm, they simply grow.

And spread a shade for sleepy cows,
And gather birds among the boughs.

They give us fruit in leaves above,
And wood to make our houses of,
And leaves to burn on Halloween,
And in the spring new buds of green.

They are the first when day's begun,
To touch the beams of morning sun.

They are the last to hold the light,
When evening changes into night.

And when the moon floats on the sky,
They hum a drowsy lullaby.

Of sleepy children long ago—
Trees are the kindest things I know.
—Unknown

Arbor Day

"Tree Planting Day" they called it
in Nebraska long ago.
Now we call it Arbor Day, and
Oh, I love it so!
I love to plant a growing thing—
A tree, a shrub, a vine—
And know it will for years and years
Keep growing there, a sign
To children who come after me
That someone thought of them,
And left behind a living friend
More precious than a gem.
—Betty Foust Smith

Tree Tunes

There are dozens of songs about trees, plants, and/or natural wonders. Some possible recording artists and songs to enjoy with children include:

"Maple Leaf Rag" —Traditional
"Tie a Yellow Ribbon 'Round the Old Oak Tree" —Tony Orlando & Dawn
"America the Beautiful" —Traditional
"This Land is Your Land" —Woody Guthrie and others
"Tapestry" —Don McLean
"Different Drummer" —Stone Ponies
"Dog and Butterfly" —Heart
"East of Ginger Trees" —Seals and Croft
"Rocky Mountain High" —John Denver
"Annie's Song" —John Denver
"Forest Lawn" —Tom Paxton
"Backstreets" —Bruce Springsteen
"Down in the Willow Garden" —Traditional
"Lullabye of Byrdland" —Traditional
"Trees" —Rush
"Don't Sit Under the Apple Tree" —The Andrews Sisters
"Lemon Tree" —Trini Lopez
"Appalachian Spring" —Aaron Copland
"The Little Nut Tree" —Traditional
"Big Yellow Taxi" —Joni Mitchell
"Carolina in the Pines" —Michael Murphy
"The Ash Grove" —Traditional

Others:

The Man Who Planted Trees

By Jean Giono

In a day when much of the world that was once forested has become desert, the following article is a shining example of what one person can do to reverse that trend or prevent it from occurring. When French/Italian author Jean Giono was asked by American magazine editors in 1953 to write about an unforgettable character, he chose to write about Elzeard Bouffier—the man who planted trees. Because Bouffier was created in Giono's imagination as a person who might exist and would be quite unforgettable if he did, the story was initially rejected. Vogue *magazine was the first to publish it, and within a few years it was translated into several languages. For years, it has inspired reforestation efforts worldwide. As reprinted here, the article is an adaptation of the original story,* The Man Who Planted Trees, *published in hardcover and paperback by Chelsea Green Publishing Company of Post Mills, Vermont. The 54-page book includes 20 wood engravings by artist Michael McCurdy. The book is available by calling 1-800-639-4099.*

About 40 years ago, I was trekking across the mountain heights in that ancient land where the Alps thrust down into Provence. In the deserted region, everything was barren and colorless. Nothing grew there but wild lavender.

After three days of walking, I found myself amidst unparalleled desolation. I had no water. I camped near the vestiges of an abandoned village. The clustered houses suggested there must once have been a well or a spring. Indeed, there was a spring, but it was dry.

It was a fine June day brilliant with sunshine. But over the unsheltered land, the wind blew with unendurable ferocity. It growled over the carcasses of houses like an enraged dragon. I moved camp.

After five hours of walking, I glimpsed in the distance a small black silhouette and took it for a solitary tree. I started toward it. It was a shepherd. Thirty sheep were lying about him on the baking earth.

He gave me a drink from his water gourd and, a little later, took me to his cottage. He drew his water—excellent water—from a very deep natural well.

He spoke little. It is the way of those who live alone. He lived not in a cabin, but in a real house of stone. It bore plain evidence of how his own efforts had reclaimed the ruins. The sound of the wind against its tiles was the sound of sea waves hitting the shores.

He was cleanly shaved. All his buttons were firmly sewed on. His clothes had been mended with meticulous care. He did not smoke. His dog was as silent as he was friendly, without being servile.

It was understood from the first that I should stay for the night. The nearest village was a day away. The shepherd shared his food with me.

Then he fetched a small sack and poured out a heap of acorns on the table. He began to inspect them, one by one, with great concentration, separating the good from the bad. I offered to help him. He told me it was his job. After he had set aside a large enough pile, he counted them out by 10s. When he had thus selected 100 perfect acorns, he went to bed.

The next day I asked if I might be there for another day. He agreed. In the morning he opened his pen and led out his flock. Before leaving, he plunged his carefully selected sack of acorns into a pail of water.

Instead of a stick, he carried an iron rod, thick as a thumb and 5 feet long. His pasture was in a valley. He left his flock in the care of his dog and

climbed a ridge. I followed. I was afraid he would rebuke me for my indiscretion. Instead he invited me to go along. We climbed to the top of the ridge.

There he began thrusting his iron rod into the earth, making a hole in which he planted an acorn. He refilled the hole. He was planting an oak. I asked him if the land belonged to him. He answered no. Did he know whose it was? He did not. Nor was he interested in finding out. He planted his 100 acorns with the greatest care.

I must have been fairly insistent in my questioning, for he answered. For three years he had been planting trees in this wilderness. He had planted 100,000. Of them, 20,000 had sprouted. Of the 20,000, he still expected to lose about half to rodents and the unpredictable designs of Mother Earth. There remained 10,000 oak trees to grow, where nothing grew before.

I began to wonder about the age of this man. Fifty-five, he told me. His name was Elzeard Bouffier. He had a farm in the lowlands once. There he had lived his life. He had lost his only son, and then his wife. Then he had withdrawn into this solitude. He felt that this land was dying for want of trees. Having no pressing business of his own, he had resolved to remedy this state of affairs.

I told him that in 30 years his 10,000 oaks would be magnificent. He answered simply that, given life, he would have planted so many trees that those 10,000 would be a drop in the ocean.

Presently he was studying the reproduction of beech trees and had a beech-nut nursery near his house. The seedlings, which he protected from his sheep with a wire fence, were beautiful. He was also considering birches for valleys where there could be moisture below the surface.

We parted the next day. The war started in 1914, and I became a soldier. As soldiers do, I forgot everything but the war. I forgot about the old man and his trees, too.

Five years later, the war was over. I took to the road again, to the barren lands, following my wanderlust.

Elzeard Bouffier had not died. In fact, he was extremely spry. He had changed jobs. Now he had only four sheep. He had gotten rid of his sheep because they threatened his young trees. He had imperturbably continued to plant.

The oaks of 1910 were then 10 years old and higher than either of us. His forest measured 11 kilometers by 3 (6.8 by 1.86 miles). It had all sprung up from the hands and soul of this one man—a man who could be as effectual as God in realms other than that of destruction. Creation seemed to come about in a sort of chain reaction. I saw water flowing in the brooks that had been dry since the memory of man. As the water reappeared, so there reappeared willows, rushes, meadows, gardens, flowers, and a certain purpose in being alive.

Hunters and forest officials came to see this wonderful "natural" forest. When they saw that it was all the work of one man, they did not meddle. They left him to himself. He worked in such total solitude that toward the end of his life, he lost the habit of speech. Or perhaps he saw no need for it.

The only serious danger to his work occurred during the Second World War. Cars were being run on wood-burning generators. There was never enough wood. Cutting was started among his oaks. But railway lines were so far away that the effort flopped. The shepherd saw nothing of it. He was 30 kilometers away, planting his trees in peace. He ignored the war of 1939 as he did that of 1914.

I saw Elzeard Bouffier for the last time in June of 1945. He was then 87.

I had started back along the route through the wasteland. But now there was a bus. I no longer recognized the scenes of my earlier journeys. Only when I heard the name of the village could I actually believe I was in the region that had been all ruins and desolation once.

The bus put me down at the village that in 1913 had a few houses and fewer inhabitants. The living was bad. Living in excessively harsh climate in winter and in summer, there was no escape from unceasing conflict of personalities. Irrational ambition reached

inordinate proportions in the continual desire for escape. The soundest characters broke under the perpetual grind. They had been savage creatures. Malice, mistrust, and hatred had composed the spirit of the land. They were little removed, physically and morally, from the conditions of prehistoric man. There were epidemics of suicides and frequent cases of insanity. All around them, nettles were feeding upon the remains of abandoned houses, left beached in time. And over all there was the wind, the ceaseless, rattling wind, to rasp upon the nerves.

Their condition had been beyond hope. They had to wait for nothing but death, a condition which rarely predisposes to virtue.

But everything had changed. Even the wind. Instead of the harsh, dry wind, a gentle wind was blowing, laden with scents. A sound like water came from the mountains; it was the forest wind. Most amazing of all, I heard the sound of water falling into a pool. A fountain had been built, and it was flowing freely. What touched me most was that someone had planted a linden by its side. It must have been four years old and already in full leaf, the incontestable sign of resurrection.

The village bore signs of labor for which help is required. Ruins had been cleared away, dilapidated walls torn down, and houses restored. The new houses were surrounded by little gardens where vegetables and flowers grew in orderly confusion. The war just finished had not allowed full blooming of life, but Lazarus was out of the tomb. I saw little fields of barley and rye. Deep in the narrow valley, the meadows were turning green.

One man, armed only with physical and moral resources, was able to raise this land from wasteland. The old and unlearned shepherd who fathered this miracle died in peace at the hospice in Banon in 1947.

—Reprinted from *American Forests,* July 1986, pages 25-26. Used with permission.

The Book Nook

Here are some books to help your students find out more about trees and forests. The interest and reading levels of each book are listed so you know which ones to recommend. Ask your media center specialist or librarian to help you find other forest-related materials.

A Sand County Almanac by Aldo Leopold. Oxford University Press: 1949. Interest level: Grades 8-Adult. Reading level: Grade 9. Features an essay on nature and wildlife for every month of the year.

A Tree for Me by Nancy Van Laan. Alfred A Knopf: 2000. Interest level: Grades K-3. Reading level: Grade 2. A child climbs five different trees, looking for a place to hide and finding an increasing number of animals already in residence, until finally the perfect tree is found.

Acorn to Oak Tree by Oliver S. Owen. Abdo & Daughters: 1994. Interest level: Grades 3-6. Reading level: Grade 3. Learn how the tiny acorn sprouts first into a seedling and then a sapling, which will later become the mighty oak.

Apple King by Francesca Bosca. North-South Books: 2001. Interest level: Grades PreK-2. Reading level: Grade 2. A selfish king keeps a beautiful apple tree and its wonderful fruit all to himself, until an invasion of worms teaches him a lesson about sharing.

Apple Trees by John F. Prevost. Abdo & Daughters: 1996. Interest level: Grades 2-4. Reading level: Grade 4. Presents brief information about the roots, trunk, leaves, fruits, and varieties of apple trees, pests that affect them, and their economic uses.

Apple Trees by Gail Saunders-Smith. Pebble Books: 1998. Interest level: Grades K-2. Reading level: Grade 1. An apple tree is described in simple text and photographs as it goes through the seasons.

Autumn Leaves: A Guide to the Fall Colors of the Northwoods by Ronald M. Lanner. Northword Press: 1990. Interest level: Young adult. Reading level: Young adult. Northern American trees in their fall colors are described through text and photographs.

Be a Friend to Trees by Patricia Lauber. Harper Collins Publishers: 1994. Interest level: Grades 1-3. Reading level: Grade 3. Discusses the importance of trees as sources of food, oxygen, and other essential things.

Beautiful Christmas Tree by Charlotte Zolotow. Houghton Mifflin Company: 1999. Interest level: Grades K-3. Reading level: Grade 3. Although his elegant neighbors do not appreciate his efforts, a kind old man transforms his rundown house and a small neglected pine tree into the best on the street.

Big Tree by Bruce Hiscock. Boyds Mills Press: 1999. Interest level: Grades 1-4. Reading level: Grade 4. Follows the development of a large old maple tree from its growth from a seed during the American Revolution to its maturity in the late 20th century.

Birches by Robert Frost. Henry Holt: 1988. Interest level: Grades 3-6. Reading level: Grade 4. An illustrated version of the well-known poem about birch trees and the pleasures of climbing them.

Blue Spruce by Mario Cuomo. Sleeping Bear Press: 1999. Interest level: Grades K-4. Reading level: Grade 3. When a storm knocks down the blue spruce tree in a boy's yard, he and his father work with all their might to right the tree again.

Champion of Arbor Day: J. Sterling Morton by Sandy Beaty. Acorn Books: 1999. Interest level: Grades 4-12. Reading level: Grade 6. The story of J. Sterling Morton, one of this nation's environmental visionaries.

Cherry Tree by Ruskin Bond. Boyds Mills Press: 1996. Interest level: Grades K-3. Reading level: Grade 3. A story from India in which a little girl plants a cherry seed and cares for the cherry tree through its difficult life. A story about life and growing older.

Cottonwood Trees by John F. Prevost. Abdo & Daughters: 1996. Interest level: Grades 2-4. Reading level: Grade 4. Provides basic information about the cottonwood, including its structure, economic uses, and the pests and diseases that affect it.

Dead Log by Jen Green. Crabtree Publishing Company: 1999. Interest level: Grades 2-4. Reading level: Grade 4. Describes the various creatures and plants that live in, on, or under a dead log.

Dead Log Alive! by Jo S. Kittinger. Franklin Watts: 1996. Interest level: Grades 4-7. Reading level: Grade 6. Describes the variety of animal and plant life found on, in, and around dead logs, and explains the role that dying trees play in nature's cycles.

Dinosaur Tree by Douglas Henderson. Aladdin: 1999. Interest level: Grades 3-6. Reading level: Grade 4. Traces the life cycle of a tree in the late Triassic period and what happens to the tree when a storm capsizes it 500 years later.

Elm Tree and Three Sisters by Erika Weihs. Viking Penguin: 2001. Interest level: Grades K-3. Reading level: Grade 3. When three young sisters plant a tiny elm tree in their barren back yard, they find it becomes an integral part of their lives as they grow older.

Encyclopedia of North American Trees by Sam Benvie. Firefly Books: 2000. Interest level: Grades 6-12. Reading level: Grade 7. Describes 278 species of trees and their characteristics.

Exploring Tree Habitats by Patti Seifert. Mondo Publishing: 1994. Interest level: Grades 1-5. Reading level: Grade 4. Explore the world and discover a tremendous variety of tree habitats and animal life.

Fantastic Trees by Edwin Menninger. Timber Press: 1995. Interest level: Grades 5-12. Reading level: Grade 6. A humorous but factual survey of unusual trees with strange habits such as producing flowers and fruit underground, telling time, making noises, and creating their own rain.

Fire: Friend or Foe by Dorothy Hinshaw Patent. Clarion: 1998. Interest level: Grades 4-8. Reading level: Grade 7. Discusses forest fires and the effect they have on both people and the natural world.

Fires of Autumn: The Cloquet-Moose Lake Disaster of 1918 by Francis M. Carroll. Minnesota Historical Society: 1990. Interest level: Grade 10-Adult. Reading level: Grade 10. Tells the dramatic stories of the origins of the fires and of the survivors and victims in the major disaster areas.

Forest Fire by Christopher Lampton. Millbrook Press: 1995. Interest level: Grades 3-6. Reading level: Grade 6. Describes, in text and color photographs, the causes for forest fires, how they are detected, techniques used to put them out, and the damage that is made. Examines the beneficial effects of small fires on plant and animal life.

Forest Fire! by Mary Ann Fraser. Troll Associates: 1996. Interest level: Grades 1-2. Reading level: Grade 1. Describes the forest life cycle and the destructive and renewing aspects of forest fires.

Forests by Andy Owen. Heinemann Library: 1998. Interest level: Grades 2-4. Reading level: Grade 3. Introduces the various forests of the world, including mangrove, broadleaf, evergreen, and rain forests.

Forests and Woodlands by Rose Pipes. Raintree/Steck-Vaughn: 1999. Interest level: Grades 2-5. Reading level: Grade 4. Introduces some notable forests and woodlands around the world, including the taiga in Russia, the eucalyptus woodlands in Australia, and the mangrove forests of Central and South America.

From Acorn to Oak Tree by Jan Kottke. Children's Press: 2000. Interest level: Grades K-2. Reading level: Grade 2. Follows the journey of an acorn and explains how it becomes an oak tree.

Grandfather Four Winds and Rising Moon by Michael Chanin. HJ Kramer: 1994. Interest level: Grades PreK-2. Reading level: Grade 1. Grandfather Four Winds helps his young grandson learn the lessons of courage, gratitude, generosity, and faith from the old apple tree that is sacred to their people.

Great Dimpole Oak by Janet Taylor Lisle. Puffin Books: 1999. Interest level: Grades 3-7. Reading level: Grade 5. The citizens of Dimpole rally together to save an historic oak tree from being cut down.

Hellroaring: The Life and Times of a Fire Bum by Peter M. Leschak. North Star Press of St. Cloud: 1994. Interest level: Grades 6-8. Reading level: Grade 7. Chronicles the author's adventures as a wildland firefighter.

Hopper's Treetop Adventure by Marcus Pfister. North-South Books: 1997. Interest level: Grades K-2. Reading level: Grade 2. While searching for nuts in the forest, Hopper the hare meets a friendly squirrel and climbs up into his tree to spend time with him.

How Trees Help Me by Bobbie Kalman and Janine Schaub. Crabtree Publishing: 1992. Interest level: Grades 1-6. Reading level: Grade 4. Find out about the parts of a tree, why trees are important, and the life of a tree. Includes a short story, "The Troll and the Tree," and fun activities to do to learn about trees.

If the Trees Could Talk by Stuart A. Kallen. Abdo & Daughters: 1994. Interest level: Grades K-3. Reading level: Grade 3. A tree talks about how it was planted and the important part it plays in the environment.

In a Tree by David M. Schwartz. Gareth Stevens: 1999. Interest level: Grades 1-3. Reading level: Grade 3. Introduces, in simple text and photographs, the characteristics of some of the trees and animals that can be found in a forest. Includes a caterpillar, raccoon, yellow warbler, owl, squirrel, a white pine, and an oak.

In the Deep, Dark Forest by Paul Humphrey. Raintree/Steck-Vaughn: 1995. Interest level: Grades K-3. Reading level: Grade 1. Looks at different plants and animals that live in the forest.

John Blair and the Great Hinckley Fire by Josephine Nobisso. Houghton Mifflin Company: 2000. Interest level: Grades 3-5. Reading level: Grade 4. Tells how a brave African-American porter helped save many lives when the train on which he was working was caught up in the horrendous firestorm near Hinckley, Minnesota in 1894.

Kid's Guide to How Trees Grow by Patricia Ayers. Power Kids Press: 2000. Interest level: Grades 2-5. Reading level: Grade 4. Describes the basics of how different types of trees grow.

Living Tree by Nigel S. Hester. Franklin Watts: 1990. Interest level: Grades 3-5. Reading level: Grade 4. Examines the parts of a tree and its life cycle from seedling to decay.

Log's Life by Wendy S. Pfeffer. Simon & Schuster: 1997. Interest level: Grades K-3. Reading level: Grade 3. Introduction to the life cycle of a tree.

Maple Trees by Marcia S. Freeman. Pebble Books: 1999. Interest level: Grades K-2. Reading level: Grade 1. Simple text and photographs describe the trunks, branches, leaves, seeds, and life cycle of maple trees.

Mighty Tree by Dick Gackenbach. Harcourt Brace Jovanovich: 1992. Interest level: Grades K-3. Reading level: Grade 3. Three seeds grow into three beautiful trees, each of which serves a different function in nature and for people.

Minnesota Trees by David M. Rathke. Minnesota Extension Service: 1995. Interest level: Grades 4-Adult. Reading level: Grade 7. Introduces more than 100 trees found in Minnesota forests and back yards.

Money Tree by Sarah Stewart. Farrar Straus & Giroux: 1994. Interest level: Grades K-3. Reading level: Grade 1. In summer the leaves on the strange tree growing in Miss McGillicuddy's yard are harvested by many people, but when Miss McGillicuddy thinks about needing firewood for the winter, she realizes the tree may have another use.

Night Tree by Eve Bunting. Harcourt Brace Jovanovich: 1991. Interest level: Grades K-2. Reading level: Grade 2. A family makes its annual pilgrimage to decorate an evergreen tree with food for the forest animals at Christmas time

Oak Trees by Marcia S. Freeman. Pebble Books: 1999. Interest level: Grades K-2. Reading level: Grade 1. The trunks, branches, leaves, and seeds of oak trees are described with simple text and photographs.

Pearl Plants a Tree by Jane Breskin Zalben. Simon & Schuster: 1995. Interest level: Grades K-3. Reading level: Grade 1. In the spring Pearl and Grandpa plant an apple tree. The celebration of Arbor Day in the United States and around the world is discussed.

Pine Tree Parable by Liz Curti Higgs. Word: 1997. Interest level: Grades 1-2. Reading level: Grade 1. A farmer and his wife, who grow trees to sell for Christmas, give their prized, perfect tree to a poor family who cannot afford to pay for it.

Quaking Aspen by Bonnie Holmes. Carolrhoda: 1999. Interest level: Grades 2-4. Reading level: Grade 3. Describes the life cycle of the quaking aspen, its role in the ecosystem, and how it is threatened by animals and people.

Red Leaf, Yellow Leaf by Lois Ehlert. Harcourt Brace Jovanovich: 1991. Interest level: Grades K-3. Reading level: Grade 3. A child describes the growth of a maple tree from seed to sapling.

Science Project Ideas About Trees by Robert Gardner. Enslow Publishing: 1997. Interest level: Grades 4-9. Reading level: Grade 6. Contains many experiments introducing the processes that take place in plants and trees.

Secret Life of Trees by Chiara Chevallier. DK Ink: 1999. Interest level: Grades 1-3. Reading level: Grade 2. Details the parts and inner lives of trees and all the organisms that live within them.

Someday a Tree by Eve Bunting. Clarion: 1993. Interest level: Grades K-3. Reading level: Grade 3. A young girl, her parents, and their neighbors try to save an old oak tree poisoned by pollution.

Spotter's Guide to Trees of North America by Alan F. Mitchell. EDC Publishing: 1992. Interest level: Grades 2-Adult. Reading level: Grade 6. How to identify over 85 species of trees.

The First Forest by John Gile. Worzalla: 1989. Interest level: Grades K-4. Reading level: Grade 4. Originally created as a bedtime story for the author's children, this fanciful tale tells how the first trees came to be and teaches about the need to respect each other and the earth.

The Giving Tree by Shel Silverstein. Harper & Row: 1964. Interest level: Grades K-4. Reading level: Grade 2. A classic tale of a tree that keeps giving throughout the decades.

The Tremendous Tree Book by Barbara Brenner and May Garelick. Boyds Mills Press: 1979. Interest level: Grades K-4. Reading level: Grade 4. Celebrates the marvels of trees in a simple rhyme style.

Tree by David Burnie. Dorling Kindersley: 2000. Interest level: Grades 4-8. Reading level: Grade 7. Photographs and text explore the anatomy and life cycle of trees, examining the different kinds of bark, seeds, and leaves, the commercial processing of trees to make lumber, the creatures that live in trees, and other aspects.

Tree Book by Pamela Hickman. Kids Can Press: 1999. Interest level: Grades 3-5. Reading level: Grade 4. Information and activities to help children learn about the different kinds of trees living throughout the country.

Tree in a Forest by Jan Thornhill. Greey De Pencier Books: 1991. Interest level: Grades K-4. Reading level: Grade 4. Presents the life story of a 200-year-old maple tree.

What's Inside Trees? by Jane Kelly Kosek. Power Kids Press: 1999. Interest level: Grades 3-6. Reading level: Grade 4. Describes what is inside trees, how they use sunlight and obtain nourishment, how they grow and reproduce, and how they can be protected in their endangered status.

Wild in the City by Jan Thornhill. Owl Communications: 1999. Interest level: Grades K-2. Reading level: Grade 1. Describes the variety of wildlife living right in Jenny's neighborhood.

Wildfire by Patrick Cone. Carolrhoda: 1997. Interest level: Grades 3-6. Reading level: Grade 6. Briefly traces the history of wildfire before going on to discuss types, when and where they start, their behavior, ecological effects, fighting and preventing them.

For More Information

Environmental Education Resources:

- Sharing Environmental Education Knowledge (SEEK)
  525 South Lake Avenue
  Suite 400
  Duluth, MN 55802
  218-529-6258
  1-888-668-3224 (Toll Free)
  http://mnseek.net

"Hands-On" Classroom Learning Experiences:

- Project Learning Tree
  Minnesota Department of Natural Resources
  500 Lafayette Road
  St Paul, MN 55155-4044
  651-296-3406
  http://www.dnr.state.mn.us/forestry/learning_tree
- Project WILD-Aquatic WILD
  Minnesota Department of Natural Resources
  500 Lafayette Road
  St. Paul, MN 55155-4007
  651-297-2423
  http://www.dnr.state.mn.us/fish_and_wildlife/project_wild
- Project WET
  Minnesota Department of Natural Resources
  500 Lafayette Road
  St. Paul, MN 55155-4032
  651-297-4951
  http://www.dnr.state.mn.us/waters/project_wet
- School Forest Program
  Minnesota Department of Natural Resources
  500 Lafayette Road
  St. Paul, MN 55155-4044
  651-297-2214

General Reference:

- Minnesota Department of Natural Resources
  Information Center
  500 Lafayette Road
  St. Paul, MN 55155-4040
  651-296-6157 (Metro Area)
  1-888-646-6367 (Toll Free)
  http://www.dnr.state.mn.us
- Minnesota Department of Agriculture
  Agronomy and Plant Protection - Shade Tree Program
  90 West Plato Boulevard
  St. Paul, MN 55107
  651-296-8507
  http://www.mda.state.mn.us

Specific forest questions may be directed to:

- Minnesota Department of Natural Resources
  Division of Forestry
  500 Lafayette Road
  St. Paul, MN 55155-4044
  651-296-4491
  http://www.dnr.state.mn.us/forestry
- Extension Forest Resources
  University of Minnesota
  1530 North Cleveland Avenue
  St. Paul, MN 55108
  612-624-3020
  http://www.cnr.umn.edu/FR/extension
- Extension Wood and Paper Science
  University of Minnesota
  2008 Folwell Avenue
  St. Paul, MN 55108
  612-624-7712
  http://www.extension.umn.edu/topics.html?topic=2
- North Central Research Station
  Forest Service, U.S. Department of Agriculture
  1992 Folwell Avenue
  St. Paul, MN 55108-6148
  651-649-5000
  http://www.ncrs.fs.fed.us
- State and Private Forestry, Northeastern Area
  Forest Service, U.S. Department of Agriculture
  1992 Folwell Avenue
  St. Paul, MN 55108
  651-649-5244
  http://www.na.fs.fed.us/spfo

State Forests and State Parks:

- Minnesota Department of Natural Resources
  Information Center
  500 Lafayette Road
  St. Paul, MN 55155-4040
  651-296-6157 (Metro Area)
  1-888-646-6367 (Toll Free)
  http://www.dnr.state.mn.us

National Forests:

- Chippewa National Forest
  200 Ash Avenue Northwest
  Cass Lake, MN 56633
  218-335-8600
  http://www.fs.fed.us/r9/chippewa
- Superior National Forest
  8901 Grand Avenue Place
  Duluth, MN 55808
  218-626-4300
  http://www.fs.fed.us/r9/superior

National Park:

- Voyageurs National Park
  3131 Highway 53
  International Falls, MN 56649
  218-283-9821
  http://www.nps.gov/voya

Arbor Day Celebrations:

- Minnesota Arbor Month Partnership
  500 Lafayette Road
  St. Paul, MN 55155-4044
  651-296-4491
  http://www.dnr.state.mn.us/forestry/arborday

Reference Materials:

- Minnesota Extension Distribution Center
  University of Minnesota
  Room 20 Coffey Hall
  1420 Eckles Avenue
  St. Paul, MN 55108
  612-625-8173
  http://www.extension.umn.edu

Places to Visit and Learn More:

- Forest History Center
  2609 County Road 76
  Grand Rapids, MN 55744
  218-327-4482
  http://www.mnhs.org/foresthistory
- Hinckley Fire Museum
  106 Old Highway 61
  Hinckley, MN 55037
  320-384-7338
- Minnesota's Bookstore
  117 University Avenue
  St. Paul, MN 55155
  651-297-3000 (Metro Area)
  1-800-657-3757 (Toll Free)
  http://www.comm.media.state.mn.us
- Minnesota Landscape Arboretum
  3675 Arboretum Drive
  P.O. Box 39
  Chanhassen, MN 55317
  952-443-2460
  http://www.arboretum.umn.edu
- Northland Arboretum
  Northwest 7th Street
  P.O. Box 375
  Brainerd, MN 56401-0375
  218-829-8770
  http://www.brainerd.net/~thearb

Additional Information and Materials:

- American Forests
  910 - 17th Street Northwest
  Suite 600
  Washington, DC 20006
  202-955-4500
  http://www.americanforests.org
- Minnesota Association of Soil and Water Conservation Districts
  790 Cleveland Avenue South
  Suite 216
  St. Paul, MN 55116
  651-690-9028
  http://www.maswcd.org
- Minnesota Forest Industries
  903 Medical Arts Building
  324 West Superior Street
  Duluth, MN 55802
  218-722-5013
  http://www.minnesotaforests.com
- Minnesota Forestry Association
  P.O. Box 496
  Grand Rapids, MN 55744
  218-326-3000
  1-800-821-8733
  http://www.mnforest.com
- Minnesota Shade Tree Advisory Committee
  1200 Warner Road
  St. Paul, MN 55106
  http://www.mnstac.org
- Minnesota Society of Arboriculture
  110 Green Hall
  1530 North Cleveland Avenue
  St. Paul, MN 55108
  http://www.isa-msa.org
- National Arbor Day Foundation
  100 Arbor Avenue
  Nebraska City, NE 68410
  402-474-5655
  http://www.arborday.org
- National Audubon Society
  700 Broadway
  New York, NY 10003
  212-979-3000
  http://www.audubon.org

- National Symbols Program—Woodsy Owl and Smokey Bear
  Forest Service, U.S. Department of Agriculture
  500 Lafayette Road
  St. Paul, MN 55155-4044
  651-205-4570
  http://www.symbols.gov
- National Tree Trust
  1120 G Street Northwest
  Suite 770
  Washington, DC 20005
  202-628-8733
  1-800-846-8733
  http://www.nationaltreetrust.org
- National Wildlife Federation
  11100 Wildlife Center Drive
  Reston, VA 20190-5362
  1-800-822-9919
  http://www.nwf.org
- Society of American Foresters
  5400 Grosvenor Lane
  Bethesda, MD 20814
  301-897-8720
  http://www.safnet.org
- Temperate Forest Foundation
  14780 Southwest Osprey Drive
  Suite 355
  Beaverton, OR 97007-8070
  503-579-6762
  http://www.forestinfo.org
- The Nature Conservancy
  4245 North Fairfax Drive
  Suite 100
  Arlington, VA 22203-1606
  703-841-5300
  1-800-628-6860
  http://www.nature.org
- Tree Trust
  2350 Wycliff Street
  Suite 200
  St. Paul, MN 55114
  651-644-5800
  http://www.treetrust.org

Other Sources for Information:

- Why leaves change color
  http://www.na.fs.fed.us/spfo/pubs/misc/autumn/autumn_colors.htm
  http://www.na.fs.fed.us/spfo/pubs/misc/leaves/leaves.htm
  http://www.na.fs.fed.us/spfo/pubs/fs/colors/colors.htm
- Video loan library—Forest Service, U.S. Department of Agriculture
  http://www.r5.fs.fed.us/video
- Tree fact sheets
  http://www.fw.vt.edu/dendro/dendrology/syllabus/biglist_frame.htm
- High school environmental competition
  http://www.envirothon.org
- Urban forestry information
  http://www.treelink.org
- Natural Inquirer—a science education resource journal for Grade 5 and older
  http://www.naturalinquirer.usda.gov
- Quality photographs of forest insects and disease organisms
  http://www.forestryimages.org
- City foresters
- County extension offices
- Local arboretums and botanical gardens
- Local libraries
- Local natural history museums
- Local tree nurseries
- Local parks
- Nature centers
- University departments of biology, botany, conservation, and forestry

For further information or to obtain additional copies contact:
The Minnesota Arbor Month Partnership
500 Lafayette Road
St. Paul, MN 55155-4044
651-296-4491

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These learning materials are printed using paper containing 30 percent post-consumer waste and vegetable-based inks.