DISCOVERY GUIDE

Table of Contents

PREFACE

The search for knowledge about a subject should lead to a better understanding of it, a curiosity or desire to learn more about it, and an attitude of respect and reverence for it. This resource is designed to provide just such opportunities for hands-on dynamic learning experiences on the subject of trees. Simple, fun activities will give educator and student alike the chance to use their senses and imagination to explore the workings of this incredible plant and its interrelationships to the environment and us.

Here in Minnesota, we are richly blessed with the magnificent giants of the plant world. Scan the horizon from your window with the eye of a child: tall, rounded, giant green lollipops stuck in the earth; cone-shaped rocket ships piercing the sky; gnarled and twisted Halloween props; lacy black fingers scratching the winter sky. No matter what the season or shape, we enjoy the abundance of trees' diversity throughout the state.

It would be easy to take these giants of the plant kingdom for granted. But as with all living things, their lives are in fragile balance with the world around them. Lest they become the extinct dinosaurs of their kind, we need to learn about them, how to help preserve their space, and how to live in harmony with them.

The following activities will guide the participant through the WHO, WHAT, WHERE, WHY, AND HOWS of Minnesota trees and forests. For the children, let it be a wonderful adventure through the richness of our state's natural resources. For all, let it be the beginning of a journey that will lead to the respect and reverence necessary to live in harmony with the world around us.

The activities will provide the children opportunities to experience, explore, and expand their knowledge base. Within each subject area, activities are grouped as follows: Primary, Intermediate, Advanced to correspond with grade levels K-9. Each grouping blends into the next, allowing educators to pick a variety of activities appropriate for their groups. Cross-referencing to the corresponding background and scientific information is marked as follows: See Chapter X in *Where Are All the Trees? A Minnesota Primer.* Each section includes a bibliography and craft and music activities, if appropriate. Finally, in Unit Four, 16 Minnesota trees are introduced. Use these fact sheets and pictures to help reinforce students' identification skills.

The base information for any scientific endeavor is the same for all, no matter what age. The detail and intricacies of what each child learns depend only on where his or her natural curiosity leads. A preschooler once described a tree as a big stick with leaves on—what an adventure from there to the workings of xylem and phloem and the miracle of photosynthesis. Enjoy the trip!

INTRODUCTION

The following activities have a very singular, simple purpose. They are NOT designed to provide each child or participant with everything he or she needs to know about trees. On the contrary, they are designed to instill enough curiosity and enthusiasm to spur the children on to WANT to learn everything they can about trees.

Within each unit, activities are loosely labeled P-Primary, I-Intermediate, and A-Advanced to provide some guidelines to the involvement and information contained within them. Many believe, however, that any pure exploration into science and nature has no age boundary. Discovery of something new is exciting and fresh whether it is being seen through the eyes of a 5-year-old or an 80-year-old. The noted British writer and biologist Thomas Huxley expressed it this way: "For every man the world is as fresh as it was the first day, and as full of untold novelties for him who has the eyes to see them."

In the same spirit of simplicity, most of the references listed in the units are children's and juvenile's books. Scientific and technical information in these books has already been reduced to an understandable level for the young naturalists. Such material removes one of the biggest stumbling blocks to introducing young people to the world of science and nature exploration by making technical concepts simple to understand.

With these tools and simple activities on how to use them at hand, add your own enthusiasm and curiosity, and use it all to open your children's minds and senses to the world outside their own Minnesota back door.

UNIT ONE: WHAT IS A TREE?

UNIT ONE DISCOVERIES

Students will be introduced to the parts of a tree and how they work together to keep the tree alive. For background see the Introduction and Chapter One in *Where Are All the Trees? A Minnesota Primer.*

KEY

- P — Primary Students
- I — Intermediate Students
- A — Advanced Students

To study something you must first identify it and then find it. Just what is a tree? *A Teachers' Guide to Arbor Month, 1990,* laid down some very simple guidelines. A tree is the largest of all plants and differs from other plants in four ways:

1. Most trees grow at least 15 to 20 feet tall.
2. They have one woody stem that is called a trunk.
3. The trunk grows at least 3 to 4 inches thick.
4. A tree's trunk can stand by itself.

No other plant has all four of these traits. Now that you know WHAT you are looking for, let's go out and find one.

Activity 1: Meeting the Neighbors!

P I A

All ages, any time or any season, can explore and enjoy the yard, the block, the neighborhood park as they get to know their leafy neighbors. Pack a lunch, open the door, and let's explore!

Editor's note: Every time you take the children outside, stress the need to be "Good Naturalists." Always leave your place the way you found it.

Preview an area for safety and identification of available species. Bring the children to it and just let them SENSE. What's big, little, tall, short? What color are the trees? What shape are they? What does their skin (bark) feel like? For the younger ones, make it a spyglass walk (make spyglasses out of construction paper or a toilet paper roll). Have them lie down and look up, roll over, and look down.

VARIATIONS

Tree Seek and Find

Pair off children and blindfold one partner. Have the other take him or her to a tree to explore it. How long did it take to get there? How fat is the tree? What does the bark feel like? Can you reach branches? Take blindfolded partners back to the starting place a different way, remove their blindfolds, and see if they can find "their" trees. Repeat for other partners.

Used with permission from Joseph Cornell, Sharing Nature with Children.

Silent Walk

Organize a group and stress that there will be no talking during the hike—just the use of silent hand signals to point out interesting things along the way. Agree upon simple signals (arm raised for "stop," etc.). Off you go for a very quiet exploration.

Blindfolded Walk or Trust Walk

(Probably not suited for a younger group. Try a Silent Sit instead—see next activity.)

To establish a keener awareness of the other senses (hearing, smell, touch), blindfold the participants and lead them through an area. All are silent except the leader who quietly and safely guides them, pointing out things to listen to, smell, or touch. As a variation, take them back unblindfolded along the same way so that they can see what their other senses had explored.

Silent Sit

Assign children places to sit quietly in the chosen area. Have them put their heads in their laps or close eyes and "explore" with their ears, noses, and hands.

Activity 2: Adopt a Tree

P

As a group (or individually if there are enough trees available), adopt a tree to get to know and observe as time goes by. Try to have someone adopt an evergreen so that the differences between it and deciduous trees can be noted. Remember to always stress the "Good Naturalist" rules when outside. This activity helps the children come to understand the tree as another living thing that can be helped or harmed by them.

I A

Vary this activity for older children by making observation the key—add a journal to record the data. Depending on the age, help the children identify their tree and note shape, size, leaf structure, injuries, branch and twig shapes, changes with the seasons, animal inhabitants, etc. You are helping them make a friend for life.

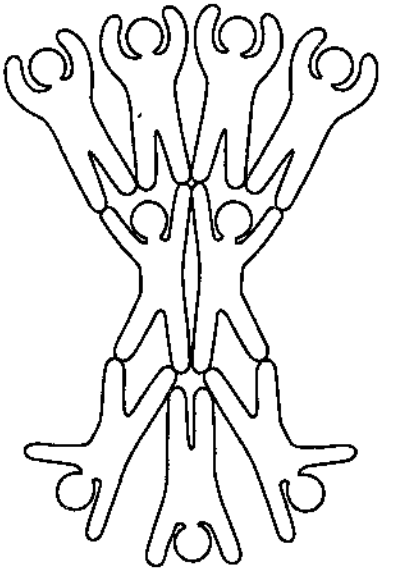
Activity 3: Let's Build a Human Tree!

P

Tell the children that they are going to learn about a tree by becoming the different parts.

Assign the basic parts to the children in the following ratios: 2: trunk, 3: roots, 4 or more: crown.

Following the diagram, lay the two "trunk" parts side by side with arms extended up to make the branches. Lay the three "root systems" feet to feet at the base of the trunk. Have their arms extended out to form the lateral roots. Finally, lay the "crown" among the branches with arms encircled to form the crown.



Make a forest with more children or smaller saplings with fewer.

You can also make different seasons: children who are "crowns" are gone in winter, have arms pulled in for spring, and slowly unfold for summer; for fall, "crown" children can drop and lie on the forest floor around the trunk or fly away. Or add sound effects: "roots" can "slurp, slurp" as they wiggle fingers; "trunks" can say "stretch" as they reach up; "crown" can "swish" as they wave arms.

Older students can act out and verbalize the function of each layer of the trunk and root system. Intermediate ages seem to enjoy the play and vocalizations. Using the activity to visually dramatize various things that can happen to the tree seems to work better with the older students.

Make name cards in the following numbers using the sample sheets included at the end of this unit.

1	heartwood
1	taproot
3	lateral roots
4	sapwood
4-6	cambium
6-8	phloem
6-10	bark (or as many as needed for all to participate)
1	bug
1	lawn mower
1	woodpecker

Cards can be punched and attached to string so they can be worn around the neck. Have students select a card and stand in a circle. As you assemble the tree, explain briefly to each part what it is doing to help the tree.

Ask the **heartwood** to come to the center.

Leader: "This is the heartwood—the inner core, the strength of the tree. The heartwood's job is to hold the trunk and branches upright so the leaves can get their share of the sun. The heartwood has been around a long time—so long that it's dead. But it's well preserved! The heartwood used to be alive, but its thousands of little tubes that carried water up and down are now all clogged with resin and pitch."

Have students say, "I stand tall."

Student who is heartwood will repeat.

Ask the **taproot** to sit at the base of the heartwood, facing outward.

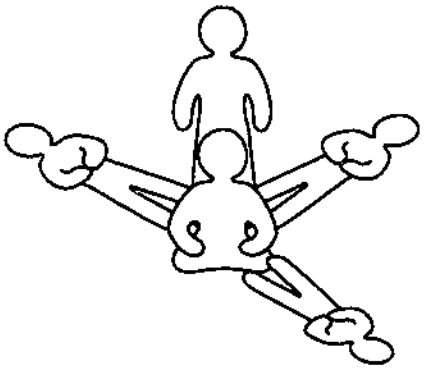
Leader: "You are a very long root, called a taproot. Plant yourself deep in the ground—about 30 feet. The taproot enables the tree to get water from deep in the earth, and also anchors the tree firmly to the ground. When storms come, the taproot keeps the tree from being blown over by high winds.

Have students say, "I anchor."

Student who is the taproot will repeat.

Then have heartwood say, "I stand tall" and taproot say, "I anchor."

Ask the three **lateral roots** to lie on their backs with their feet up against the tree and bodies extending away from the tree.



Leader: "You are the lateral roots. There are hundreds and hundreds of you. You grow outward all around the tree, like branches but underground. You also help hold the tree upright. At your tips are tiny root hairs.

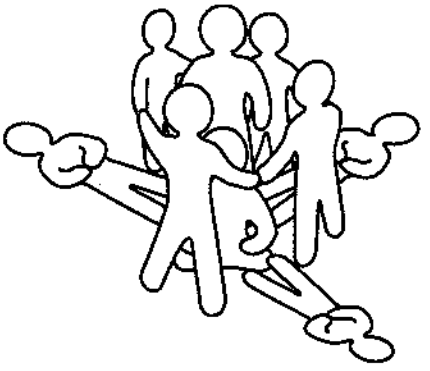
"Trees have thousands of miles of root hairs that cover every square inch of soil into which they grow. When they sense that there is water nearby, the cells grow toward it and suck it up. The tips of the root hairs have cells as tough as football helmets. I want the lateral roots to wiggle their fingers and practice slurping up water."

Have students say, "slurp, slurp." Students that are lateral roots will say, "slurp, slurp."

Then have the heartwood say, "I stand tall," the taproot say, "I anchor," and the lateral roots say, "slurp, slurp."

> "Teach less,
> share more."
>
> —Joseph Cornell

Ask the four **sapwoods** to form a complete circle around the heartwood, facing the heartwood. Have them hold hands and be careful not to step on any roots.



Leader: "You are the part of the tree called the sapwood, or xylem. You draw water up from the roots and lift it to the tree's highest branches. You are the most efficient pump in the world, with no moving parts. You're able to lift hundreds of gallons of water a day, and you do this at speeds of more than 100 miles an hour! After the roots slurp the water from the ground, your job is to bring the water up the tree."

Students that are the sapwood will do a pumping up action while saying, "We pump, we pump."

Then have the heartwood say, "I stand tall," the taproot say, "I anchor," the lateral roots say, "slurp, slurp," and the sapwood say, "we pump, we pump."

Have the **cambiums** form a circle around the sapwood, also facing inward and holding hands.

Leader: "Toward the inside of the tree is the cambium layer, the growing part of the tree. Its job is to make the trunk, branches, and roots grow thicker. Every year it adds a new layer to the sapwood and phloem."

The students that are the cambium will say, "We make new cells."

Then have the heartwood say, "I stand tall," the taproot say, "I anchor," the lateral

roots say, "slurp, slurp," the sapwood say, "we pump, we pump," and the cambium say, "we make new cells."

Next have the **phloem** join hands and form a larger circle around the cambium.

Leader: "The phloem has tiny pipelines. The food made by the leaves moves through the phloem to other parts of the tree. This food is 'sap.'"

Have the phloem pretend they are transporting food down from the leaves by starting out holding their arms above their heads, then lowering them and raising them again.

The students that are phloem say, "We bring sap around, we bring sap around."

Then have the heartwood say, "I stand tall," the taproot say, I anchor," the lateral roots say, "slurp, slurp," the sapwood say, "we pump, we pump," the cambium say, "we make new cells," and the phloem say, "we bring sap around, we bring sap around."

Ask all of the remaining students to be the **bark.** Have them circle the tree, facing outward. They hold hands and ward off enemies.

Have them say, "we protect, we protect."

Describe different events that can happen to the tree: fire, bark being peeled off, roots being damaged, holes being drilled, branches falling off, etc. Have participants react to what is happening. Introduce the **bug,** the **lawn mower,** and then the **woodpecker.** When the bug is introduced, the bark will be able to stop the bug from entering the tree until the tree is damaged by the lawn mower. The bug will enter where the lawn mower hit the tree. Once inside, the bug can move freely under the bark but no deeper. The woodpecker is then sent to "get the bug."

While you are going around the tree, lead the rest of the tree groups in their parts. Shout the commands for all the parts in sequence. Go through the sequence three or four times.

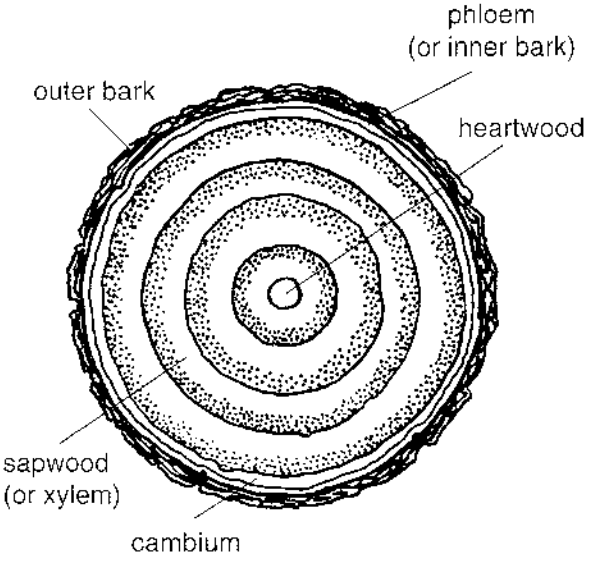
When you finish, have the students give themselves a big hand for being such a wonderful tree. And help the roots up off the ground!

Adapted with permission from Joseph Cornell, Sharing the Joy of Nature.

Activity 4: Learn Those Layers

I A

Can you label each layer? The layers you're looking for are: outer bark, heartwood, phloem (or inner bark), cambium, and sapwood. Use Activity Sheet 1A—Learn those layers!



THE SUM OF THE PARTS EQUALS THE WHOLE!

These last three activities provide opportunities for more detailed study of the various parts of the tree. Use your nature walks to pick up leaves, twigs, cones, seeds, again always making sure that the areas are safe. Each neighborhood will be unique, and the material you collect will serve to personalize your particular study with the children. Continue to stress the need to be "Good Naturalists" and to stay on the trails or in the safe areas. Use the collected materials to provide learning opportunities back at home (or the classroom) and for the art projects listed later in this section.

Activity 5: Leaf it Up!

Any walk or outdoor time is a great time to collect specimens: leaves, twigs, branches, seeds, pine cones. As much as possible encourage the children to pick up what has already fallen from the trees.

Prepare ahead of time construction paper cutouts of the leaves from your yard or area. Tape them up around the room the day of your hike. When the children return with their leaves, spend some time talking about them. What shape are they? What color and size? How do they feel? Then give a leaf to a child and tell him or her to go on a treasure hunt and find the match in the room somewhere. Give each child a turn. Put all the leaves in the middle and have the children sort them back out again (by size, color, or shape—whatever category you choose). Each game will reinforce their identification skills. Use this activity to introduce the children to the Minnesota species that are not familiar to the area they live in. Use the pictures provided in Unit Four to help them become familiar with their state's treasures. Play the same match games, adding a new species each time.

Collect leaves and allow the children time to look at the leaves and become familiar with their characteristics. Take them back outside for a Leaf Relay Game. Divide everyone into teams and give each child a leaf. On "go," have one child from each team race to find the tree the leaf is from. The first team that has all its players find their trees wins. Have the children take the leaves and press them between layers of newspaper to dry them out. Then help them make a simple leaf collection of their new friends and neighbors.

Leaves play a crucial role not only in the life of the tree, but also in our lives. They are the food manufacturing factories for the whole organism, using sunlight, water, and carbon dioxide to make glucose, a sugar. This incredible process is called photosynthesis,

and when it happens, the tree releases oxygen into the air as a by-product—oxygen we can breathe! Go over the following description of a leaf to help the students understand the complexity of this remarkable "living machine." Then with the help of a little kitchen magic, construct an edible leaf and dine, compliments of the neighbors.

Upper and Lower Epidermis: These two layers make up the protective "skin" of a leaf. They let in light and are usually coated with a waxy covering that reduces water loss. Stomata, tiny holes that open and close to let in carbon dioxide and release oxygen, are part of a leaf's epidermal layers. (Most stomata are found in the lower epidermis. A single leaf can have more than a million!)

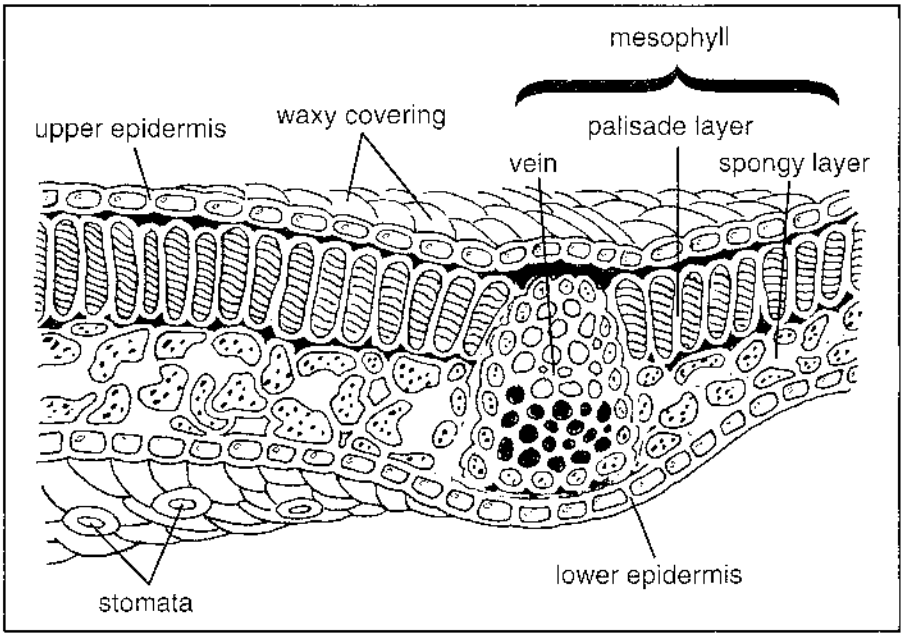
Mesophyll (Ground Layer): This middle layer of the leaf is made up of several other layers. The spongy layer contains loosely packed, differently shaped cells. Gases that take part in photosynthesis pass into this layer through a leaf's stomata. Some cells in the spongy layer have chloroplasts that contain chlorophyll, the pigment that absorbs light energy to power photosynthesis.

The palisade layer contains many chloroplasts in its cells. Most of the reactions in photosynthesis occur in this layer.

The veins branch out to almost every cell in a leaf. They bring water and minerals to the leaf cells and carry sugar out of the leaf.

Once you've discussed the layers of a leaf, have the kids make a couple of edible leaf models by following the directions provided on the next page. To give the kids an idea of where each layer in a leaf is located and how the layers fit together, talk about the gelatin models and the layers represented in them before serving them to the kids. (Once the gelatin models are cut, the layers will tend to mix together.)

Point out in the gelatin models the upper and lower epidermal layers (green gelatin), the stomata (bananas), the mesophyll (yellow gelatin), the spongy layer (cantaloupe), the palisade layer (grapes), the vein (strawberries), and the leaf's protective waxy cuticle (whipped cream). (In an actual leaf, the waxy cuticle covers both the upper and lower epidermis.) Also ask the kids which of the kinds of fruit in the models represent layers in the leaf that would contain chloroplasts (grapes and cantaloupe). Then let the kids munch on their edible leaves!



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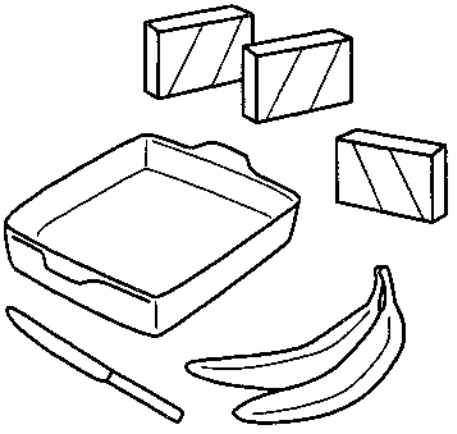
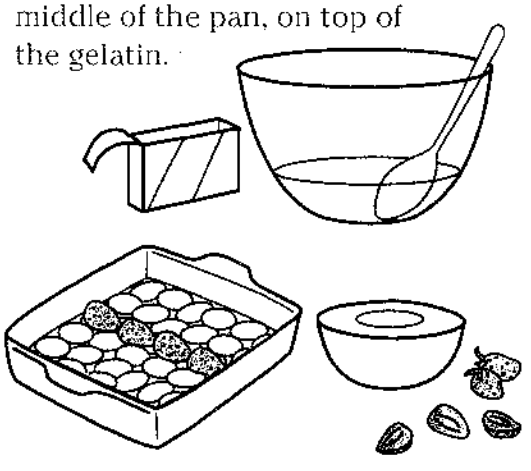
How to Make Edible Leaves

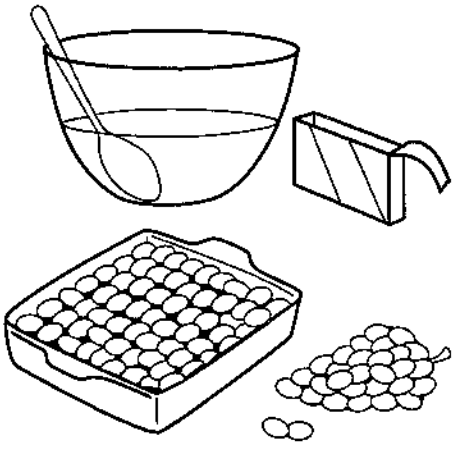
1. For each 8 x 8 inch (20 x 20 centimeter) glass pan you'll need two packets of yellow gelatin and one packet of green gelatin. You can substitute different types of fruit if the ones we suggest are out of season.
2. Cut a banana into 1/4 inch (6 millimeter) slices and scatter them over the bottom of the pan.



3. Mix the green gelatin according to the directions on the gelatin box. Before chilling the gelatin, pour just enough of it into the pan to cover the bananas. Save the leftover gelatin and keep it at room temperature.
4. Cool the banana and gelatin mixture in a refrigerator or freezer until the gelatin is firm. (It will take about one hour to firm up in the refrigerator and about 30 minutes or less in a freezer.)
5. Make a row of strawberries down the middle of the pan, on top of the gelatin.



6. Scoop out small chunks of cantaloupe and cover the cooled layer with them.
7. Mix one package of yellow gelatin, then pour it over the strawberries and cantaloupe. Cool the mixture until the yellow layer is firm.
8. Arrange the grapes side by side in rows across the yellow layer.



9. Mix the second package of yellow gelatin and pour it over the grapes, then cool the mixture until this newest layer is firm.
10. Pour the remainder of the green gelatin into the container, and cool the mixture one last time.
11. Spread a thin layer of whipped cream over the final layer of green gelatin.

Editor's note: After your kids have created and eaten their leafy "food factories," they can take a microscopic look at the cross section of a leaf. You can order slides of leaf cross sections by writing to Carolina Biological Supply at either 2700 York Road, Burlington, NC 27215, or at Box 187, Gladstone, OR 97027. Or you can call 800-334-5551. (You can also check with your local junior or senior high school science department.)

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Activity 6: Rally Round the Roots

On your explore walks, take time to look down. Many trees have huge surface roots that can be followed out from the trunk. They appear and disappear on their search for water. Remind the children not to disturb them—they are living tissue doing the important job of holding the tree up and looking for water. Very carefully remove soil, if possible, to take a peek at the smaller roots underground. Remember to cover them up when you are through.

Tree root expert Thomas Perry tells us how to examine tree roots. Most of the small absorbing roots of trees are in the forest litter layer and top inches of the soil. They are often smaller than the lead in a pencil. To 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 a hand 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 will often smell of rotting things.

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 that grow horizontally. These horizontal roots are usually located four to 11 inches below the surface.

To look at roots in a grassy lawn, go 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 will 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 several days.

Used with permission from A Teachers' Guide to Arbor Month, *Minnesota Arbor Month Partnership, 1990.*

VARIATIONS

A Closer Look

To get an even better look at roots, experiment with growing seeds back home (or in the classroom). Place a damp sponge on a plate and sprinkle with radish or zinnia seeds. Keep moist and examine the seeds to see the root hairs as they grow.

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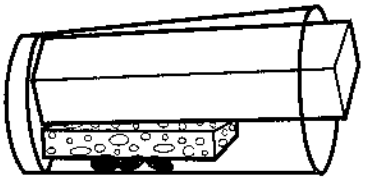
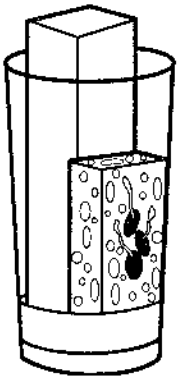
Sponge Sprout

Place bean or corn seeds against the side of an empty glass lying on its side. Hold in place with a wet sponge that is supported by a block of wood or anything that will keep it along the side.





Keep an inch of water in the bottom to keep the sponge wet, and watch the seeds sprout.

Activity 7: Bark Up a Tree

Make a cast of bark by pressing clay firmly against a tree. Gently remove and place face up in a shoe box. Mix 2 cups of plaster of paris with enough water to make a thick, creamy mix. Pour over clay and set aside until hard (usually several hours). When hard, strip away box and clay. Do several and use them for a match game back outside to see if the children can identify the trees they came from.

Used with permission from Seymour Simon, Trees on Your Street.

"I like trees because they seem more resigned to the way they have to live than other things do."

—Willa Cather
O Pioneer

ARTS AND CRAFTS

LET'S BUILD A TREE

Use the simple patterns on Activity Sheets 1B and 1C. Have the children color, cut, and then paste the trunk, roots and crown onto a big piece of construction paper. They can add grass, sun, animals, birds, etc., to complete the scene.

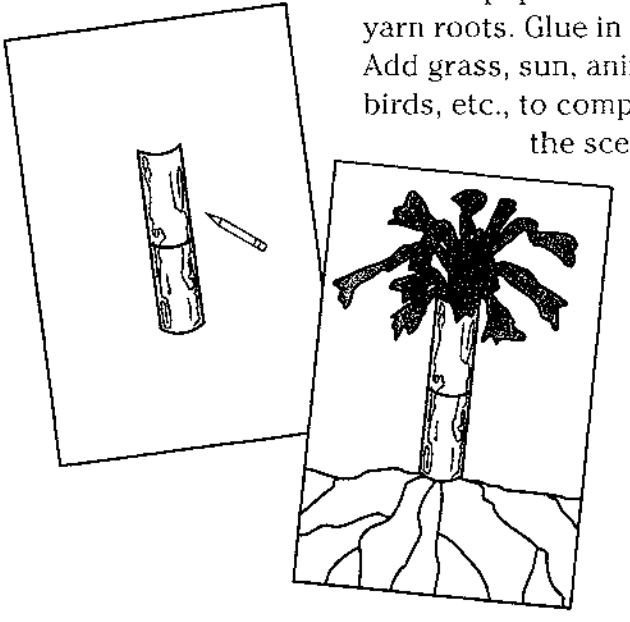
3-D TREES

Gather together a large piece of construction paper, a toilet paper tube or a paper towel tube (this will make a larger tree), green tissue paper, scissors, markers, crayons, yarn, glue, and tape. Following the directions below, construct a three-dimensional tree.

For your trunk, cut each tube in half, vertically. Make both halves the same size. Use markers or crayons to make knotholes on the pieces.

Tape your halves end-to-end on your large piece of construction paper. Leave room for your crowns and roots!

Make paper leaves and yarn roots. Glue in place. Add grass, sun, animals, birds, etc., to complete the scene.



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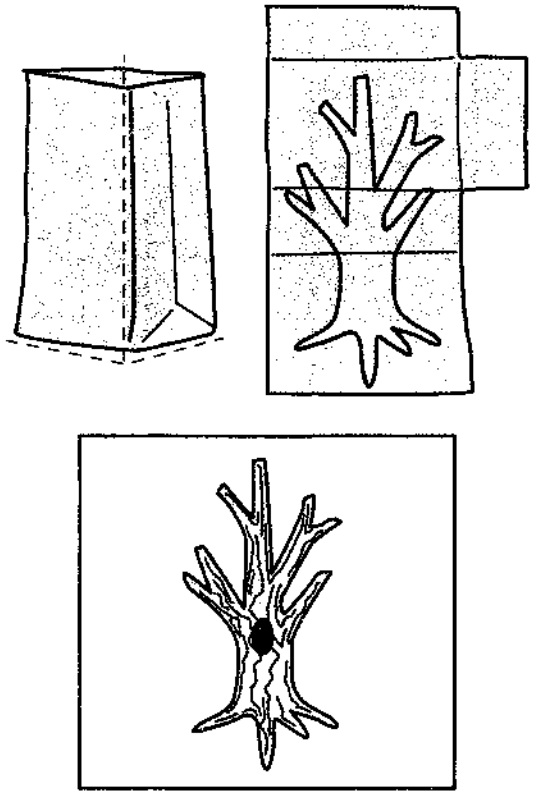
TEXTURED TREES

Open a paper bag (large, medium, or small—depending on the size of the tree you want to construct) and lay flat. Draw the roots, trunk, and branches similar to the following diagram or in your own design:



Add features by coloring in (one suggestion is to draw lines, bark contours, and wildlife holes with a dark marker and then overlay it all with different shades of brown crayons). Cut out and then crumple to give texture. Open up and paste or tape edges down on a piece of construction paper or tag board. (You can "stuff" the inside of the tree to give it more depth.)

Depending on the colors and paper used, many different textured barks can be simulated. This is an excellent discussion starter on the variety of trees that exist and how unique they are, even by the color of their "skins."

Used with permission from Deb Murphy.

BACKYARD MONSTERS!

Gather paper, crayons, scissors, glue, and a sack full of the items you have collected on your nature walks. Turn the imaginations loose and create your own "critters."

Have the children describe them, name them, tell about what they eat and where they live. Then hold an awards ceremony for all of the new creations: the greenest, shortest, tallest, smallest, fiercest, most bashful, etc. All are winners.

LEAF RUBBINGS

Place one leaf at a time under a piece of lightweight construction or typing paper. Show the children how to use the side of a crayon (one of the only times they can delightfully take the paper off of the crayons and get away with it!) to rub out the outline of the leaf underneath. Repeat the process by changing leaves and colors to cover the paper with dramatic effect.

SUN CATCHERS

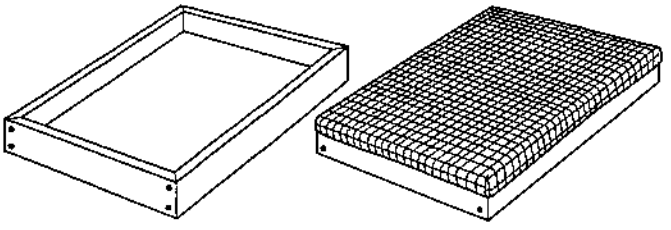
Place gathered leaves on a piece of waxed paper cut to desired size. Use a grater or potato peeler to shave crayon bits and scatter around the leaves. (An equally dramatic effect is to sprinkle glitter on the waxed paper.) Place another piece of waxed paper of equal size on top. Cover with a piece of newspaper and iron with a warm iron. (Depending on the age of the children, this should be supervised or performed only by adults.) Attach a string and hang in the sunshine.

SUN PRINTS

Purchase a solargraphics kit at a nature supply store. Place objects on the special paper, cover with plexiglass, and then expose to the sunlight until the original blue paper turns white. Remove everything and submerge the paper into a shallow dish of water. It will return to its original blue color everywhere except where the leaves were placed; those areas will now be white. The resulting pictures can be very dramatic.

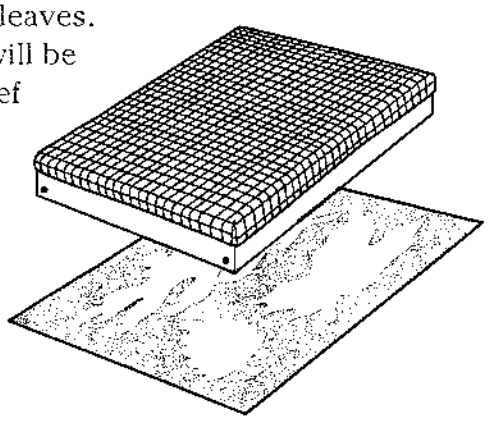
SPLATTER PRINTS

Construct a simple box and attach a piece of screen over it.



Cover working area with newspaper or an old plastic cloth. Place a piece of paper under the screen assembly with your leaf arrangement on it. Using a toothbrush or small paint brush, dip into desired tempera paints and scrape brush over the screen so that the paint is splattered on the paper underneath. (Make sure the children have on old clothes or paint shirts for this one!)

Remove the screen and take off the leaves. The result will be a lovely relief picture of the leaves. (Use more than one color or add glitter for a dramatic effect.)



NATURE COLLAGES

To twigs, leaves, seeds, etc., add markers, color crayons, fabric paints, Elmer's colored glues, water paint. Put on the aprons, pass out the paper, and watch the magic happen.

Any age responds to the beat and rhythm of music, whether listening to it or making it. Try some of the following series for background music during your art activities, guided imagery stories for quiet times, or just beautiful listening.

- Mannheim Steamroller: Any of the Fresh Aire Series.
- Mannheim Steamroller: Yellowstone, The Music of Nature.
- Solitudes: Any of the series. Some combine music with nature sounds. Others are all natural and from different settings (lake, stream, forest, seashore).

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Hill, Katherine E. *Exploring the Natural World with Young Children.* Harcourt, Brace, and Jovanovich, 1976.

National Wildlife Federation. *Trees Are Terrific* issue of *NatureScope,* 1992.

Sisson, Edith A. *Nature with Children of all Ages.* Prentice-Hall, 1982.

The following resources are all children's books. They are marked loosely with a P (Primary), I (Intermediate), or A (Advanced) after each entry to indicate a general level of the information presented. As stated before, any of them are useful at any level because of the easy access to information they present.

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Heartwood

"I stand tall"

Taproot

"I anchor"

Lateral roots

"slurp, slurp"

Sapwood

"we pump, we pump"

Cambium

"we make new cells"

Phloem

"we bring sap around"

Bark

“we protect, we protect”

Bug

“chomp, chomp”

Lawn mower

"varoom, varoom"

Woodpecker

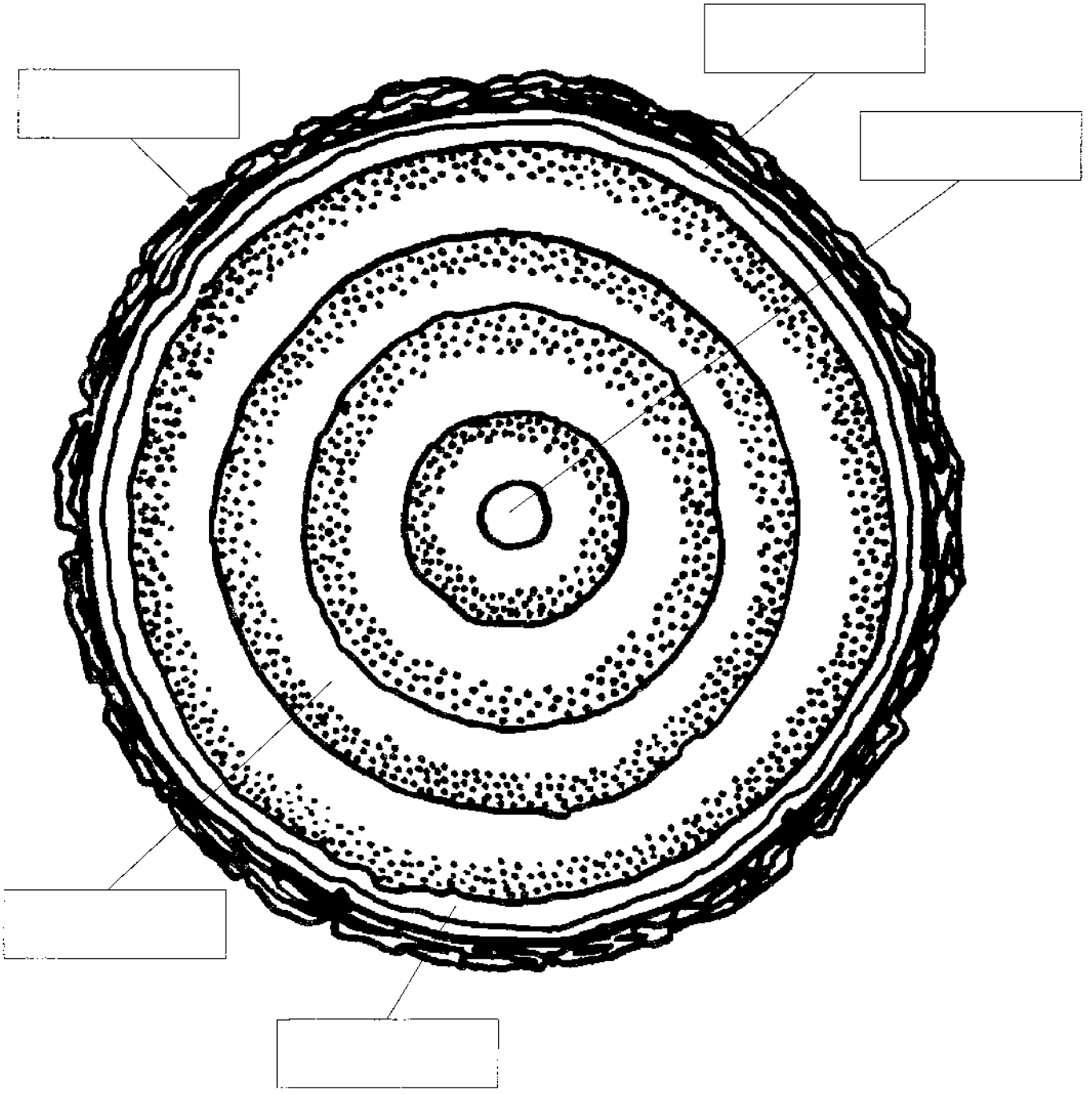
"get the bug"

ACTIVITY SHEET 1A

LEARN THOSE LAYERS

Can you label each layer? The layers you're looking for are:

outer bark
cambium
heartwood
sapwood (or xylem)
phloem (or inner bark)



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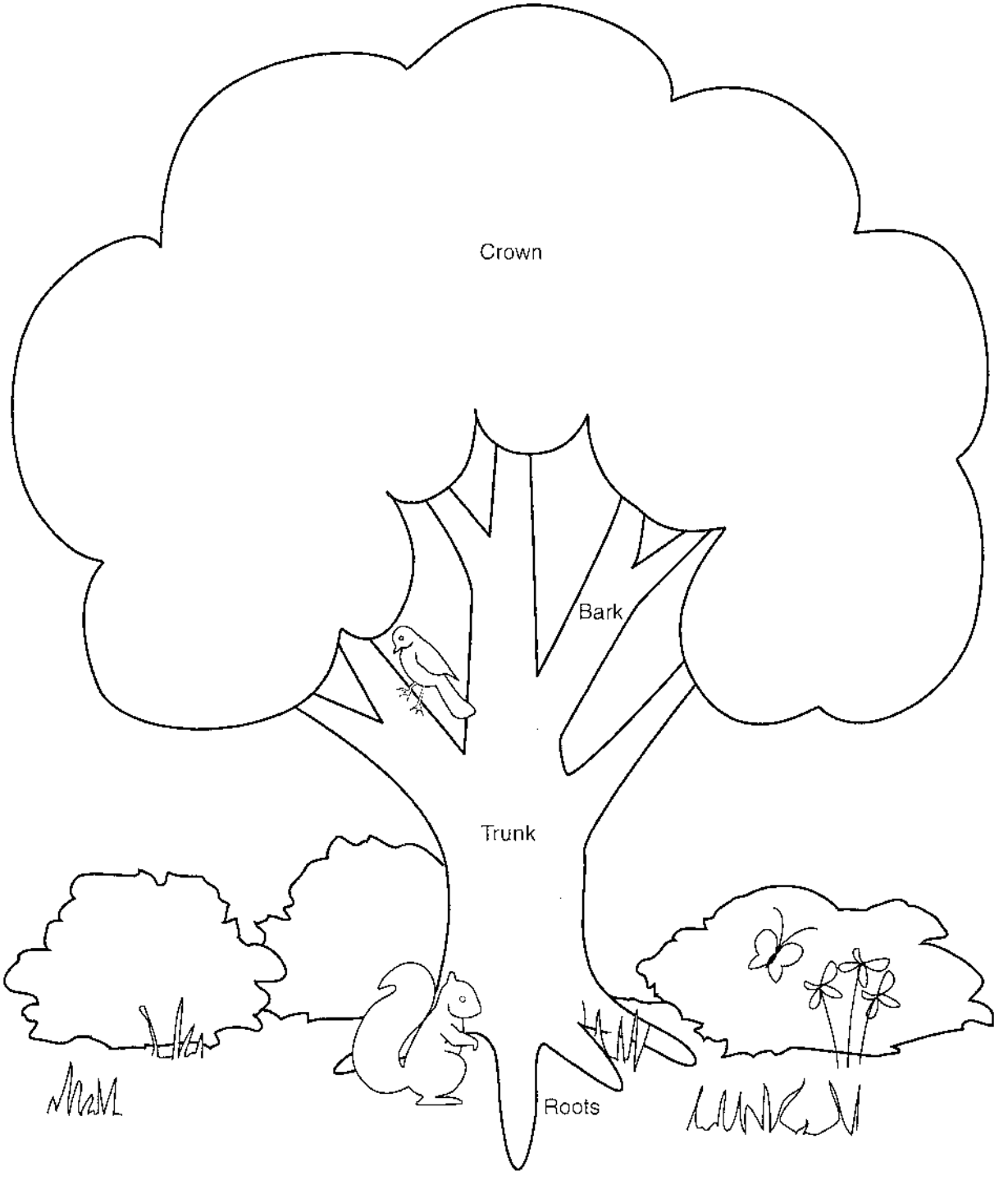
ACTIVITY SHEET 1B

WHAT IS A TREE?

Create a large construction paper tree on the bulletin board. Label the roots, trunk, crown, and bark.

Students participate by adding other things that share a tree's living space: grass, squirrels, birds, mice, woodpeckers, flowers, shrubs, bushes, etc.



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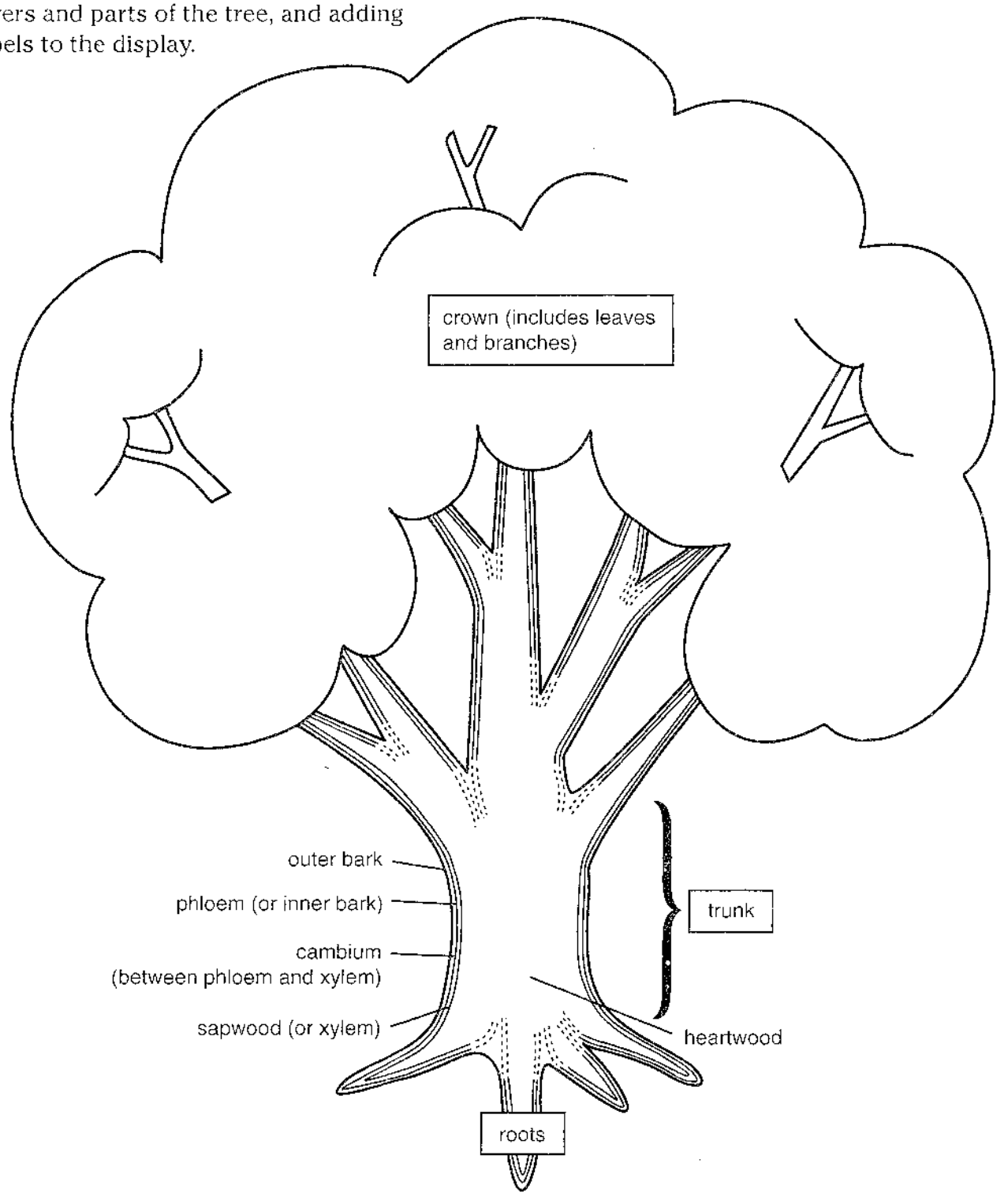
ACTIVITY SHEET 1C

PARTS OF A TREE

Make a large tree cutout (3 1/2 to 4 feet tall). Post on a bulletin board or wall.

Students participate by painting or coloring the tree, drawing in the layers and parts of the tree, and adding labels to the display.



Used with permission from A Teachers' Guide to Arbor Month, *Minnesota Arbor Month Partnership, 1990.*

UNIT TWO:
IT TAKES ALL KINDS—EXPLORING THE DIFFERENT KINDS OF TREES

UNIT TWO DISCOVERIES

Students will be introduced to different kinds of trees (deciduous and coniferous) and their special characteristics. For background see the Introduction and Chapter One in *Where Are All The Trees? A Minnesota Primer.*

KEY

- (P) Primary Students
- (I) Intermediate Students
- (A) Advanced Students

As with any organism, trees come in an endless variety of sizes, shapes, and colors. The environmental conditions of an area (soil, rainfall, temperature, sunlight, etc.) provide the boundaries for the living things that exist there. Those living things have to have adaptations that allow their survival within those boundaries. The activities in this unit are designed to introduce you to more of your Minnesota neighbors and to explore their special characteristics.

Activity 1: Different Shapes, Same Job

(P)

One of the simplest ways to tell trees apart is to see if they have broad leaves (deciduous) or needle leaves (coniferous or evergreen). Deciduous trees lose all of their leaves every year—usually in the fall. Evergreens lose only a portion of their needle leaves during the year, staying green in the winter. Take to the back yard or park and reintroduce yourself to your old friends. (If leaf collections are not available because of seasonal restrictions, use the Minnesota species identification sheets available in Unit Four. Also, the pictures on Activity Sheets 2A-2F at the end of this unit can helpful.)

Use your leaf collection from Unit One or collect new specimens to use as a basis of classification. Make two lists; one for deciduous and one for evergreen. Divide your leaf collection into the two basic groups. Then sort again using the pictures of the Minnesota species provided in Unit Four.

"Discovery consists in seeing what
everybody else has seen
and thinking what nobody else has thought."

—Albert Szent-Gyorgyi

I A

The shape of the leaf, its size and color, how many leaves there are on a stem, and how they are arranged are all ways of telling trees apart. A leaf key can help you sort leaves and identify the tree they came from. Using Activity Sheet 2G at the end of the unit, try to identify each of the leaves listed on Activity Sheet 2H.

The key gives you two choices each step of the way. At each step, make a choice between the two and go to the step it directs you to until you reach an identification based on the clues given. (This particular key is called a dichotomous key because it is based on the process of choosing between two characteristics.)

Pick up a leaf key at the library or use the summer key in Extension Bulletin NR-BU-0486 *Minnesota's Forest Trees* (see bibliography), and see how far you can get keying the leaves of the Minnesota species listed in Unit Four.

Activity 2: Stand Tall and Shape Up!

Another way to tell trees apart is to look at their shape. There are characteristic styles of branching that belong to each species and give them their own particular shape. Trunks of most evergreens grow straight 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 a "Christmas tree" shape. The trunks of most broadleaf trees do not reach to the top of the tree. Instead, the trunk divides into spreading branches, giving just the crown a unique (for example, rounded) shape.

P

Activity Sheet 2I shows how similar tree shapes can be to geometric shapes. Practice on the trees pictured on the sheet and then return to your back yard or park. Divide the trees up according to which shape—round, square, and triangle—they resemble the most.

Look at the tree shapes on the Minnesota species identification pages in Unit Four. Divide them up into groups based on their shapes.

I A

Minnesota winters provide a wonderful opportunity to learn about the different branching arrangements of trees. Just as the leaf arrangement on the twig helps to identify the leaf and tree, so does the branching out from the trunk. Following are examples of three different styles:

1. Whorl pattern: pine, fir, spruce
2. Opposite pattern: maple, ash, dogwood
3. Alternate pattern: alder, oak, cottonwood.

To see how these different branch arrangements define the tree shape, look at Activity Sheets 2C-2F and study the silhouette outlines given for each tree listed.

P

It's time to return to your backyard friends and observe their branching patterns. Develop a simple classification method based on the kinds of trees you have available. Then proceed to organize and categorize your trees based on your list.

I A

If you have a twig collection, use it now to note how the twig patterns of each of your trees compare to their branching patterns. If you didn't make a twig collection in Unit One, now would be a good time to do so. Remember to be a "Good Naturalist"—pick up the twigs from the ground and disturb the living organisms as little as possible.

Where are the buds on the twig and how are they arranged? What color and size is the twig? Locate leaf scars from old leaves. The bud arrangement helps managers and foresters identify trees in the winter and spring when that is all they have to go by.

Make "families" of trees based on their branching patterns. Find the biggest "family" in your neighborhood.

Using the Minnesota species identification pages in Unit Four, see how many twig and branching patterns you can identify and group.

Used with permission from Project Learning Tree.

Editor's note: An excellent source of a summer and winter key for identification is Extension Bulletin NR-BU-0486, *Minnesota's Forest Trees.* The summer key uses leaves and the winter key uses twig and bud characteristics. Also, the booklet has excellent drawings of 46 of the state's most common forest and windbreak trees. See the bibliography at the end of the unit for more information.

Activity 3: What's in a Fruit?

Another way to identify trees is by looking at the way they make new trees—what kind of seed or fruit does the tree produce? There are two main categories. Gymnosperms have "naked" seeds. The seeds are not enclosed in a fruit. Instead, they are produced on the scales of a female cone. Most coniferous trees are gymnosperms. Angiosperms have flowers and their seeds wind up in the fruits of those flowers (apples, maple "helicopters," acorns, etc.).

P

It's time to go back outdoors and collect seeds or use what you collected in Unit One. Divide the seeds into cones and fruits. How many different cone trees are represented? How many different flowering tree seeds did you find?

Use a shoe box, tissue box, or paper bag to make a touch-feel box with the cones, seeds, and twigs you collected. How many things can you identify by just feeling?

I A

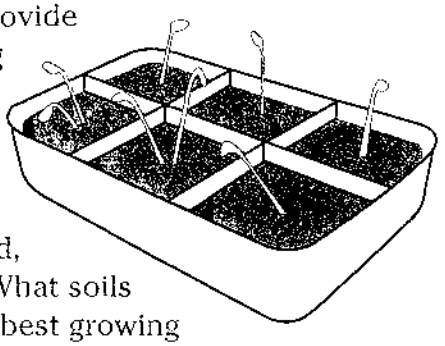
Collect seeds and identify the trees from which they came. Activity Sheets 2A-2E or Extension Bulletin NR-BU-0486, *Minnesota's Forest Trees,* can be helpful here. If you are not familiar with some of the trees in your area and a key is not available, introduce the young naturalists to the use of the library and books that can help them with their search. Never miss an opportunity to help them learn how to find out about something they don't know by using the resources available to them.

Make a display case or exhibit combining all you now know about your tree neighbors: name, leaf structure, bark characteristics, branching and twig styles, and seed type.

After looking at your own tree neighbors, use the Minnesota species identification pages in Unit Four to learn about seeds and trees not common to your area.

P I A

Remember that the purpose of seed is to perpetuate the species. To do this conditions must be right. Do some of the following experiments with a variety of seeds to see which factors provide the best growing conditions.



1. Plant the same seeds in a variety of soils: sand, loam, clay. What soils provide the best growing medium?
2. Plant two trays of seedlings. Put one in a dark room (closet) and keep one in the daylight. Water both the same and be sure to plant both sets in the same soil type. See what difference the amount of light makes on the growth of the seedlings.
3. Plant identical trays of seedlings and measure and vary the amount of water you give each.

Reprinted with permission of G. P. Putnam's Sons from Experimenting with Seeds and Plants, *Ware Budlong and Mark H. Fleitzer, ©1970.*

I A

Animals and humans benefit from plant and tree seeds—we love to eat them! See how many seeds you can find in the cryptogram on Activity Sheet 2J.

"Nature is the living, visible garment of God."

—Johann Wolfgang von Goethe

Activity 4: Nature Detectives—Scavenger Hunt

P I A

By now your young naturalists should be getting pretty familiar with their backyard neighbors. To help them proudly display and use their new found knowledge, develop a scavenger hunt list appropriate to their level. Make sure it includes items from all of the areas they have learned about: leaves, twigs, seeds, bark. Check the game area prior to the activity for safety and availability of the materials. Pass out the list of items, remind the children of the "Good Naturalist" code, and turn them loose to have a wonderful time. As always, save the collections for art activities.

Activity 5: Dining with the Neighbors

P I A

Ask the children to "forage" at home for things to eat that are provided by our neighbors, the trees. Or go on a field trip to the store and treasure hunt your way through for "tree goodies." Gather the booty (apples, oranges, plums, peaches, maple syrup, walnuts, almonds, chestnuts, pecans, fruit juices, etc.). Discuss the different foods. Talk about primitive people or American Indians and pioneers—how important was it for them to be able to find food in the forest? After your discussions, have a hearty, healthy snack, compliments of the "neighbors"!

LACY LEAF FINGERS (PRINTING WITH INK)

A dramatic way to add variety to your leaf collection is to do ink prints of each specimen you collect. After pressing your leaves, place the underside (veined side) of the leaf on a stamp pad. Cover with a newspaper to keep your hands clean and press down firmly to cover the stem, veins, and margin with ink. If the leaf is too big, move it around until the whole bottom is covered. Place the leaf carefully on a piece of white paper, cover with a CLEAN newspaper, and press. Remove newspaper and leaf carefully and add your "lacy" fingers to your collection.

Adapted with permission of Minnesota Extension Service, University of Minnesota, from Minnesota's Forest Trees, *NR-BU-0486, revised 1989.*

IN THE DOUGH!

Using the following recipes for playdough or salt dough, let the children mold their own trees and leaves. As a variation, let them make a print in the dough with a leaf, twig, or seed. Set aside and allow the playdough to dry or bake the salt dough. Allow the children to paint their creations.

PLAYDOUGH

3 cups flour
1/2 cup salt
3 Tbsp. cooking oil
1 Tbsp. alum
2 cups boiling water
food coloring

Boil the water and add the food color to it. Mix remaining ingredients in large bowl. Add the hot water (this step should be done only by the adults present to prevent accidents) and mix only until everything is moistened and cool enough to turn out on the table and knead. Knead until smooth (this step can be done by the children as the dough cools very quickly). The food color can also be added in after the dough is mixed. When done using, store in a plastic bag inside a closed container.

SALT DOUGH

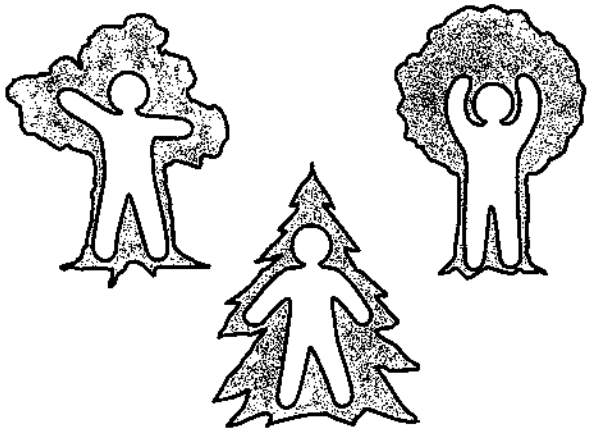
2 cups flour
1 cup salt
1/2 cup water
2 Tbsp. cooking oil
food coloring

Mix all ingredients and knead until a soft, pliable ball forms. Keep hands floured to prevent sticking. Color with food color (this can be added to the water before all the ingredients are mixed) and shape. Bake on an aluminum cookie sheet at 300° for at least one hour or until shapes are hard.

Fossilized prints of leaves, twigs, and seeds have long been used as clues to help identify the plant species of the past. Using clay or playdough, have the students make impressions and then plaster casts of their specimens. (Follow the directions in Activity 7 in Unit One.) The students can make a whole set of casts for their trees: bark, twig, leaf. These casts can also be used for some of the matching games in the activities.

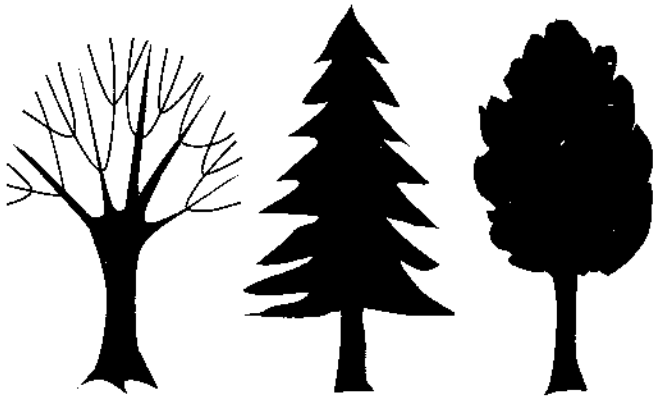
SHAPELY PICTURES

Give children pieces of paper large enough to lie down on. Ask them to shape their legs and arms into the outline of their adopted or favorite tree. Broadly trace the outline of the shape around them. See examples below. Have them color or paint in their "tree."



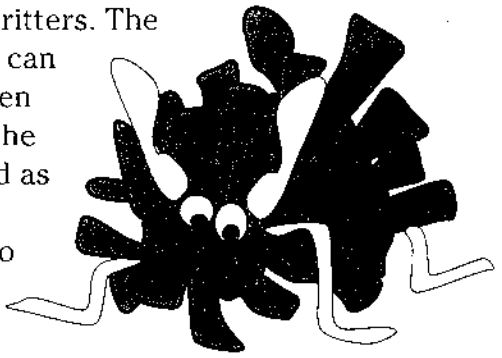
SILHOUETTES

Give the children large pieces of heavy art paper, black paint, and brushes. Ask them to paint in silhouette (outline only) pictures of the trees in their area. From the lacy fingers of bare winter branches reaching into the winter sky to the full-bodied shapes of the summer foliage, the pictures can be dramatic and poetic. See examples below.



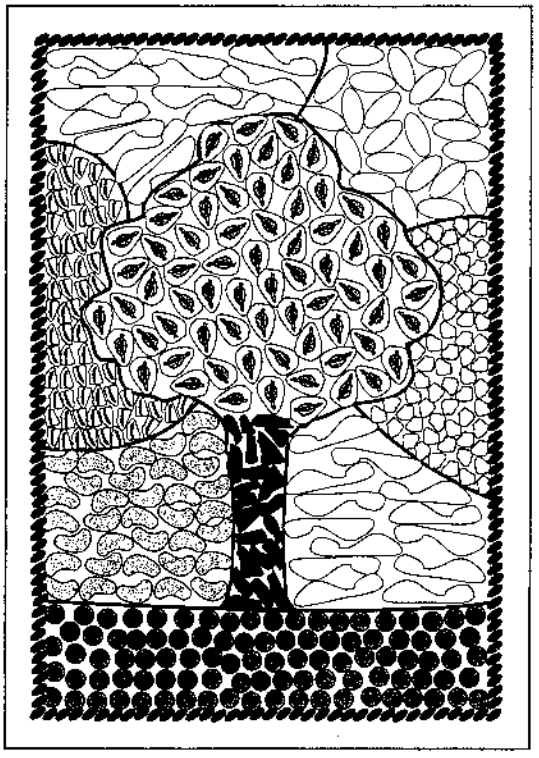
PINE CONE CRITTERS

Using whole pine cones, add paper, pipe cleaners, twigs, grass, etc., to make interesting imaginary backyard critters. The pine cones can also be taken apart and the pieces used as interesting additions to other art projects.



"STAINED GLASS" SEED PICTURES

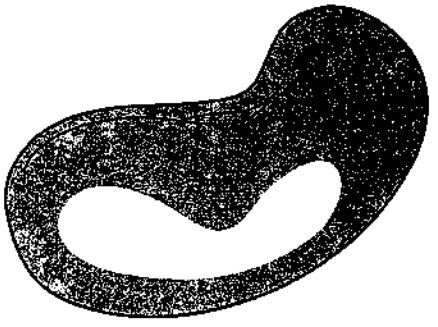
Gather a variety of seeds both collected (acorns, maple seeds, elm seeds, pine cones, flower seeds, etc.) and bought (corn, beans, peas, sunflower seeds, etc.). Draw a simple picture of a forest animal or bird or tree. Then glue the different seeds in place to make a "stained glass" seed picture. See example below.



NATURE'S MUSIC

1. "I'm a Little Sprout"

Combining movement and music is a wonderful way to reinforce ideas. Using the seed pattern below, make enough seeds for all of your young participants. Making them out of tagboard or laminating them will help them last longer. Pass them out and to the melody of "I'm a Little Teapot," sing and act out the song, "I'm a Little Sprout."



"I'm a Little Sprout!"

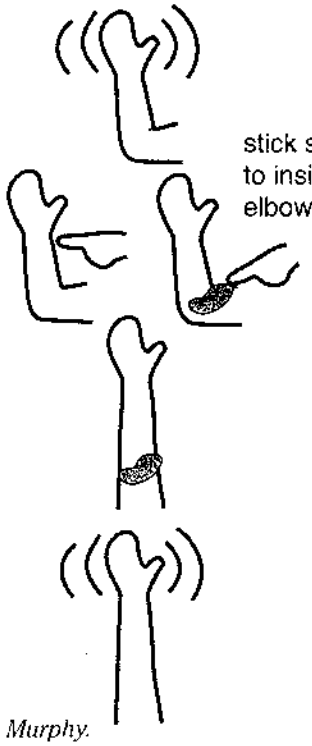
I'm a little plant
so bright and green.

stick seed
to inside of
elbow

Here is my stem
and here is my seed.

When I get so big I
poke right out.

Then I become a
"Little Sprout!"



Used with permission from Deb Murphy.

2. Magic Mood Music

Go back to any of the music selections in Unit One (page 16) or pick from the following list or use any of your personal favorites. Ask the children to listen to the music first. Then re-play it as they act it out, draw it out, or write a short story or poem about what images the music sparks in their imaginations.

"Appalachian Spring" *by Aaron Copland*

"Peter and the Wolf" *by Prokofiev*

"A Walk in the Black Forest" *by Horst Jankowski*

"William Tell Overture" *by Rossini*

"Thunder and Lightning" *polka by Johann Strauss*

"The Nutcracker Suite" *by Tchaikovsky*

"Woodland Sketches" *by MacDowell*

"Finlandia" *by Sibelius*

"Grand Canyon Suite" *by Ferde Grofe*

"Symphony No. 6" *by Beethoven*

"Rocky Mountain High" *by John Denver*

Used with permission from Project Learning Tree.

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General resources for sharing nature with young people:

Bowden, Marcia. *Nature for the Very Young: A Handbook of Indoor and Outdoor Activities.* Wiley, 1989.

Katz, Adrienne. *Naturewatch: Exploring Nature with Your Children.* Addison-Wesley Publishing Company, 1986.

Special selection: The following book belongs in every unit. Introduce it and use it often—the message is important.

Silverstein, Shel. *The Giving Tree.* Harper & Row, 1964.

The following resources are general guides to identification. They are loosely marked with a P (Primary), I (Intermediate), or A (Advanced) to indicate a general level of the information presented. All are excellent references.

Collingwood, G. H. and Warren D. Brush. *Knowing Your Trees.* The American Forestry Association, 1978. (P, I, A)

Elementary Science Study. *Teacher's Guide for Budding Twigs.* Webster Division, McGraw-Hill, 1970. (I, A)

Minnesota Department of Natural Resources, Division of Forestry. *Trees of Minnesota.* (I, A)

Symonds, George W. D. *The Tree Identification Book.* M. Barrows, 1958. (P, I, A). Excellent!

Wiggers, Ray. *Picture Guide to Tree Leaves.* F. Watts, 1991. (I, A)

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Coats, Laura Jane. *The Oak Tree.* Macmillan Publishing Company, 1987. (P)

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Scholten, Harold. *Minnesota's Forest Trees* (NR-BU-0486). Minnesota Extension Service, University of Minnesota, Natural Resources, 1989. (I, A)

Selsam, Millicent. *Tree Flowers.* W. Morrow, 1984. (P, I, A). Excellent!

Simon, Seymour. *A Tree on your Street.* Holiday House, 1973. (I, A)

Sullivan, George. *Trees.* Follett Publishing Company, 1970. (P, I)

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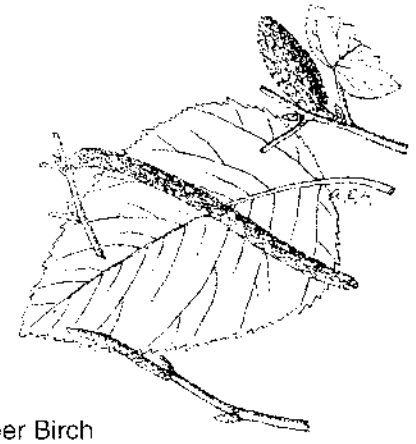
ACTIVITY SHEET 2A

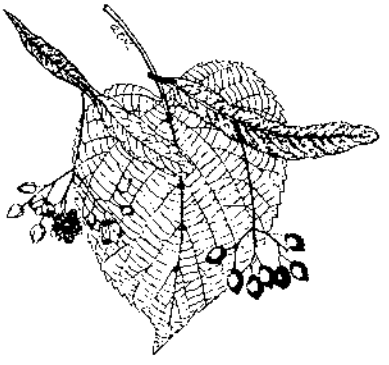
LEAVES AND SEEDS



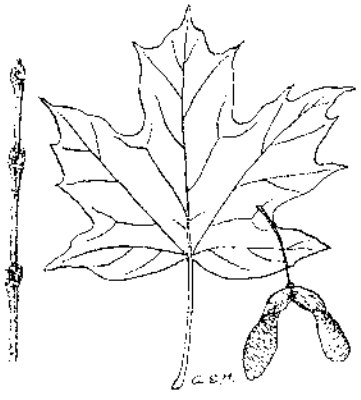
Paper Birch

Green Ash

Quaking Aspen



Basswood



Sugar Maple

Bur Oak

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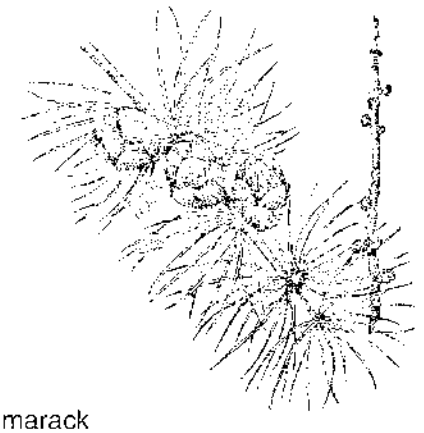
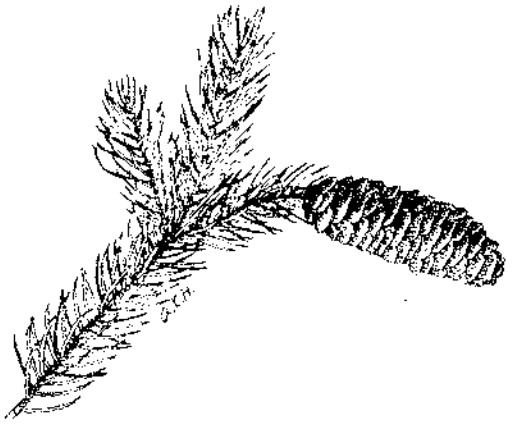
ACTIVITY SHEET 2B

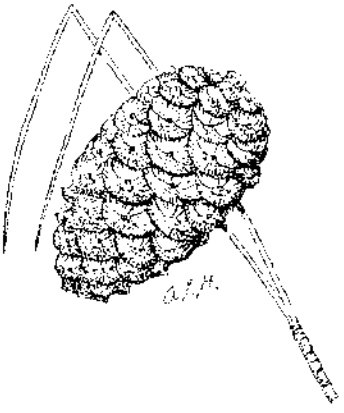
LEAVES AND SEEDS



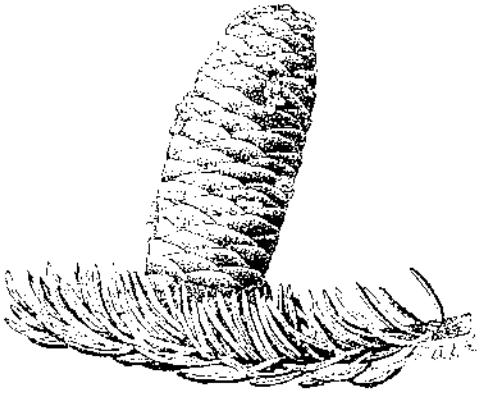
Tamarack



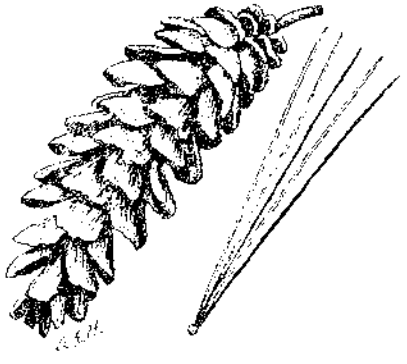
White Spruce



Red (Norway) Pine (Minnesota's State Tree)



Balsam Fir



White Pine

White Cedar

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ACTIVITY SHEET 2C

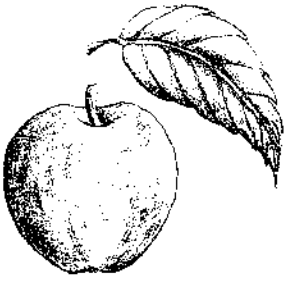
TREE SHAPES, LEAVES, AND SEEDS

Make a copy of these puzzles for each group. Grades K-2 use puzzles A-D only (letters are on back of puzzle pieces); Grades 3 and up use all puzzles.

For sturdier puzzles, mount these sheets to tagboard before cutting apart. Print self-check code letters on the back of each piece, then laminate if desired.

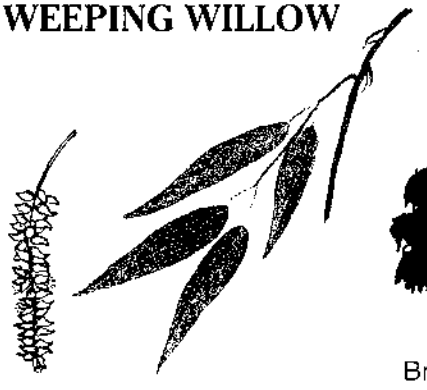
Each group picks a leader. The "leader" shuffles and spreads the puzzle pieces. Group members work together to match the tree with its leaves and silhouette form. When everyone is satisfied that the puzzles are correctly matched, the "leader" turns them over. Matching alphabet code letters mean a correct answer. Everyone in the group studies the matched puzzle pieces and shares ideas about how to remember the shape of each tree.

APPLE



Broadly Globe-Shaped (Rounded)

WEEPING WILLOW



Broadly Weeping

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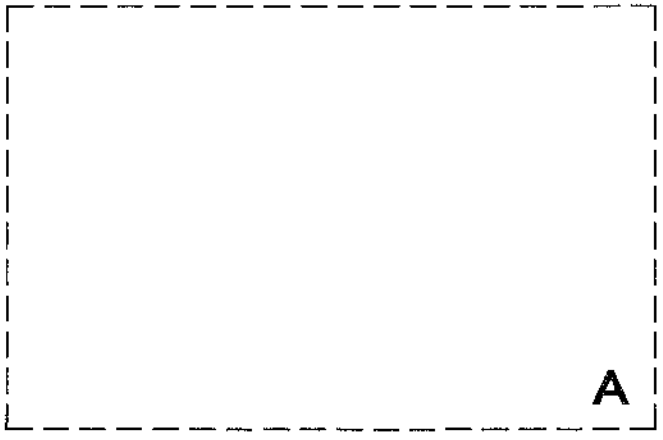
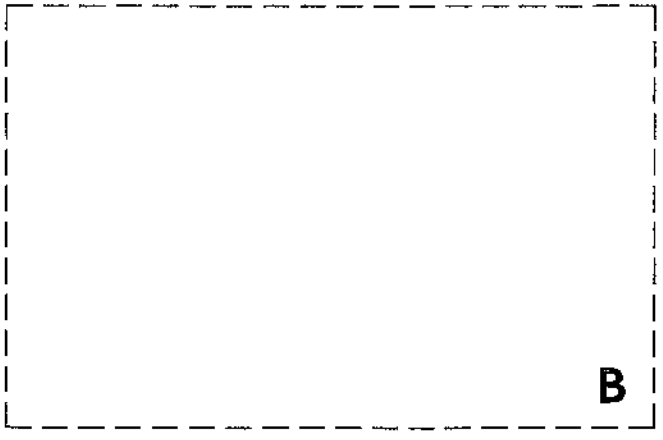

A


A


B


B

ACTIVITY SHEET 2D

TREE SHAPES, LEAVES, AND SEEDS

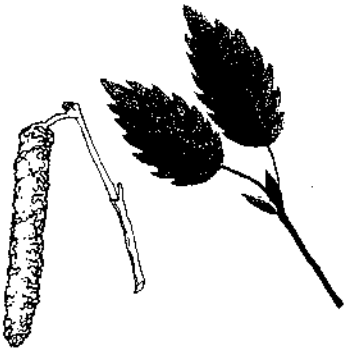
WHITE SPRUCE

Cone

RED (NORWAY) PINE

Pyramid

PAPER BIRCH



Moderately Oval

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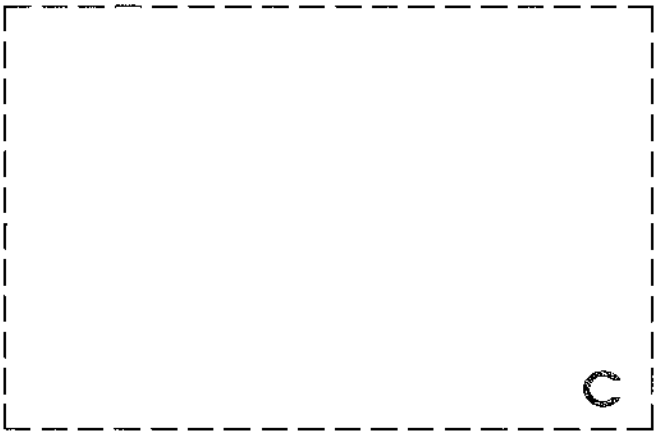
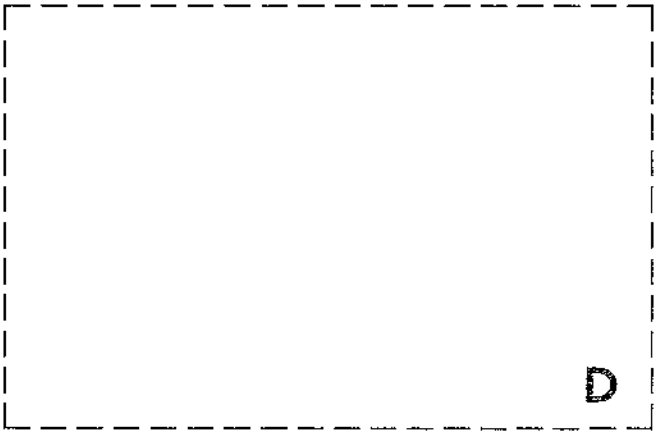
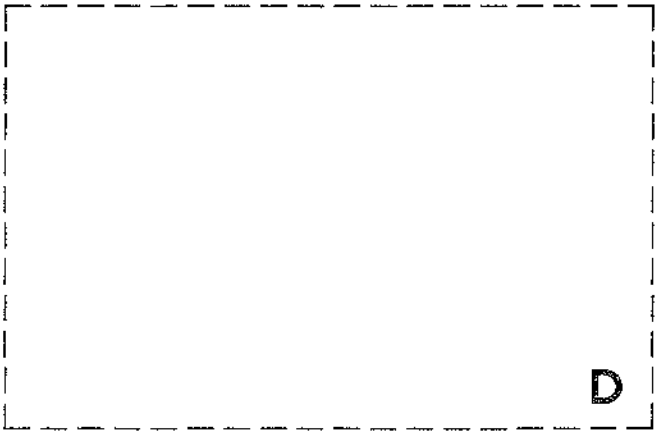
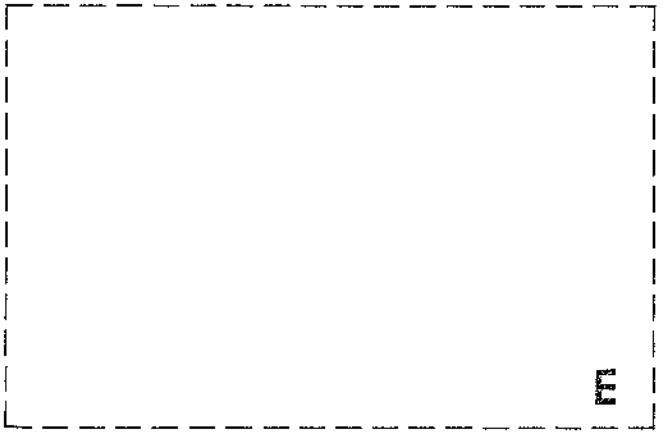

C


C


D


D


E


E

ACTIVITY SHEET 2E

TREE SHAPES, LEAVES, AND SEEDS

AMERICAN ELM

Broadly Vased-Shaped

BUR OAK

Broadly Globe-Shaped (Rounded)

RED MAPLE

Broadly Globe-Shaped (Rounded)

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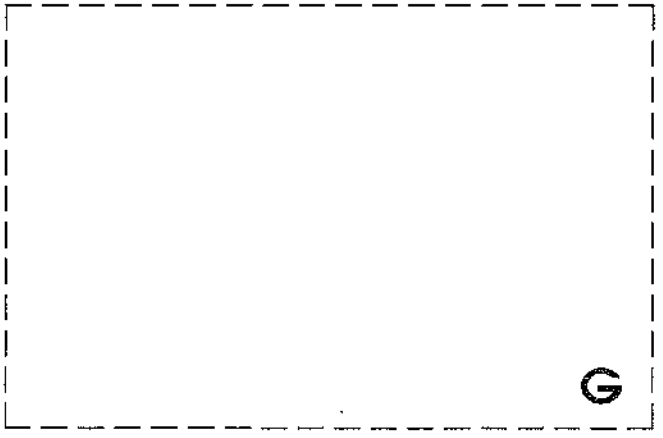
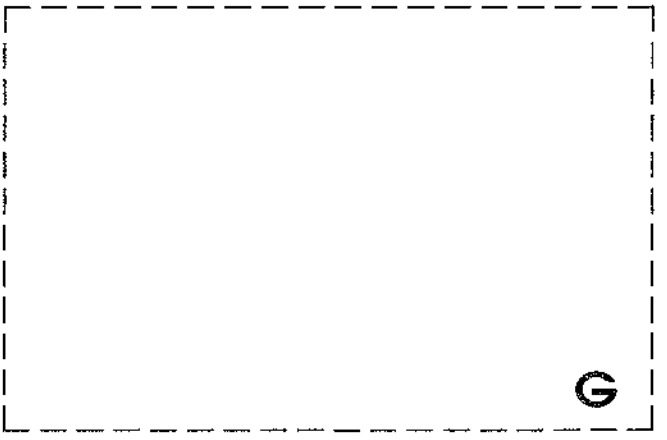
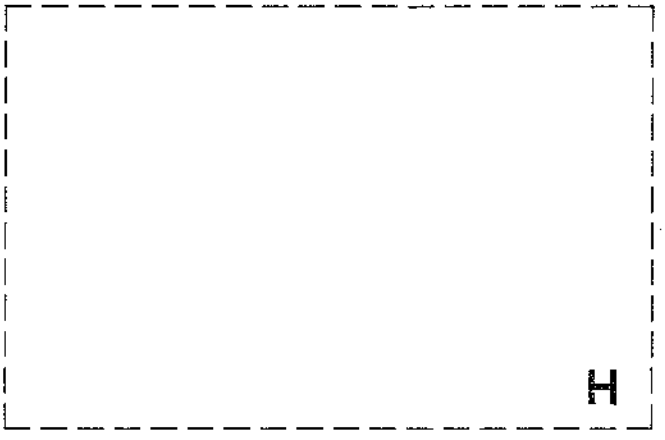
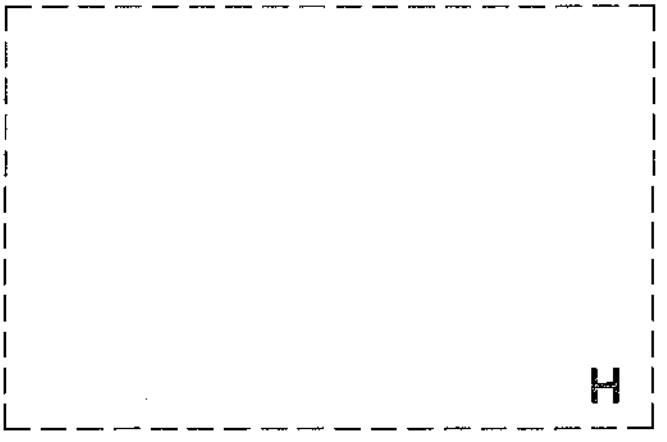
F


F


G


G


H


H

ACTIVITY SHEET 2F

TREE SHAPE MATCH-UP

Can you identify each tree shape? (If you need help, do the puzzle game on Activity Sheets 2C-2E.) Match the letter of the tree name to its correct shape. See answers below.

1.____

2.____

3.____

4.____

5.____

6.____

7.____

8.____

A. Weeping Willow

B. White Spruce

C. Red (Norway) Pine

D. Paper Birch

E. American Elm

F. Bur Oak

G. Red Maple

H. Apple

Answers:

1. D. Paper Birch
2. E. American Elm
3. F. Bur Oak
4. B. White Spruce
5. G. Red Maple
6. A. Weeping Willow
7. C. Red (Norway) Pine
8. H. Apple

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ACTIVITY SHEET 2G

KEYING OUT TREES

Use this key to help you identify the leaves on Activity Sheet 2H.

LEAF KEY

1. Leaves are shaped like needles ..... go to 2
   Leaves are broad and flat ..... go to 3

2. Long needles grow in bunches of five ..... WHITE PINE
   Needles are short and grow singly along the branch ..... SITKA SPRUCE

3. Leaves are **opposite** ..... go to 4
   Leaves are **alternate** ..... go to 5

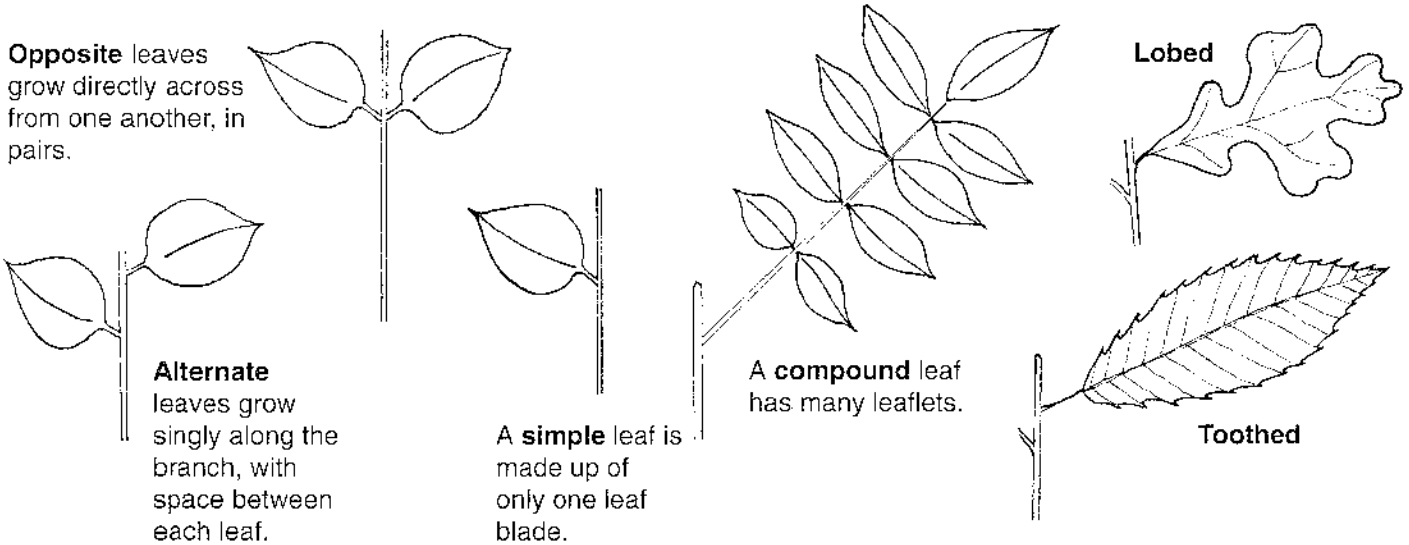
4. Leaves are **simple** ..... SILVER MAPLE
   Leaves are **compound.** Leaflets grow around the stem in a circle ....HORSE CHESTNUT

5. Leaves are **simple** ..... go to 6
   Leaves are **compound** ..... go to 8

6. Leaves are **lobed** ..... WHITE OAK
   Leaves are **toothed** ..... go to 7

7. Leaves are long and slender ..... WEEPING WILLOW
   Leaves are rounded ..... CHOKE CHERRY

8. Branches have thorns ..... HONEY LOCUST
   Leaflets are **toothed** ..... BLACK WALNUT



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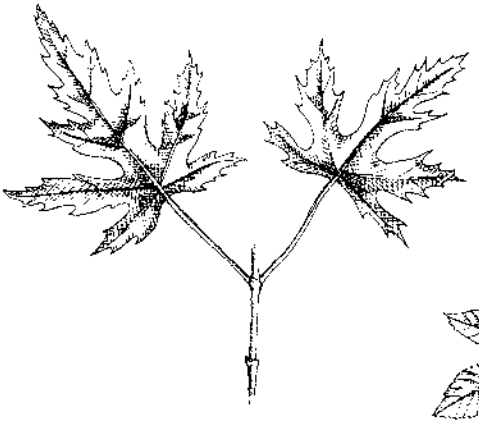
ACTIVITY SHEET 2H

KEYING OUT TREES

Use the key on Activity Sheet 2G to help you identify these leaves. See answers below.



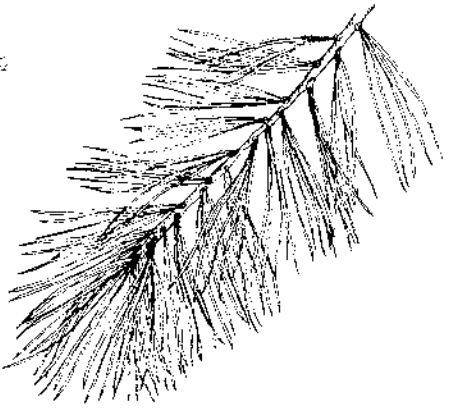
1. _____

2. _____

3. _____

4. _____

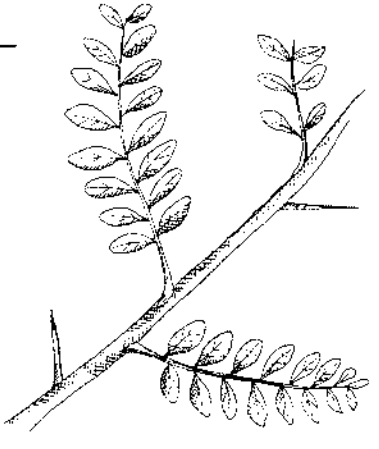
5. _____



6. _____

7. _____

8. _____



9. _____

Answers: 1. Silver Maple, 2. Horse Chestnut, 3. Black Walnut, 4. White Oak, 5. Weeping Willow, 6. White Pine, 7. Sitka Spruce, 8. Choke Cherry, 9. Honey Locust

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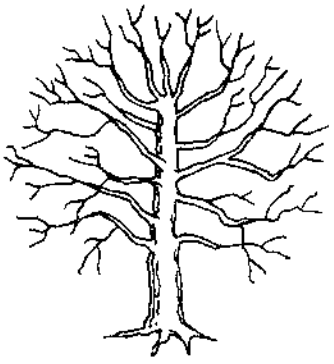
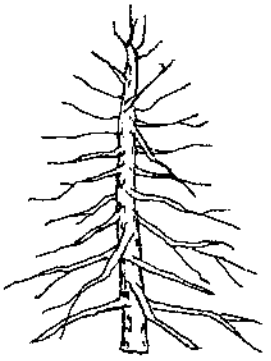
ACTIVITY SHEET 21

EXPLORE TREE SHAPES

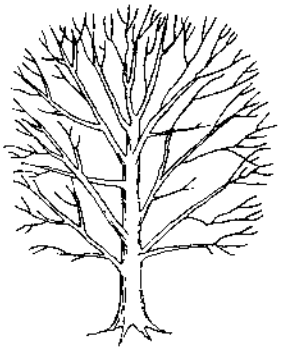
Cut out the shapes below and paste them on a tree that matches each shape.



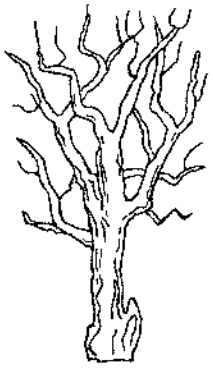
OAK



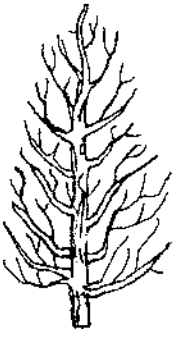
SPRUCE



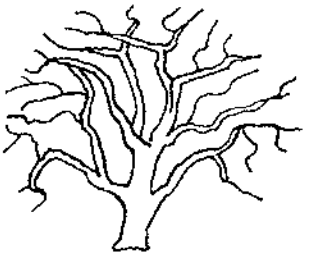
MAPLE



CYPRESS



CEDAR



CRAB APPLE

round	square	triangle

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ACTIVITY SHEET 2J

WHAT'S IN A FRUIT—SEED SEARCH

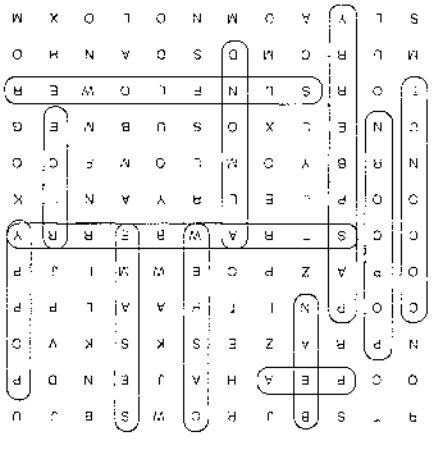
How many plants can you name whose seeds are often eaten by humans? Check out the puzzle below. Names are up and down and across. Did you find all 12?

R	T	S	B	J	R	C	W	S	B	J	U
O	C	P	E	A	H	A	J	E	N	D	P
N	P	R	A	Z	E	S	K	S	K	V	O
C	O	R	N	I	T	H	A	A	L	P	P
O	P	A	Z	P	C	E	W	M	I	J	P
C	C	S	T	R	A	W	B	E	R	R	Y
O	O	P	L	E	L	R	Y	A	N	I	K
N	R	B	Y	O	M	L	O	M	F	C	O
U	N	E	L	X	O	S	U	B	M	E	G
T	O	R	S	U	N	F	L	O	W	E	R
M	U	R	C	M	D	S	D	A	N	H	O
S	L	Y	A	D	M	N	O	L	O	X	M

Look for these seeds:

ALMOND	CASHEW	PEA	POPPY	RICE	STRAWBERRY
BEAN	COCONUT	POPCORN	RASPBERRY	SESAME	SUNFLOWER

Answers:



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UNIT THREE: WHAT IS A FOREST?

UNIT THREE DISCOVERIES

Students will be introduced to a forest and start to explore how all the living things that are a part of it (plant, animal, people, etc.) relate to each other. For background see the Introduction and Chapters Two, Three, and Four in *Where Are All The Trees? A Minnesota Primer.*

KEY

- (P) Primary Students
- (I) Intermediate Students
- (A) Advanced Students

Living things on their own have a natural life cycle. Grouped together, they become part of an intricate, connected web that also has a delicate cycle of its own. A forest, whether in the city park or covering acres of the countryside, is a unique group of living and non-living things that are interdependent. To learn more about this forest ecosystem, find a safe forested area near you. Get permission to be there if it is private land, check it out first before you bring the children and let's go...

"If you would know strength and patience, welcome the company of trees."

—Hal Borland

Activity 1: Into the Woods

(P) (I) (A)

There is nothing like walking out of the sunlight into the instant shade and coolness of a wooded area: the smell of damp earth, the sound of the wind in the leaves above, the animal sounds. Just let the children SENSE for a while and start to drink in the differences between this forest home and the home they just came from. What lives here?

Observe the trees. What kinds of trees are there? (Call up the identification skills practiced in Unit Two.) How big are the trees—are they old or young? Are the trees healthy, sick, or dead?

Look at the understory—what kinds of saplings are present? Are there flowers or bushes? How thick is the undercover?

Can you tell if the forest developed by itself? Or is there evidence that people have planted it, harvested it, or changed it in any way?

Editor's note: Due to travel restrictions or availability, it may not be possible to actually take the children to a forested area. Don't let that stop you from introducing them to this wonderful environment. Use any of the books in the bibliography to take them on an "imaginary" hike.

Back home or in the classroom, have the children jot down their observations and speculations about what they saw. Then contact a naturalist or park ranger for the area or your local extension or forestry office. Find out the real story about the forest you are studying.

Activity 2: Rock Bottom Story

P I A

Unless you are observing a reforested area, the vegetation took a long time to develop to its present state and was influenced by many factors. Our part of the country, like any other, has a unique "base" story. The stones and rock (for example, sandstone, limestone, granite) formed so long ago provide the contour base upon which the soil and vegetation exist. Their shape and height (dish, mound, smooth, jagged) dictate their ability to hold stable vegetation groups. Again, go back to your forest to get the rock bottom story.

Walk the area. Is there high ground, low areas? Note the different plants that grow in the different areas. Are there areas of bare rock? Are there areas (for example, a river bank, cut away hillside or roadside) where you can find out how far below the surface soil the bedrock is?

Take different shaped objects (shallow and deep dishes, plastic glasses, toy pails). Try putting soil into them or around the outside of them. What holds the soil in place? How can you get the soil to stick to the sides of the artificial "hills" you have made?

Activity 3: Hold That Soil!

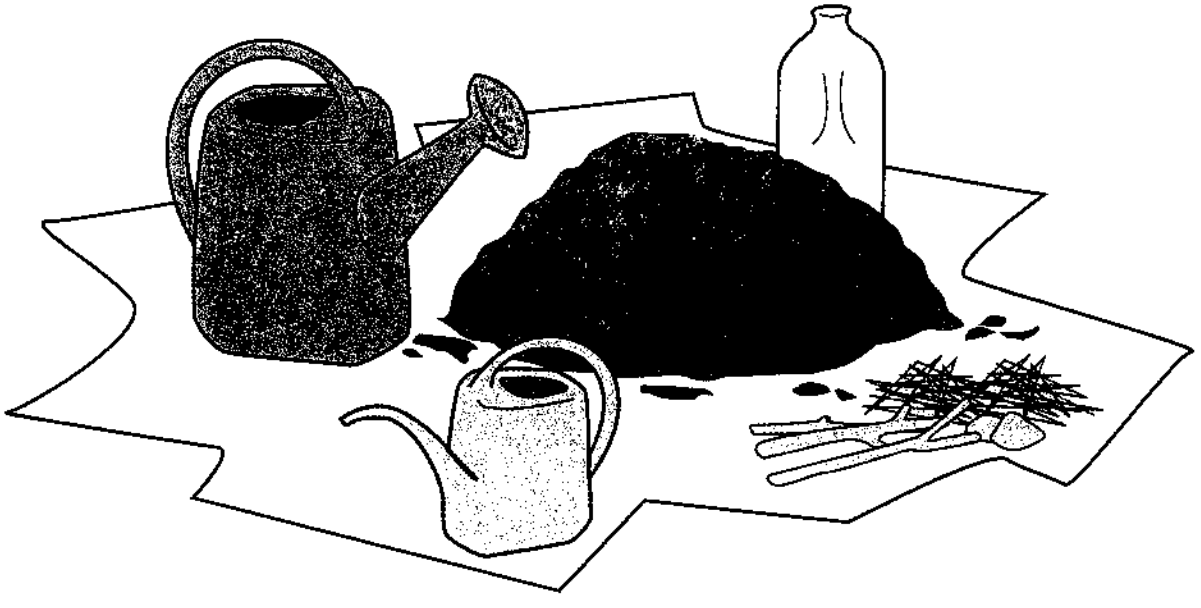
P I A

Gather soil, a large pan, and watering cans. Spread newspaper or a large piece of plastic. In the pan make a mound of soil or just a graded slope. Using different watering cans, (gentle spray, heavy downpour) water the pan and watch what happens to the soil. Does it wash away? Do gullies form?

Remake the hill or slope. (Have enough soil to do each experiment with fresh, dry soil.) This time, add grass, net, sticks, etc., to form ground cover. Repeat the watering procedure and see what happens when there is something to break the water's force and hold the soil.

For older groups, vary and mix the soil types (sandy, humus or organic, clay) to add another variable to the experiment. Which types are affected the most by runoff?

These experiments help the children understand the value of ground cover of all kinds. Grass, bushes, and trees all help hold the soil in place over the bedrock, thus performing an invaluable service to themselves and us.



Speaking of soil, where does this stuff come from? Within the living web of the forest, organisms live, die, and decompose. This process of the breakdown of organic matter guarantees the recycling of materials and energy and creates the soil build-up so crucial to sustain the delicate ecosystem. The following activities look at some of those processes and the organisms involved.

Activity 4: Producer-Consumer-Decomposer Game

P

The children are going to become the components of the forest life cycle orchestra. Divide them into three equal groups as follows:

Producers: The producers represent the plant life, the stable base of the food chain. Tell them most of the living things in the forest eat the plant life. Have them put the palms of their hands together in front of them and raise them above their heads, pulling them apart in a fanning motion. While they do this, they can sing or chant: "Produce! Produce!"

Consumers: The consumers are organisms that eat the producers (the plants!). They can move their arms as if they are trying to grab something in front of them while they say: "Consume! Consume!"

Decomposers: The decomposers are the small microorganisms, bacteria, fungi, and insects that break down the producers and consumers when they die. This process turns them back into soil and releases their nutrients to be used once more. (This is an important job, but it might take some convincing for your little "muncher crunchers.") They are to wiggle their fingers in front of their faces and growl, "Munch-a-crunch, Munch-a-crunch!"

Now you have the whole orchestra in place. Help them practice their parts separately, always explaining how important each is. Then turn them loose together to sound out and act out a busy forest cycle, seeking and using the components they need.

Activity 5: Five-Year-Old "Leaf" Hunt

I A

Take the group to your yard or any area with leaf litter. Send the children out to find a new leaf. (Make sure you remind them to be "Good Naturalists" and get their specimens from the ground.) Next, send them out to find a year-old leaf. (They should be bringing back brown, dry, and partially decomposed leaves. These should be readily available around a fence line.)

Finally, ask them to find a five-year-old leaf. They might bring back the lacy vein skeleton of a leaf that is almost completely decomposed, or any other one that looks really "old." Collect all of these and save for art projects. Lead them to a bare area and pick up a handful of soil. Explain that you are holding many "five-year-old" leaves that have now completely broken down to make new soil.

Activity 6: Lots of Rot!

P I A

Any wooded area will have fallen and rotting logs to explore. Find one in your woods (or use the excellent book, *The Dead Tree* by Alvin Tresselt—see the bibliography). Have the children look at the top of the log, underneath its bark, underneath the log, the ground near by. What living things can they find? What evidence of living organisms can they find (holes made by insects or worms, cocoons or webs, nests or larger homes of larger animals, etc.)? Are there mushrooms or fungi on the log?

> A note of caution: This is a "real life" experiment and experience. The children should be instructed to disturb as little as possible, to not put their hands into any holes, to not harm any of the living organisms they might want to examine (catch and release), and to leave the area as they found it.

Back in the classroom, discuss what is happening to the log. How is each of the organisms they found helping the log to become soil? Have them draw a picture of how the area is going to look three, six, and 12 years from now.

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Activity 7: Getting Down and Dirty

We've made an initial exploration into the forest, looked at the "base" story, learned how soil was made. But, how does all of this add up to making a forest? The process of plant succession—the gradual replacement of one community by another—is a fascinating story. Let's see how we might get down and dirty!

Each tree species has its own special soil needs. Different forest groups grow in certain areas because that environment provides for their special growth needs. That kind of information helps urban and rural foresters decide what trees to plant where. Get buckets and shovels and let's play in the soil.

P

Collect different soil samples from your yards and park areas. Smell them. Feel them. What color are they? Are they sticky or do they fall apart easily? Do they contain clay, sand, or stones? How much organic matter is in them?

Using baby food jars, place a sample of each kind in one, label it, add water, and shake. Let the jar sit. Every 10 minutes watch the different layers that settle out to the bottom or stay floating.

Take some of the soil samples and plant seeds in them. Watch to see which type of soil provides the best growing medium for your seeds.

I A

As you collect your soil samples, write down what plants are growing in each of the areas sampled.

Test the pH (the acidity or alkalinity) of each sample using pH or litmus paper (available through science catalogs or check with your junior or senior high science teacher). Note that pine-needle underbrush, for example, creates an acid soil not "friendly" to other types of plants.

Do the water-shaker experiment described on the previous page and wait for layers to form. Using a turkey baster or other syringe, siphon off each layer and put through a strainer with a filter in it (coffee filters are a reasonable substitute). When dry, examine the residue.

Mix various combinations of your soil samples and try growing seeds to see which combo provides the best growing conditions.

Using the map on Activity Sheet 4B (Unit Four) and the tree identification sheets in Unit Four, try to place trees in the regions in which they would most likely grow.

Activity 8: Build a Forest on a Rock!

I A

It works well to do this activity outdoors with a large rock. Provide the soil, seeds, and water. For indoors, provide a large rock (make sure it is not smooth), soil, seeds, water, and a large old pan to work in. Ask the students to build a forest on a rock with the materials provided. Let them experiment with different ways of putting the soil and seed on the rock.

When they feel satisfied that the planting is done, announce that there is a sudden rainstorm approaching. Pour water over the rock: the seed and soil will wash away. Let them try again and offer suggestions: put the seeds in holes; make mud and cover the seeds with it. Repeat the "rainstorm" and note the bare rock again.

Talk about the fact that something (nature's "glue") is needed to hold the soil and seed there long enough to get the forest started. Go back outdoors to see what that "something" might be.

In the city, look for deep cracks in the pavement and sidewalk. Given enough time, enough organic matter collects and is sheltered enough to allow plant growth.

In the city and the woods, look for bare areas, sides of rocks, stumps, or wooden fence posts. You are going to find nature's "glue": multi-colored lichens. Lichens are remarkable symbiotic combinations of fungi and algae. The organisms help each other survive and are capable of growing on bare rock.

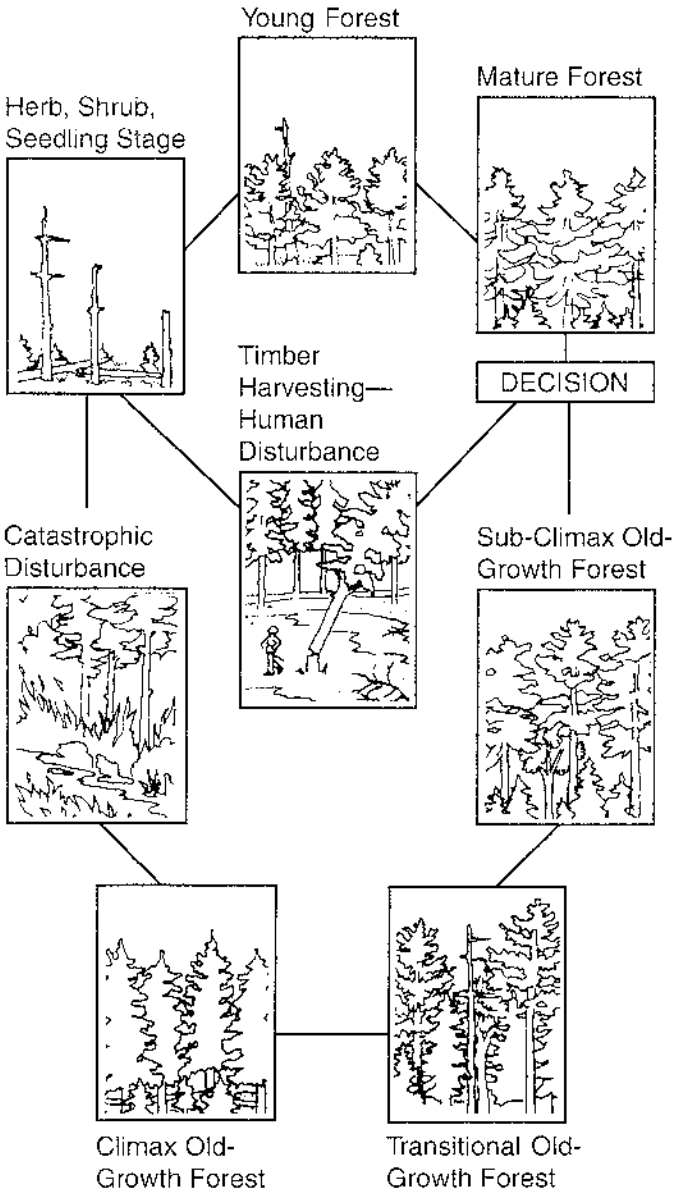
Continue your treasure hunt to perhaps find moss growing on the lichens. Enough organic matter was able to provide a stronghold for this small plant to start. Search further for the ferns and small plants growing on the mosses. Continue searching for the build-up of enough soil to support the growth of larger plants... and larger plants... and finally the trees. (Wonderful examples of plant succession can be found along the North Shore of Lake Superior.)

Used with permission from Deb Murphy.

Activity 9: Going Through Stages

Succession doesn't just take place on bare rock. All forests are always growing and changing. At different times, they are going to be new, old, dying, or a combination of all of these. Look at the following diagram of the forest cycle.

FOREST CYCLE



As you can see, both nature and people make changes that bring the cycle back to the beginning. All ages of forests are important. Each stage has its own environmental, social, and economic values. Check out a forested area near you and see what clues you can find to help you decide what stage it is in and how it got there.

Activity 10: Recipe for a Forest

Talk the children through the creation of an "imaginary" forest. What kinds of trees, animals, birds, insects, etc., would they like to live in this place? List what they have chosen on the board, and if possible, provide pictures. Then pass out paper and crayons and let them create their forest home.

> "The woods are silent, dark, and deep."
>
> —Robert Frost

Give each child an imaginary deed for a tract of land. On this land they can create any kind of forest they desire. They can put in whatever trees and plant species they want, and fill it with the animals, birds, and insects they choose. Remind them to use all of the knowledge they have gained from the exercises to make wise and appropriate choices for their forest home. Let them write a story about their imaginary place and draw pictures of it.

Adapted with permission from Joseph Cornell, Sharing Nature with Children.

With the help of Activity Sheet 3D, create a giant mural of the stages of a forest.

Activity 11: Habitat "Sit-in"

P I A

The rocks, soil, plants, and trees are only part of the forest web story. Living in, under, around, and with the trees are all the mammals, birds, insects, people, and other living organisms that make up the rest of the delicate web. The following activities will help children experience and understand some of these interesting interrelationships. Taking just their senses to explore, go once more to the forest or park for a quiet sit-in.

Assign the children each a separate spot. Ask them to quietly observe the living things they find in the tree tops, on the tree trunks, on the ground around them. Allow as much time as their age and ability permit. Back home or in the classroom, ask them to write or draw pictures of the living organisms (plants and animals), including themselves, that were part of the web.

Activity 12: Earth Windows

P I A

Use your judgment as to the readiness and comfort level of your group. A large area is required for this activity. Also, you will need enough grass clippings and/or leaves to cover the students. Make sure a prior safety check of the area is done before starting. Have children lie down and cover them with grass and leaves, making sure that they can breathe comfortably and see out. Tell them to stay still and observe the forest and surrounding area from a "bug's-eye" point of view. Tell them you will signal the group when it is time to "pop" out. (Depending on the age of the group, five to 10 minutes is sufficient.) Make them aware that real insects may come to "explore" them, but that they are safe, should remain still, and just "experience."

Editor's note: Be sensitive to the fact that some children may not be able to handle this experience because of previous bad experiences or built-in fears. Never force an experience and thereby add to the fear. Assign a different activity instead. Example: Have the child pretend to be a watchful robin on a branch, waiting very still for an insect to "pop" up to eat!

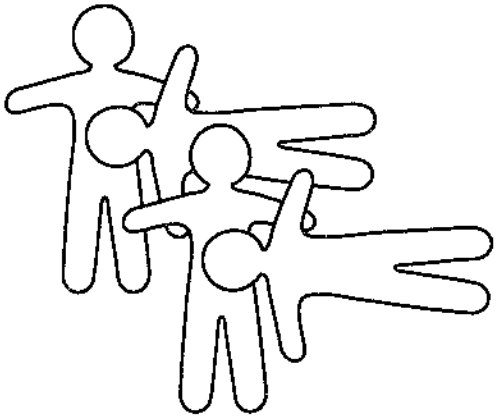
Adapted with permission from Joseph Cornell, Sharing Nature with Children.

Activity 13: Lap Links!

P I A

Divide your group up and assign "parts" of the forest web to everyone: soil, plants, trees, birds, insects, mammals, people.

Have one person lie down and the next one lie down with his/her head on the stomach of the first child. Continue stacking the children this way.



When everyone is "lap-linked," start walking around and affecting different parts of the web.

Find a "soil" and tell him or her that you are going to pour out some old paint that you don't want anymore. Tickle that person and watch the ripple effect as the laughter spreads throughout the link-up. (If you have never

tried this, lie down with the children for a lot of fun—it is impossible NOT to laugh when the stomach you're on is jiggling up and down.)

Find a "tree" and say that he or she is blocking your view to the lake so you are going to cut him or her down. Tickle and watch the ripple.

Those pesky insects just ruin your picnics so you build and put up several bat and martin houses to attract creatures to eat them! Tickle the "insect" and watch the ripple.

Go on to create as many examples as time permits, involving all of the parts of the web. Throughout the game, make sure that you are pointing out how everything is connected and cannot be affected without affecting everything else.

Activity 14: Web of Life

P I A

Arrange the children in a circle. Assign each participant a part of the forest web of life: soil, trees, other plants, insects, mammals, birds, and so on. Hand the first child the end of a ball of yarn and as you go around (and across) the group with the assignments, have each of the children grab the string and hold tight. Continue until all of the children are linked by the web of yarn. Create the same kinds of scenarios as you did in "Lap Link" (above) to affect each of the different parts of the web. As you do something to a part of the forest, have the corresponding child tug on the string. Ask who feels the tug. How many of the parts have been touched by what you did? Go around the group, repeating the exercise to reinforce the concept of the interconnectedness of the web.

Used with permission. Variations of this activity can be found in Project Learning Tree and Joseph Cornell, Sharing Nature with Children.

Activity 15: Assign a Home

P

The children are the local forest real estate agents. After learning about the housing needs of specific animals (rabbits, squirrels, deer, mice, etc.), allow each child to pick an animal. It will be that child's job to find the right forest home for their "client." It must provide for all the animal's needs. Ask the children to draw their home choices.

Using Activity Sheets 3A and 3B make a "peek-a-tree" to show some of the living arrangements that animals have.

I A

Pick a local park or forest area. It is going to be your students' job to populate it with a balanced group of living organisms, including people. Have them walk through the area and list who and what already lives there. What are they going to have to add or take away to complete a healthy web?

See Activity Sheet 3C for help getting started.

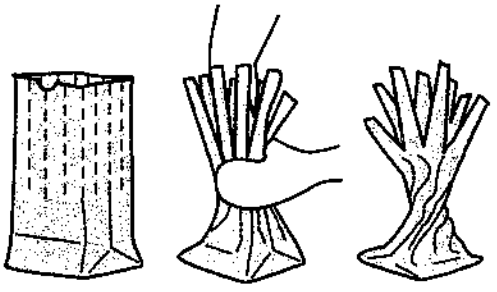
Compare the maps of past and present day vegetation areas found on Activity Sheets 4A and 4B (Unit Four). Divide the group and give each section a different area of the state. Ask each section to draw or write about plants, animals, and human involvement in the area based on the past vegetation and present vegetation.

How did the changes in forest composition affect who and what lived and worked in each area at the different times?

ARTS AND CRAFTS

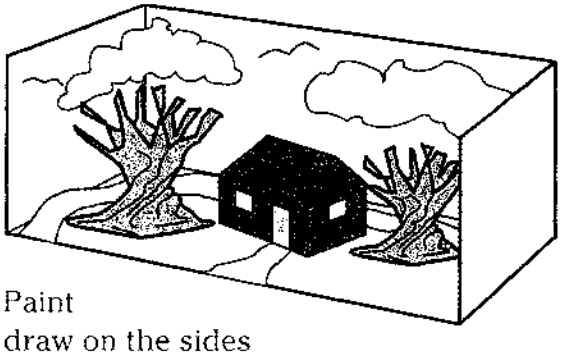
"BAGGING" A FOREST! (3-D TREES)

Take a brown paper lunch bag (or for variety, use several sizes of smaller brown bags). Have the children rip several sizes and lengths of strips at the top of the bag.



Now have them open the bag and put their hand in and twist the bag around it. Remove hand and twist the bag on its base to give the "trunk" texture and create a flat base to stand on. Now twist and separate the "branches" at the top and finish your tree. With all the trees made, create a forest or city diorama on a table top or in a large box.

A diorama is a 3-D collection of art objects, paintings, and natural objects that are put together to create a very realistic scene. Take a large box and remove the top and one side, leaving a three-sided open "stage" for your diorama.



Paint or draw on the sides and back, scenes to complement the set you are creating (sky, sun, hills, houses, trees or forest, stream or lake, etc.). Then, in the foreground on the base add dirt, grass, twigs, paper bag trees, animals, birds, houses, streets, etc.

FREEZY SUN CATCHERS

Here's one for a cold winter day. Use a pie tin or small cake tin. Lay a piece of rope around the perimeter of the inside bottom of the pan to form a frame and let the end hang out. Add sticks, leaves, seeds, acorns, etc., to the middle of the pan. Pour one to two inches of water in and freeze (outside or in the freezer). To remove the sun catcher, submerge the bottom of the pan briefly in warm water. Slide the sun catcher out and hang outside by the end of the rope. Watch it sparkle in the sunlight and have fun watching it melt!

NATURE HOUSE

Obtain a large box (washer or dryer is a good size) from an appliance store. Cut out windows and a door. Have the children glue or tape the items collected from their nature walks onto their "outdoor/indoor" house. This project will have a tendency to "shed" as it dries so it will continually need renewal and cleaning. The house and its upkeep and continued reconstruction will help the children understand what the animals go through to maintain their homes.

SPIDER WEB PICTURES

Find four, 1/2-inch diameter branches or wood strips. Make a frame by lashing them together at the corners. (If the wood isn't available, a 14-inch wooden quilting hoop can be used.) Wrap twine or string around the frame, crossing the center space to form a web. (If the frame is too smooth to hold the string in place, use tape to secure it.) Now hang leaves, twigs, seeds, etc., in the web to form your picture.

TREE TISSUE SILHOUETTES

Cut out colored tissue paper silhouettes of trees. Overlap them on drawing paper and attach with liquid starch.

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The following list of songs is from the 1993 *A Teachers' Guide to Arbor Month,* Minnesota Arbor Month Partnership. Used with permission.

Listen, sing along, dance, and enjoy!

"Maple Leaf Rag"—Traditional

"Tie a Yellow Ribbon Round the Old Oak Tree" by Tony Orlando & Dawn

"This Land is Your Land" by Woody Guthrie

"Tapestry" by Don McLean

"Scarborough Fair" by Simon and Garfunkel

"Norwegian Wood" by The Beatles

"Different Drummer" by Stone Ponies

"Dog and Butterfly" by Heart

"East of Ginger Trees" by Seals and Croft

"Rocky Mountain High" by John Denver

"Annie's Song" by John Denver

"Forest Lawn" by Tom Paxton

"Backstreets" by Bruce Springsteen

"Down in the Willow Garden"—Traditional

"Lullabye of Byrdland"—Traditional

"Trees" by Rush

"On Top of Old Smokey"—Traditional

"Don't Sit Under the Apple Tree" by The Andrews Sisters

"Willow Weep for Me"

"Lemon Tree" by Trini Lopez

"Appalachian Spring" by Aaron Copland

"The Little Nut Tree"—Traditional

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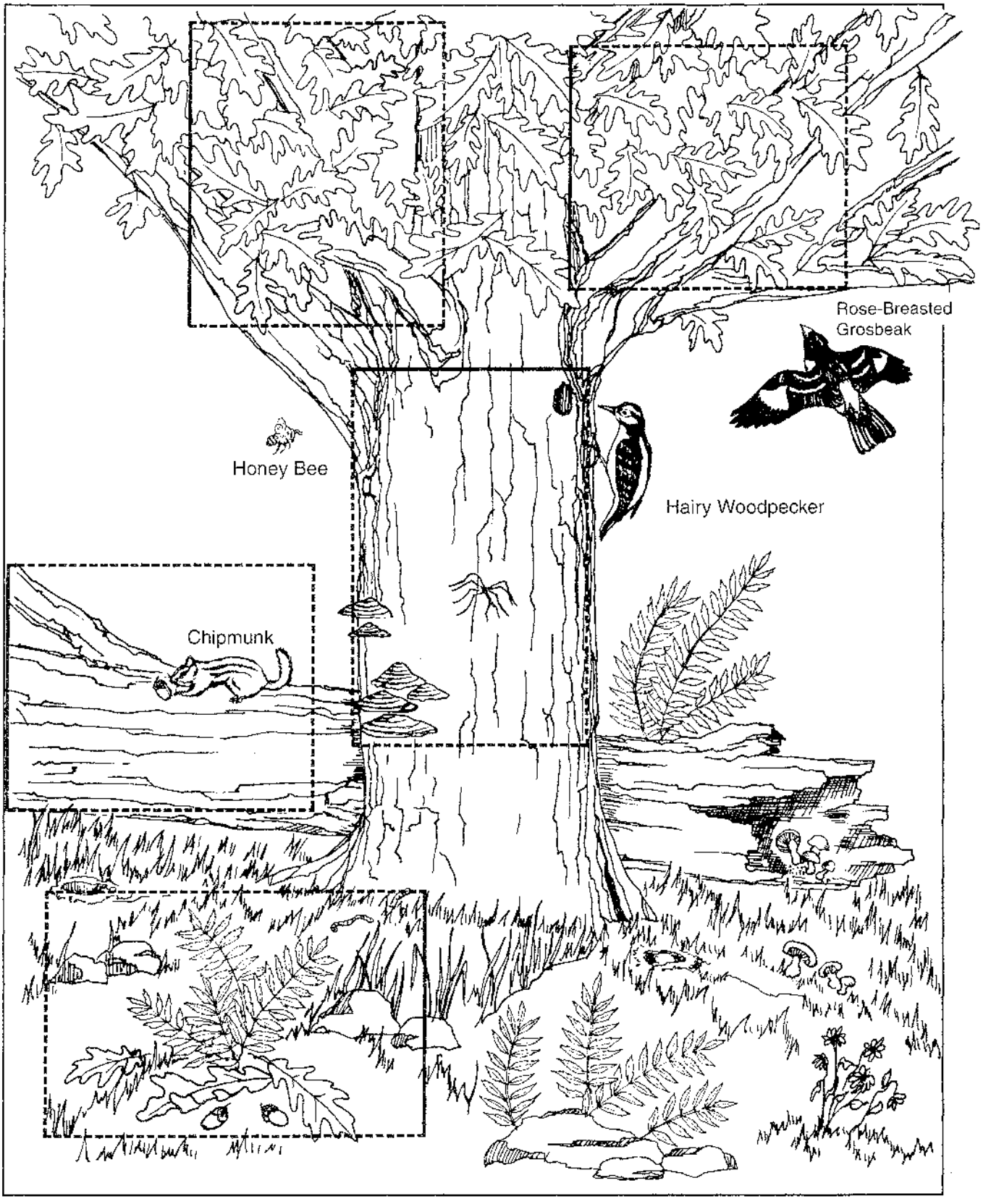
ACTIVITY SHEET 3A

UNDER COVER!



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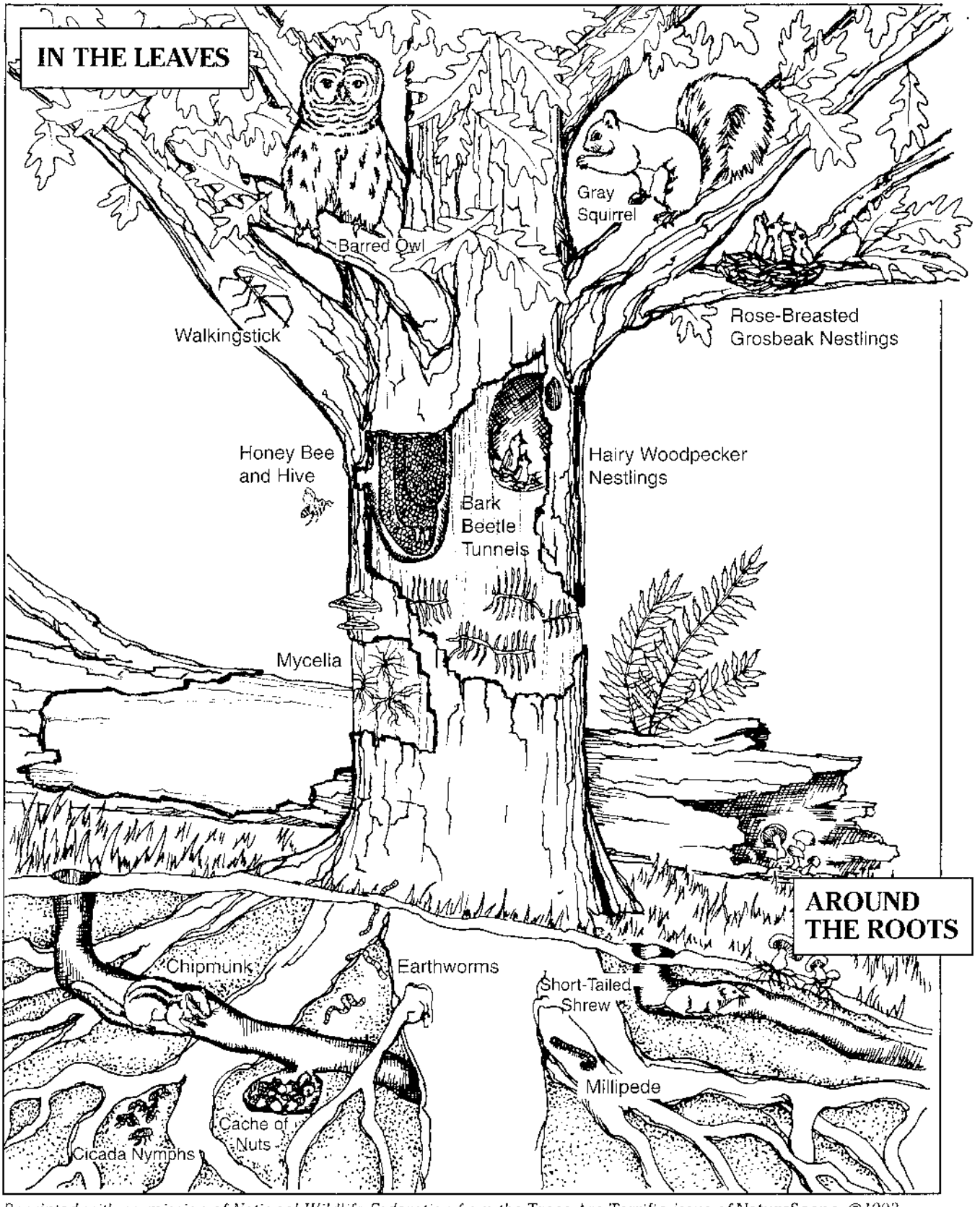
ACTIVITY SHEET 3B

UNDER COVER!



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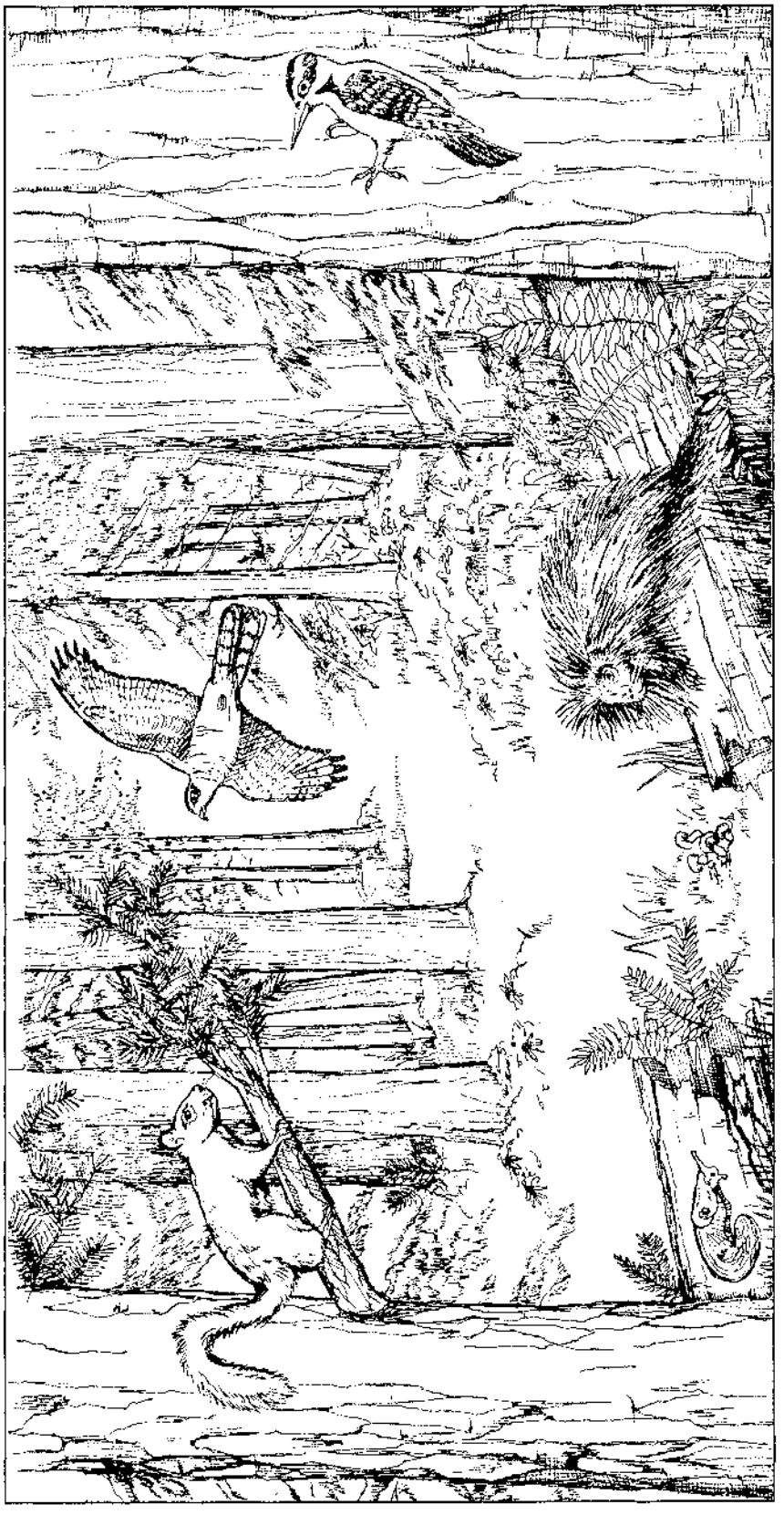
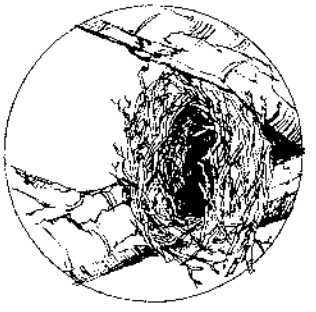
ACTIVITY SHEET 3C

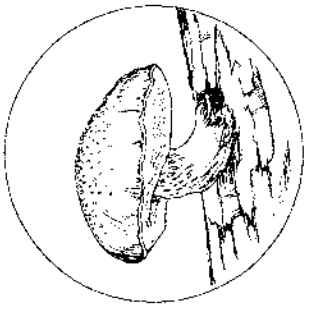
A WALK IN THE WOODS



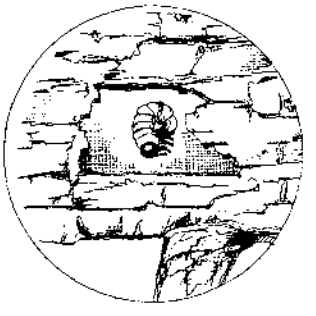
BARK



NEST



MUSHROOM



BEETLE GRUB

FIR CONE

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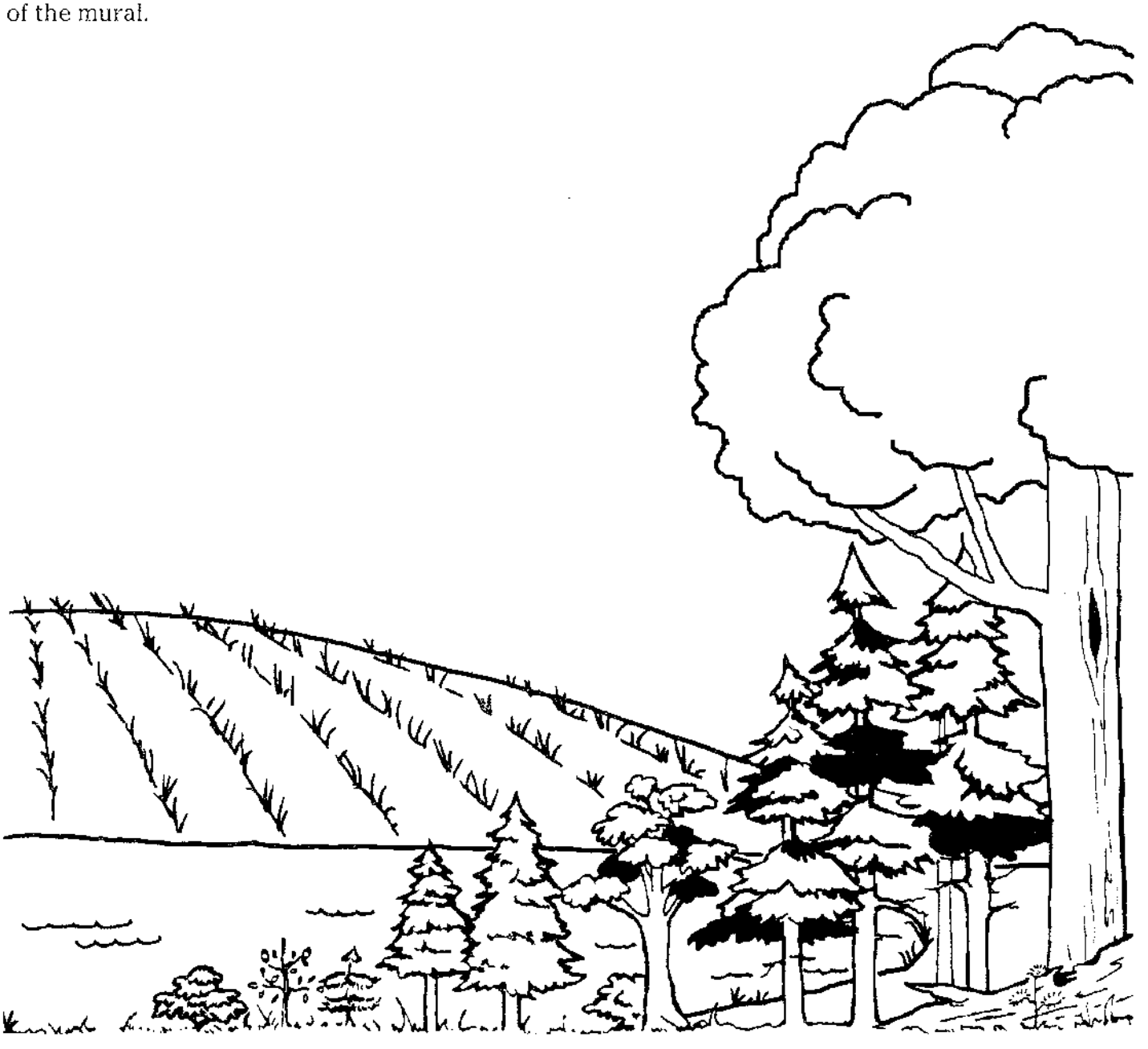
ACTIVITY SHEET 3D

STAGES OF A FOREST

Students participate by drawing and painting the stages of a forest. Include an oat field and water as part of the background scenery. After the painting is finished, students draw and paint animals to fit in the scene in the appropriate places on the mural. Make them removable so students can take them off and put them back on again. Some animals may appear in more than one place. Example: Pheasants feed in meadows or cornfields and nest in brush in woods. Hints for a happy fit: Talk about proportion and relative sizes of animals before starting this part of the mural.



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UNIT FOUR:
STANDING PROUD—MEETING OUR MINNESOTA TREES

UNIT FOUR DISCOVERIES

Students will be introduced to 16 Minnesota tree species and discover more ways to examine them, inside and out. For background see the Introduction and Chapters Two, Three, and Five in *Where Are All The Trees? A Minnesota Primer.*

KEY

- (P) Primary Students
- (I) Intermediate Students
- (A) Advanced Students

Twelve thousand years ago the great glaciers carved and molded the Minnesota terrain like the hand of a giant sculptor. They left behind features and soil combinations that allowed the development of three diverse Minnesota forest regions (see Activity Sheet 4A). Centuries came and went and people came and went and those regions were changed once more (see Activity Sheet 4B). The rich diversity of our present forest, from the flood plains of the prairie to the rugged North Shore, offer a statewide smorgasbord of the giants of the plant world. The Tree Identification Sheets at the end of this chapter provide the information necessary to introduce your students to 16 of the more than 50 species of trees that are native to Minnesota.

These pages can be used to enrich any of the activities in this booklet and would be particularly useful in the following: Unit One, Activities 2 and 5; Unit Two, Activities 1, 2, 3, and 4; and Unit Three, Activities 7 and 15.

> "You can gauge a country's wealth, its real wealth, by its tree cover."
>
> —Dr. Richard St. Barbe Baker

The trees highlighted are:

1. Tamarack (Eastern Larch)
2. Sugar Maple
3. Black Spruce
4. Paper Birch
5. Quaking (Trembling) Aspen
6. American Basswood
7. Red (Norway) Pine
8. White Spruce
9. American Elm
10. Balsam Fir
11. Black Ash
12. Bitternut Hickory
13. Black Walnut
14. Bur Oak
15. Jack Pine
16. Red Maple

Editor's note: A colorful poster of these and other Minnesota trees, called *"Minnesota's Forest Treasures,"* is available from: Minnesota's Bookstore, 117 University Avenue, St. Paul, MN 55155; 612-297-3000 (Metro Area), 800-657-3757 (Greater Minnesota). Order stock number 9-31.

Let's go back in time for just a moment and think about the forces that molded our state and set the stage for the wonderful diversity we enjoy today. As the glacial giants of the ice age moved over the land, they gouged out and dumped behind tons of dirt, rocks, and debris like giant bulldozers. How do you comprehend a river of ice two miles high and miles long? Can you imagine what impact it had on the land it went over? We're talking about...

Activity 1: The Big Push!

P I A

Gather dirt, pebbles, and sand and lay them in the bottom of a bread loaf pan. Fill with water and freeze. (Vary glacier "size" by using different size pans.) In a sandbox or bare area outside, lay down a course for the "glaciers" to roll over: plants, hills, stones, etc. Inch your glacier over the terrain very slowly, pushing down as hard as possible. What gets pushed aside? Rolled over? Smashed? What would happen if you pushed it over bare rock? Remember that the real glaciers moved and did their work very slowly. Now position the "glacier" and leave it sit to melt. What is left behind as it melts? What happens if you slowly move it backwards as it melts? Do you have any lakes (pools of water) or hills forming?

It's time to go outdoors again for a more personal look at our leafy neighbors. Our neighbors got to be our neighbors either naturally or with a little help. Let's look at...

Activity 2: Where on Earth Did They Come From?

P I A

Nature has its very own transport system to get seeds around. They can float on the breeze, cling to a passerby, get eaten in fruit and dropped back down, be buried for a snack later, or actually be exploded out!

Look at the Tree Identification Sheets at the end of this unit and Unit Two, Activity Sheets A–E. Notice how many different kinds of seeds there are. Now try to invent activities to imitate nature's methods for getting those seeds around. Some ideas:

1. Make paper airplanes or floats. See which styles fly best.
2. Put tape, sticky side out, on your long pants leg. Walk through the tall grass and see what clings to you.
3. Open up various fruits to find the seeds. Then eat the yummy "transport" systems (the fruit, not the seeds) when you are done looking at them!
4. Watch a squirrel do its job of planting oak trees by burying its winter acorn snacks.
5. Fill a brown paper bag with small bits of paper ("seeds"). Blow it up and pop it!

Next, look at your own adopted trees. Decide what type of transport system they use. Collect some of the seeds if possible (depending on the season) and add them to your ongoing collection or display.

People can help the natural process by growing and protecting seedlings to help replace trees that they use or that are destroyed naturally. Follow in the steps of Johnny Appleseed and try planting and growing different tree seeds (for example, maple, beech, oak, or apple).

> "He who plants a tree plants a hope."
>
> —Lucy Larcom

Activity 3: The Heart of the Matter

P I A

A tree is a living organism that has fluid flowing through it. In the springtime, it's possible to hear that lifeblood. Grab a stethoscope and listen to the "heartbeat" of a tree. Find a tree at least 6 inches in diameter. Can you hear a crackling noise or a swish? Are some Minnesota tree species louder than others? Is the sound different on different sides of the tree? Check every week for a while. How do the sounds vary?

Used with permission from Joseph Cornell, Sharing Nature with Children.

Activity 4: Stories to Tell—Reading the Rings on Minnesota Trees

Like the pages of a book telling a story, a tree's rings give us hints about the year-to-year events that affected its life. For all ages, several objects can be used to complete this activity: an old stump outside; cross sections of a stump or branch; the pictures on Activity Sheet 4C; tree "cookies" (two- to three-inch slices) that can be purchased for 25 cents each, or 26 cents drilled, from the Lake County Developmental Achievement Center at 218-834-5767 (allow four weeks for delivery).

P

Have the children count the rings. How old is the tree? Compare several samples. How do they differ (size, color, unusual markings)?

I A

Practice your detective skills. Using the information from Activity Sheet 4C, study your samples and try to discover what happened to the trees. If you are outside, are there clues around the area to help understand the rings' story (evidence of fire, drought, harvesting, or building)?

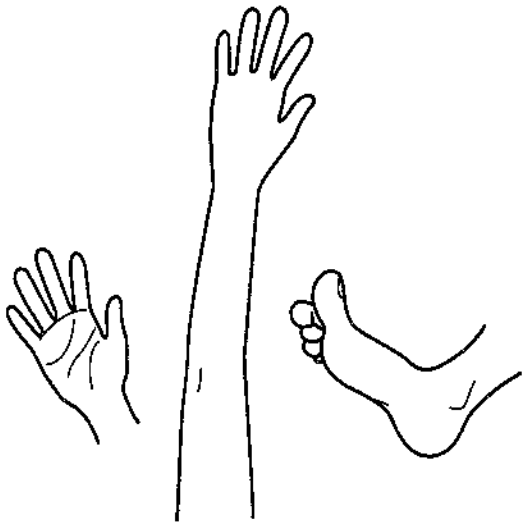
VARIATION

If you haven't read *The Giving Tree,* by Shel Silverstein, do so now. Have the students draw a picture of the stump and its rings based on the information given in the story. Use Activity Sheet 4C to help put in the markings (good growth years, broken branches from climbing, removal of many branches, stunted growth, etc.). Decide how old the tree might have been when it was cut.

The Big Tree, by Bruce Hiscock, would also be great for this activity.

Activity 5: Sizing Up a Minnesota Tree

In the old days, people used practical, available things to measure objects: fingers, hands, arms, feet! Try these simple measuring ideas out on your adopted backyard friend and its neighbors.



Around the Middle: For saplings, do you need one hand or both to go around the trunk? For bigger trees can you wrap your arms around it or do some of your friends have to help make a circle around the trunk? How many arms did it take to go around? Do you know what kind of tree this is?

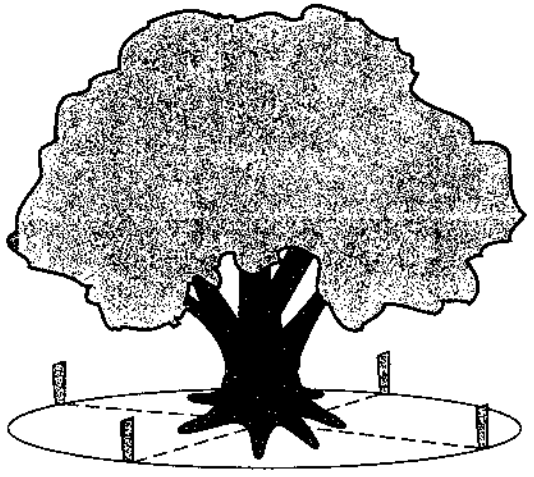
Crown Size: Pace off from the trunk until you can look up and see the edge of the crown of leaves. How many footsteps was it out to the edge? Now have everyone hold hands and form a circle out to the edge of the crown. How big (how many footsteps) across is the circle? Look under your feet for an idea of how big the tree's root system is. In many trees the root system extends a lot further out than the crown..

How High: Get a kite string on a reel. Go outside on a sunny day and, working in twos, have one child measure the partner's shadow on the ground with the kite string. Mark the length by tying a ribbon on the string. Now have one partner hold the end of the string at the base of the tree and the other reel out to the end of the tree's shadow. Mark the string to show how long the tree's shadow is. How many child shadows does it take to get to the end of the tree's shadow? Measure the other child's shadow and compare it to the tree's. Is it different than the first child's?

Challenge: Using a cloth tape measure, do some of the same measurements and find out some of the sizes in inches.

Around the Middle: Measure the distance around the tree, about 4 feet up from the ground. What is the circumference of the tree?

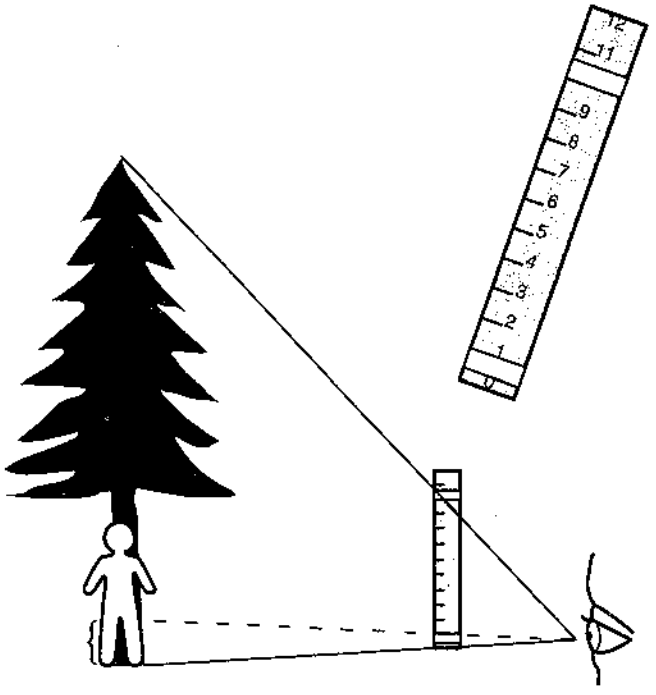
Crown Size: Pace off to the edge of the tree's crown and put a stake in the ground. Do this four times to form two perpendicular lines (see illustration). Measure each of the two lines. Add them together and divide by two to get the average crown spread.



How High: Take a 12-inch ruler and mark the 1-inch and 10-inch lines on the ruler with tape. Work in pairs. Have one partner stand at the base of the tree. Have the other hold the ruler up in front of his or her own eyes at arm length and move back until he or she can see

the whole tree from top to bottom between the 0-inch and the 10-inch mark on the ruler. Have the student move the ruler until the base of the tree is exactly at 0 inches and the top of the tree is sighted exactly at 10 inches. Then have him or her sight out from the 1-inch mark to a point on the trunk above the base. Have the partner mark this spot on the trunk with tape.

Measure the distance from the base of the tree to the 1-inch mark. Multiply by 10 to get an approximate idea of the height of the tree.



Adapted from A Teachers' Guide to Arbor Month, *Minnesota Arbor Month Partnership, 1993.*

Activity 6: Bigger and Better—Sizing Up Minnesota Forests

P I A

Large trees are old trees. See Activity Sheet 4D to see how much our population of larger Minnesota trees has grown in the last 30 years. How many of the trees you measured are "grandparents" in the forest?

I A

Look at the size of the trunks on the trees in your yard. How big a stack of wood do you think they would make? Now look at Activity Sheet 4E to see how much of the world our Minnesota wood would cover. How much has that area grown since 1936?

Activity 7: Tic Tac Tree—Minnesota Style

P I A

By now students should be getting pretty familiar with the neighbors in the back yard. Let's have a little fun with that new knowledge.

Construct blank game boards with nine squares on each. Mark the middle FREE and laminate (see example on Activity Sheet 4F). Give each child a game board and eight laminated pictures of leaves, trees (or tree shapes), or seeds (gear the pictures to the ability and age level of the group). See examples on Activity Sheet 4F. Have the children place their pictures on their game board in any order, making sure not to cover the middle square.

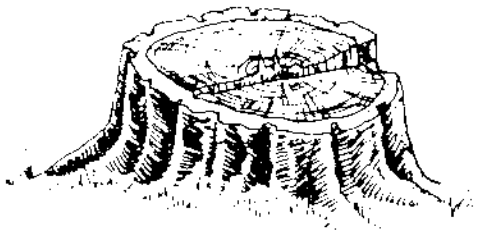
Pass out markers (stones, small twigs, acorns) and start the game, calling out the parts.

The children cover the squares as they hear them and the first one to get a TIC TAC TREE (across, down, diagonally) wins!

ARTS AND CRAFTS

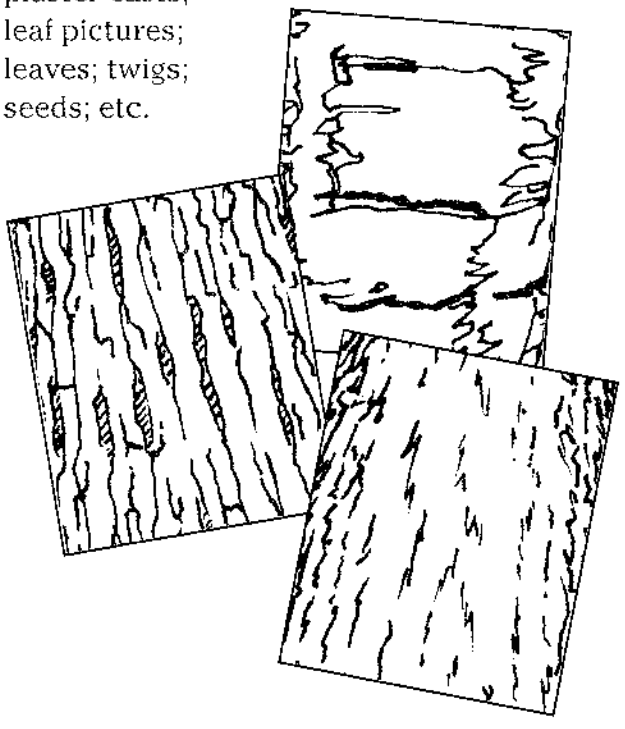
STUMP RUBBINGS

Find stumps or use your cross sections from Activity 4, Unit Four. Place light art paper on each stump and rub lightly with the side of a crayon to get textured pictures. Label these if you can identify the tree. Add them to your nature art tree collection if you have one.



BARK RUBBINGS

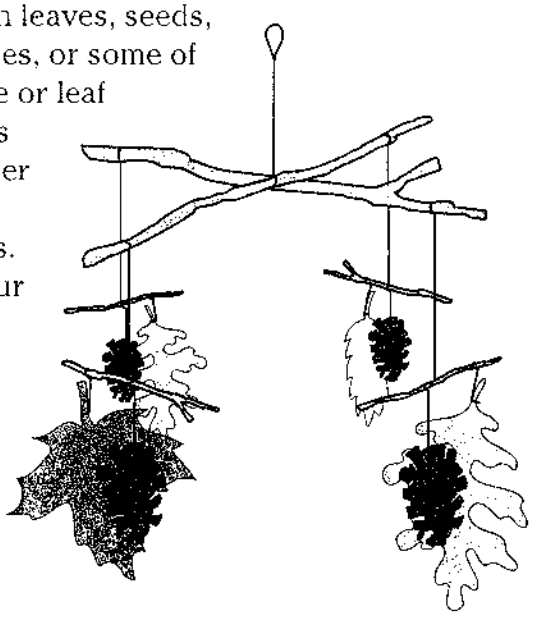
Interesting pictures can be obtained by doing bark rubbings the same way as stump and leaf rubbings. Label the rubbings. If you have not already done so in previous units, create a display of different objects from your adopted tree: bark, stump, and leaf rubbings; plaster casts; leaf pictures; leaves; twigs; seeds; etc.



TWIG MOBILES

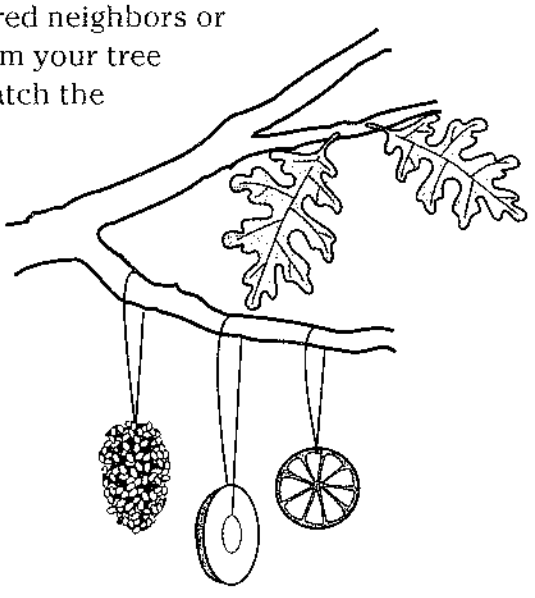
Gather a variety of different sized twigs. Using yarn or twine, attach them together in various arrangements (see illustration).

Attach leaves, seeds, pine cones, or some of your tree or leaf paintings from other art activities. Hang your mobiles.



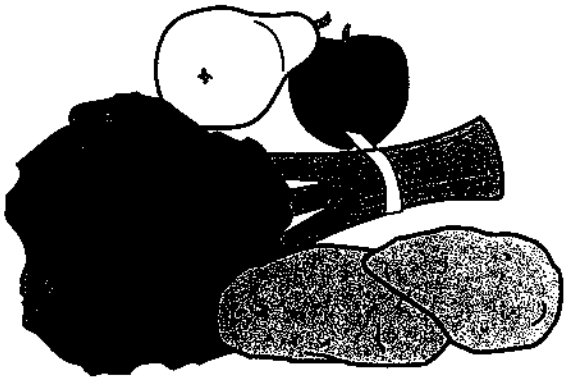
BIRD MUNCHIES

Make edible mobiles for the birds. Take pine cones and attach a piece of yarn to them. Smear them with shortening and roll in bird seed. Make apple rings and orange slice rings and attach to yarn or string. String popcorn. Using branches, make a friendly "smorgasbord" for the feathered neighbors or just trim your tree and watch the feast.



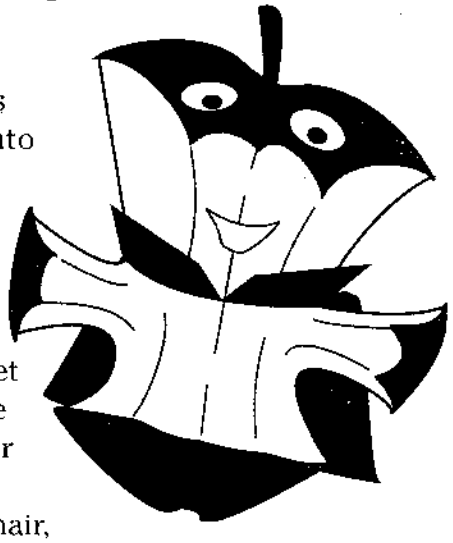
FRUIT PRINTS

Cut apples or pears in half or carve into different shapes (experiment with different fruits or veggies). Dip into tempera paints and make "fruity prints." Vary the colors and shapes or try a variety of fruits.



APPLE HEADS

Have the children "carve" an apple by eating it into various shapes. Or let older students carve a face into the apple. Set aside and allow to dry or dry in a slow oven (200°). Then let them decorate and dress their unique apple people (yarn hair, hats, glasses, wiggle eyes, beard, etc.).



NATURE'S MUSIC

1. Go on a "Hearing Hike" through some of the BBC's (British Broadcasting Co.) recordings of natural sounds.

2. Collect rhythm band and other instruments or make some of your own instruments (drums, shakers out of gourds, two sticks or sticks and stones to bang together, seeds inside milk cartons or plastic eggs, blades of grass between the thumbs to make a whistle, etc.). Create your own forest music.

   How does a forest sound? Which instrument(s) would you use to sound like breezes through the leaves, squirrels leaping from branch to branch, birds calling, a tree being chopped down or falling? How about feet shuffling through the fall leaves, a deer running through the bushes, a woodpecker pecking, a sleepy owl hooting? Would a forest sound different at night than during the daytime? Tape record your best efforts.

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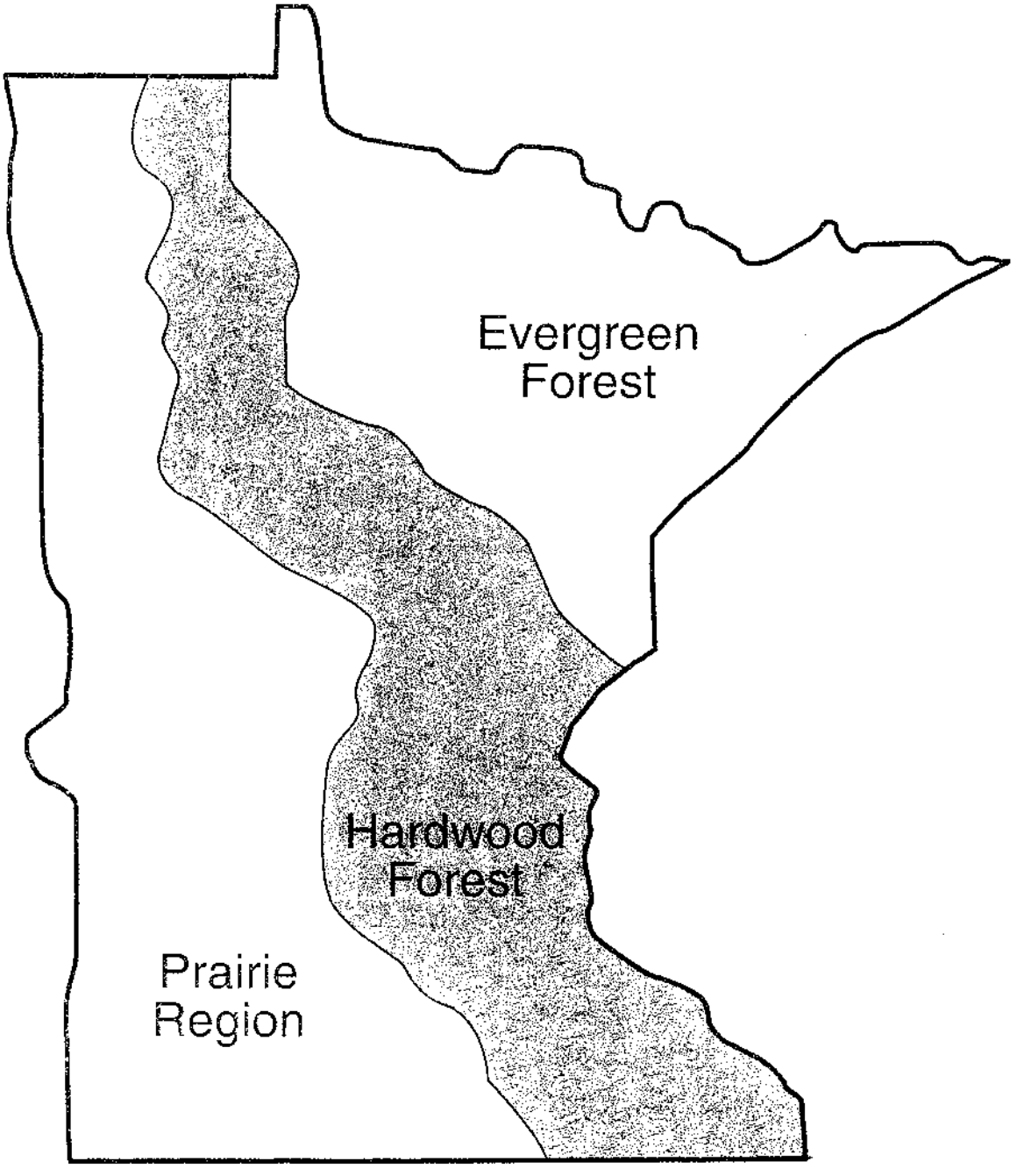
Note: The bibliographies in Units Two and Three contain excellent references that can be used in this unit also.

ACTIVITY SHEET 4A

MINNESOTA'S FOREST REGIONS—1870



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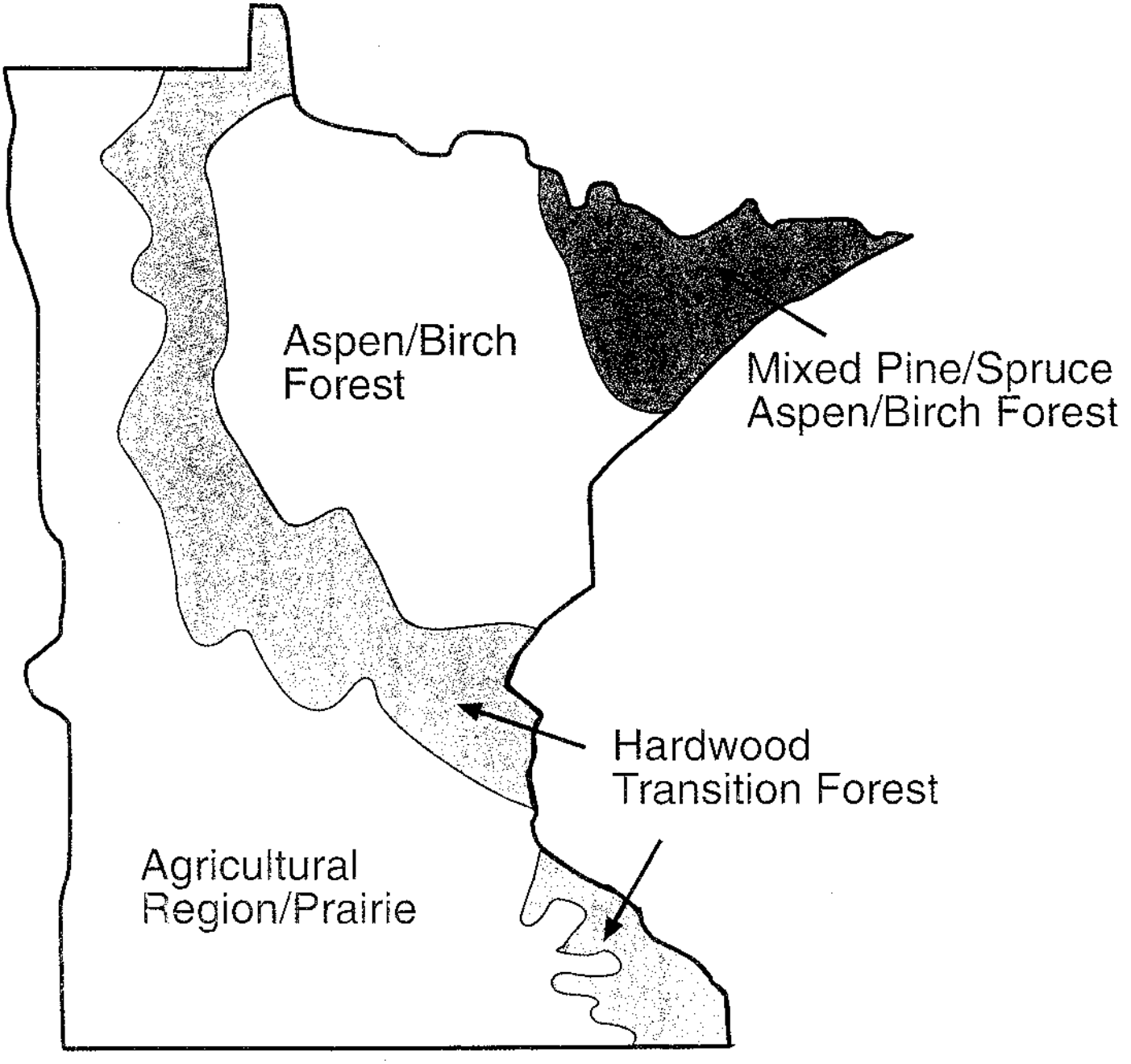
ACTIVITY SHEET 4B

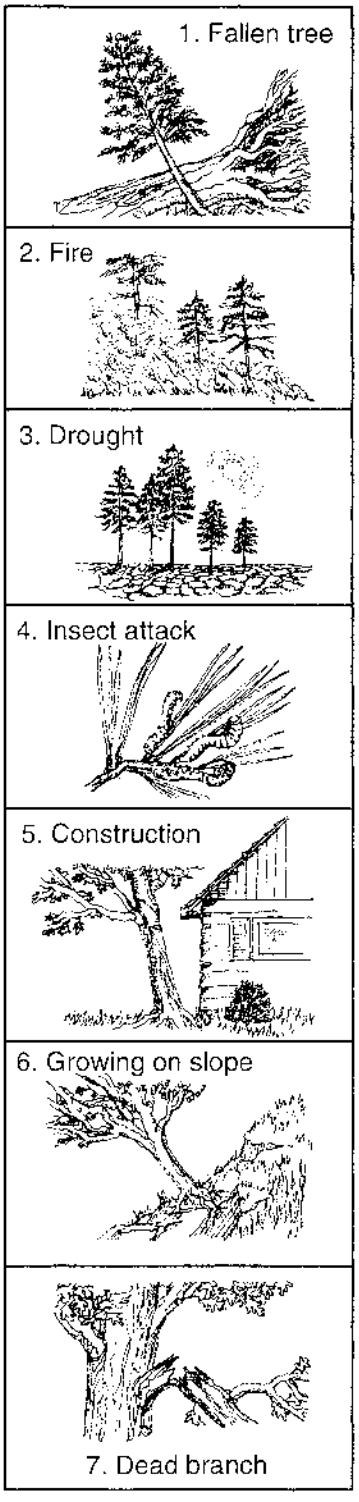
MINNESOTA: PRESENT DAY VEGETATION



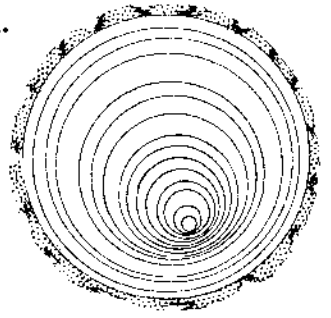
ACTIVITY SHEET 4C

READING THE RINGS

THINGS THAT AFFECT TREE GROWTH

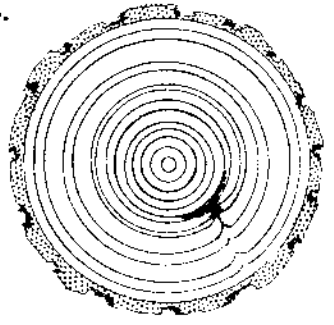


A.



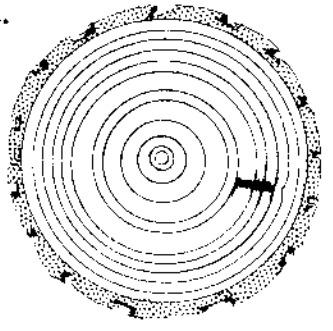
Cross Section A:
The uneven growth shown in the rings could have been caused by a fallen tree leaning against the tree (picture 1). The tree grew more on one side than the other, and curved up around the fallen tree. This uneven ring pattern could also belong to a tree growing on a steep slope (picture 6).

B.



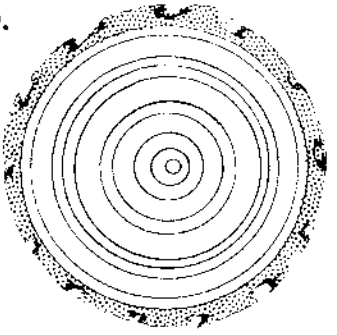
Cross Section B:
The scarring on this cross section was caused by a forest fire during the tree's sixth growing season (picture 2).

C.



Cross Section C:
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.



Cross Section D:
The narrow rings shown in this cross section could have been caused by several things such as drought (picture 3), heavy insect damage (picture 4), or damage from construction (picture 5). 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.

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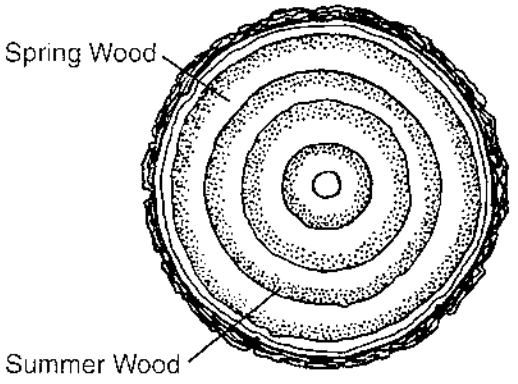
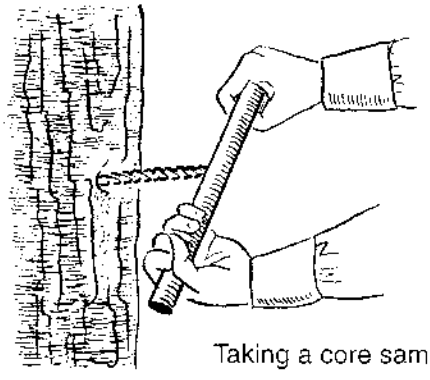
THINGS THAT AFFECT TREE GROWTH *continued*



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 stressed. Perhaps the tree was crowded by others, shaded, or stressed 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.

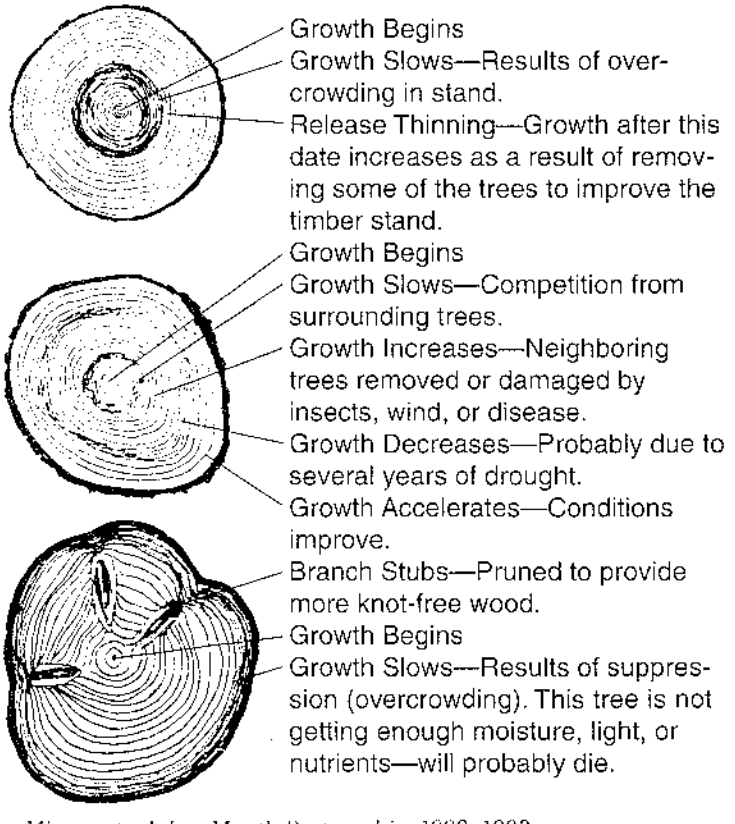


Taking a core sample

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. We can even use tree rings to figure the age of ancient buildings, boats, and other wooden things by 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 more than 8,000 years!

Examine these ring patterns. What stories do they tell? How are the growth patterns alike? How are they different?



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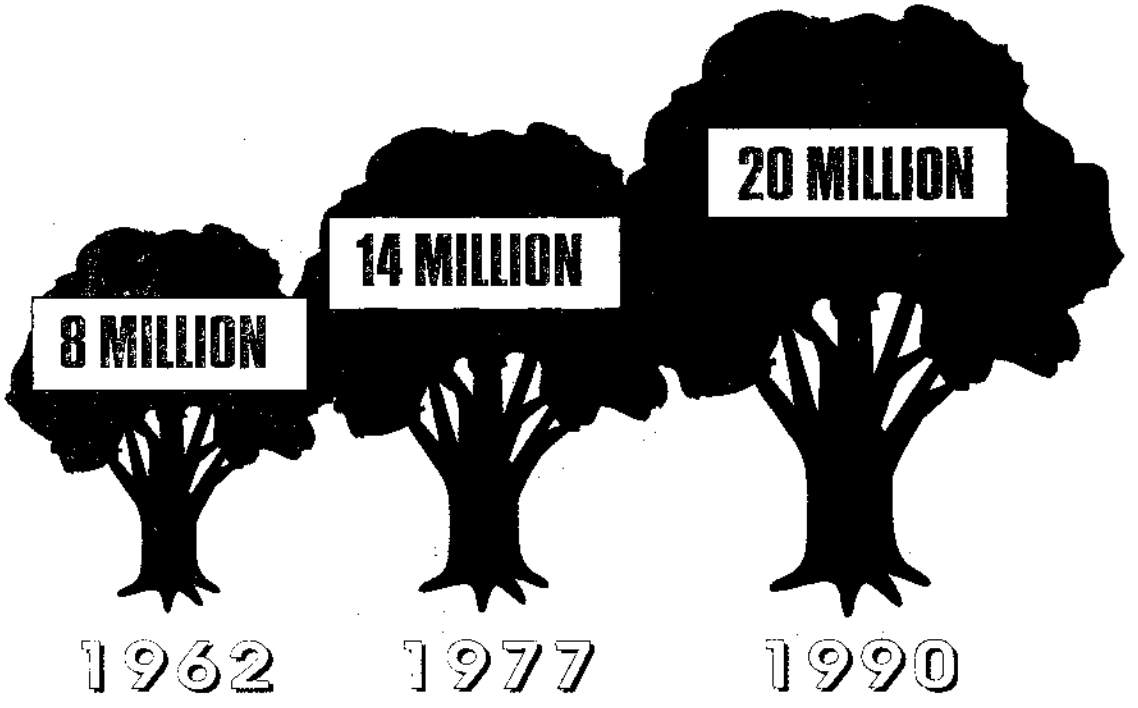
ACTIVITY SHEET 4D

HOW MANY LARGE* TREES IN MINNESOTA?

*19-inch diameter or more



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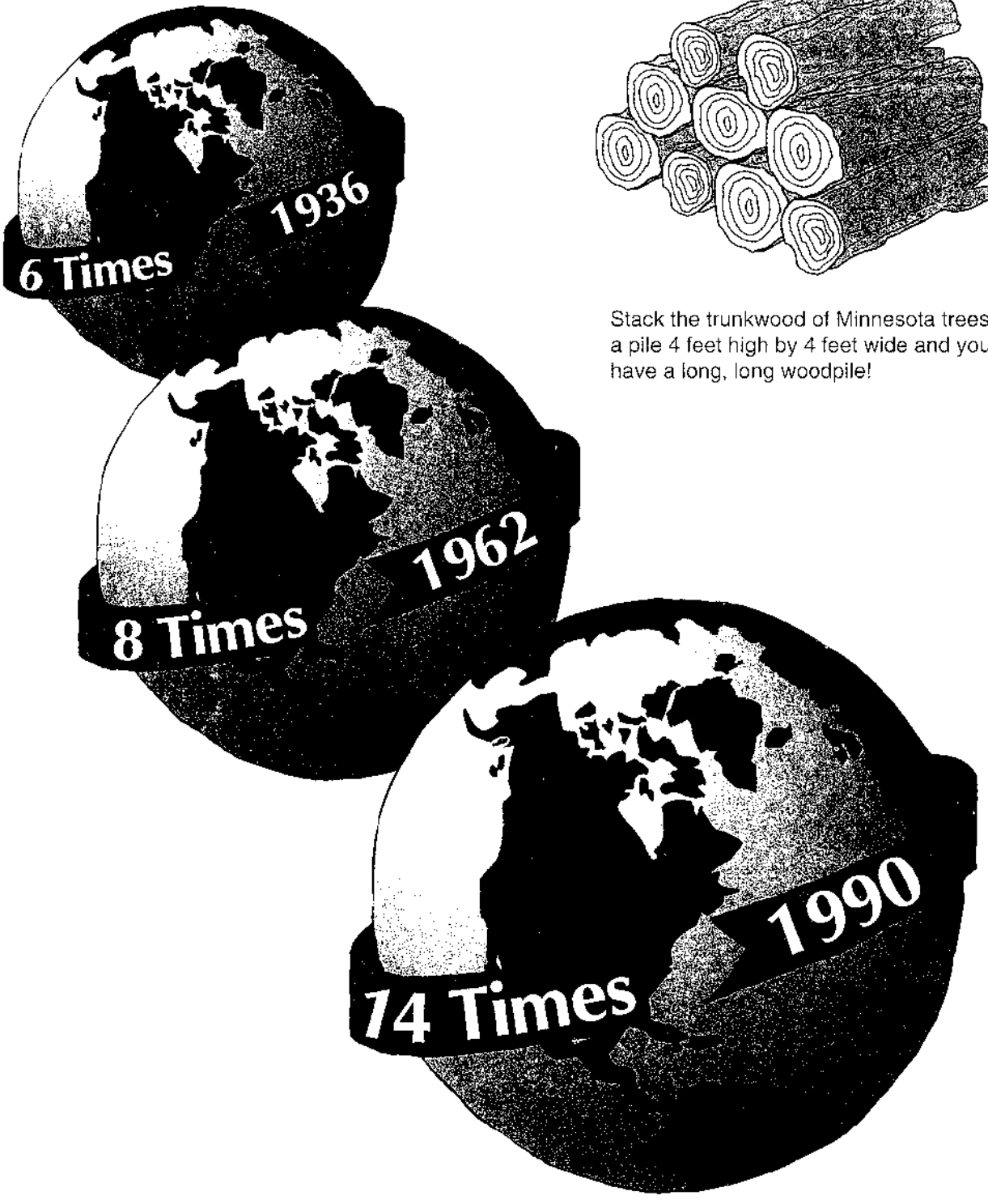
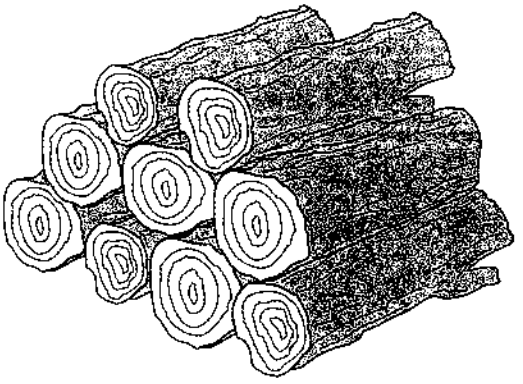
ACTIVITY SHEET 4E

HOW MUCH WORLD WOULD YOUR WOOD GO 'ROUND?





Stack the trunkwood of Minnesota trees in a pile 4 feet high by 4 feet wide and you'll have a long, long woodpile!

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ACTIVITY SHEET 4F

TIC TAC TREE—MINNESOTA STYLE

Construct blank game boards with nine squares each. Mark middle FREE and laminate.

Varying the degree of complexity depending on the age of the group, make laminated game cards (pictures of leaves, trees, seeds, etc.—see categories below) to pass out. Give each participant eight cards. (Use Activity Sheets 2A–2F, Unit Two, to get an idea of how to make the cards.)

Have each participant place his/her cards on the game board in any order, making sure not to cover the middle square.

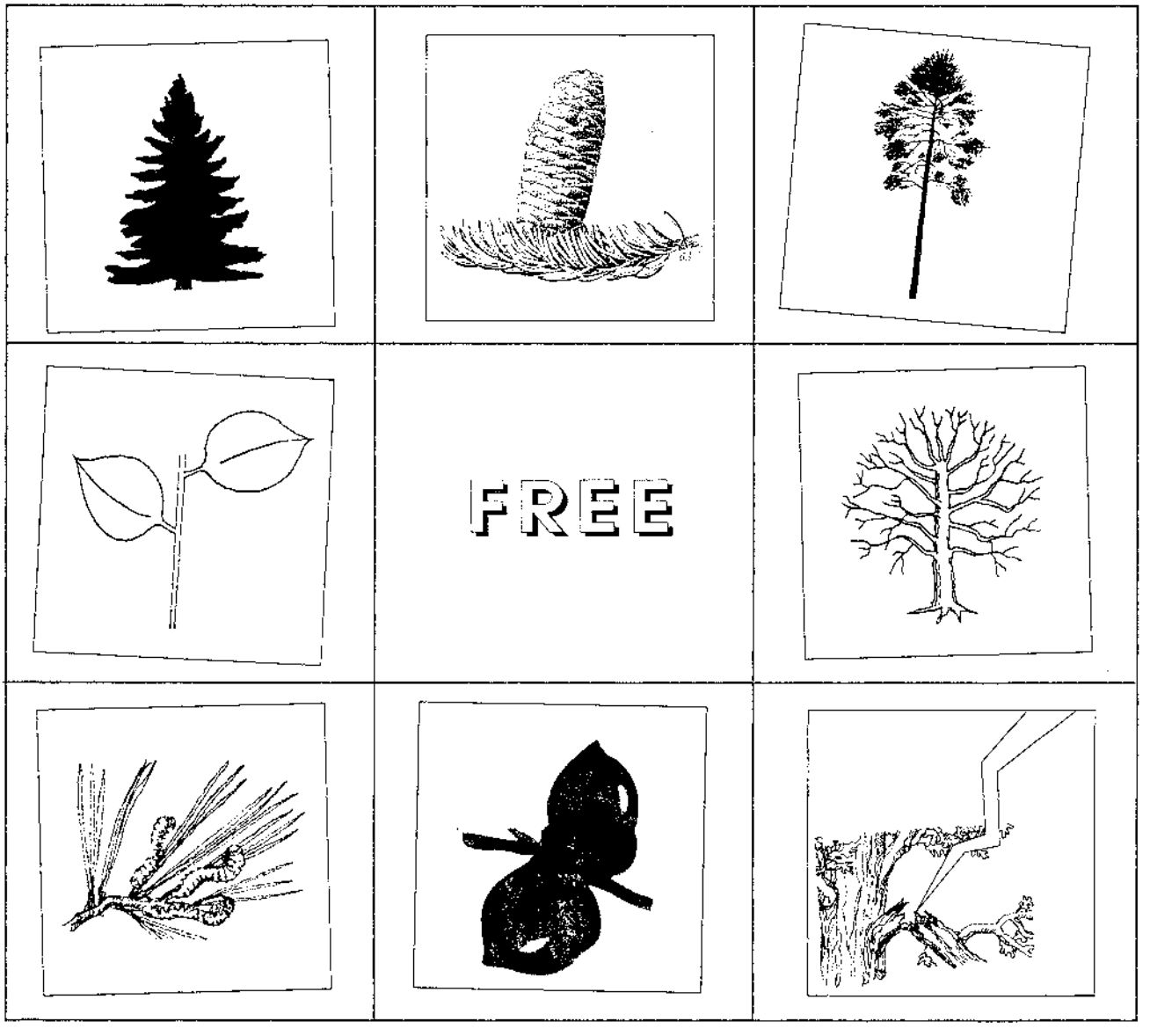
Pass out markers (stones, small twigs, acorns, etc.) and start the game, calling out different names and categories. The children cover the squares as they hear them and the first one to get a TIC TAC TREE (across, down, diagonally) wins!

Examples of Categories

Leaves: whorl, opposite, alternate
Shapes: globe, cone, weeping
Seeds: pine cone, acorn, maple

Other Possibilities

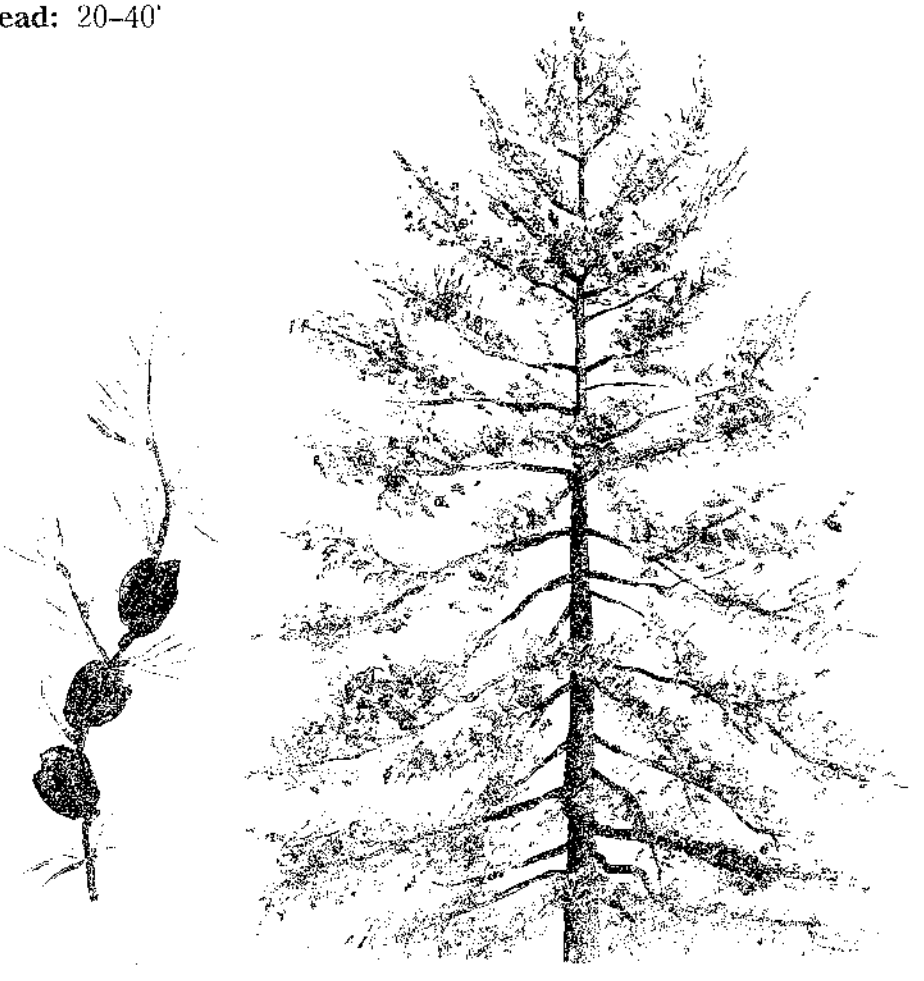
Injuries and problems: fire, lightning, flooding, disease, insects
Other: tree names, branching styles



Tamarack (Eastern Larch)

Larix laricina

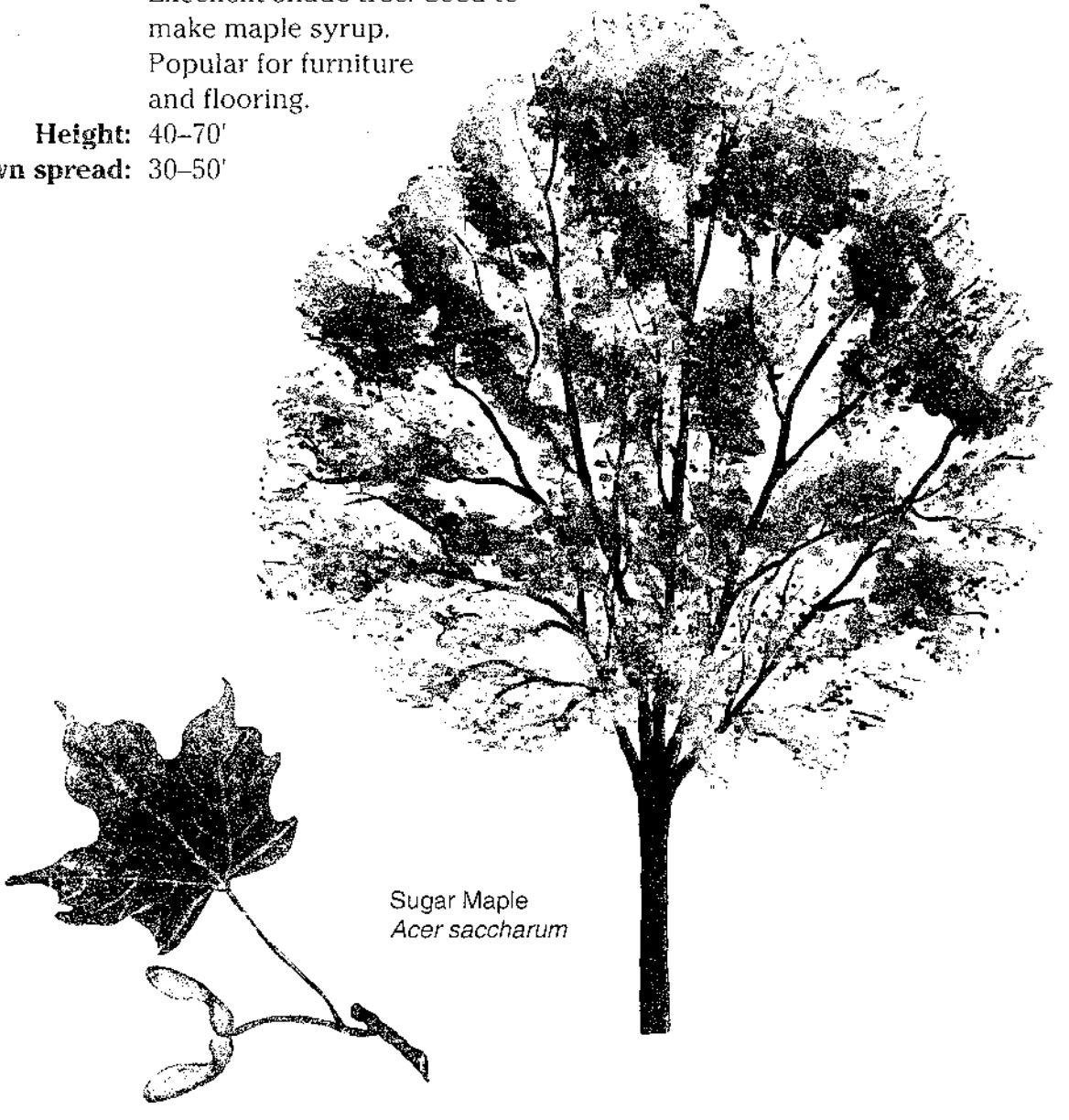
Tamarack: Conifer (deciduous)
Tree appearance: Wispy, thinnish tree.
Leaf appearance: Fine, medium-length needles that cluster off the branch.
Seed: Very small cone.
Growing conditions: Quite tolerant of drought or poorly-drained soil.
Special feature: Minnesota's only conifer that is deciduous. In fall, the needles of the tamarack turn deep yellow and drop.
Uses: Provides nesting sites for great gray owls in northern Minnesota; also used for posts and paper.
Height: 40–70'
Crown spread: 20–40'



Tamarack (Eastern Larch)
Larix laricina

Sugar Maple
Acer saccharum

Sugar Maple: Deciduous
Tree appearance: Has a dense, upright oval to rounded crown.
Leaf appearance: Three-pointed lobes; quite large. In fall, leaves range from clear yellow to golden orange or orangish red.
Seed: Pea-sized seed with large wings; tends to fly down like little helicopters.
Growing conditions: Fertile, well-drained soil with ample moisture. Full shade or partial shade.
Special feature: Sap is used as maple syrup.
Uses: Seeds eaten by all kinds of birds. Excellent shade tree. Used to make maple syrup. Popular for furniture and flooring.
Height: 40–70'
Crown spread: 30–50'

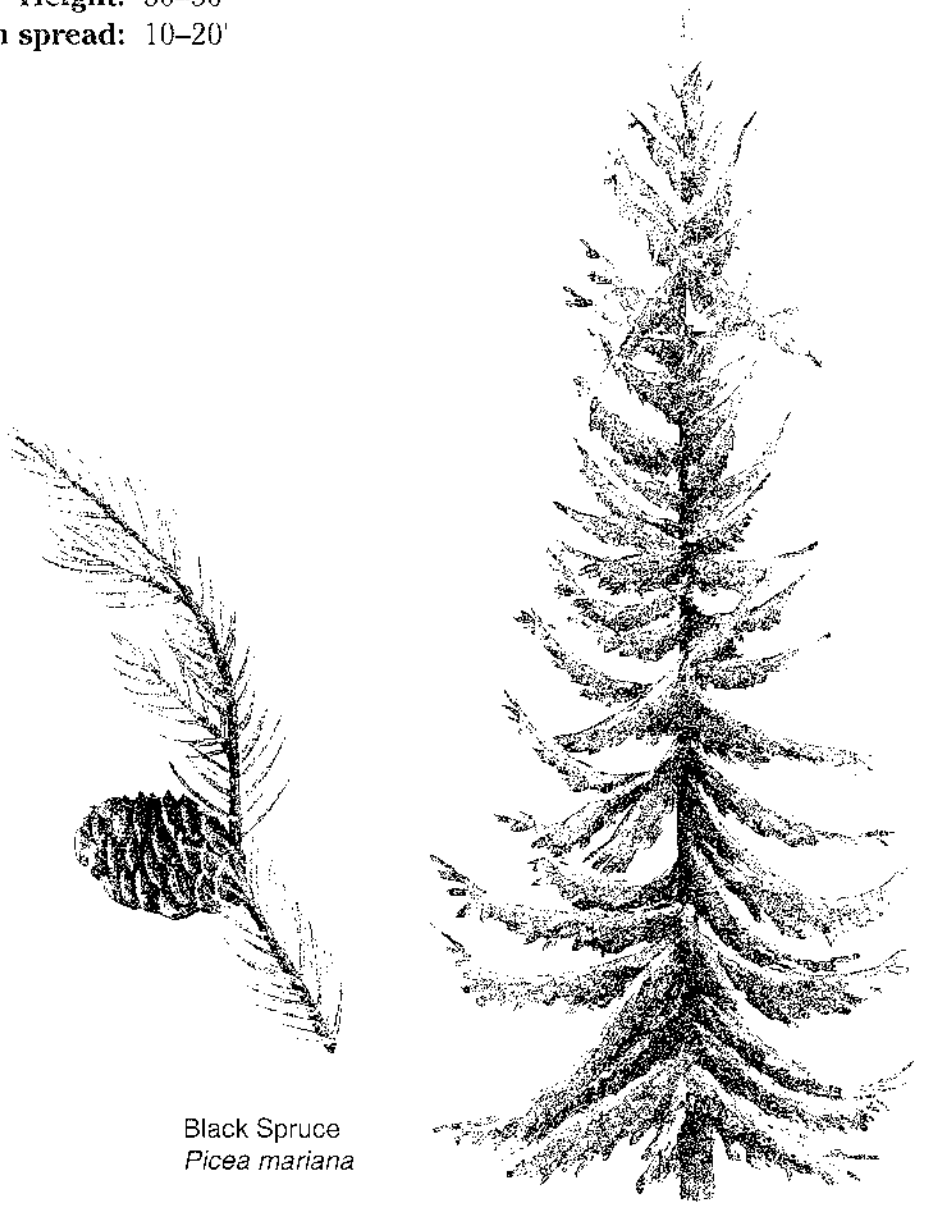


Sugar Maple
Acer saccharum

Black Spruce

Picea mariana

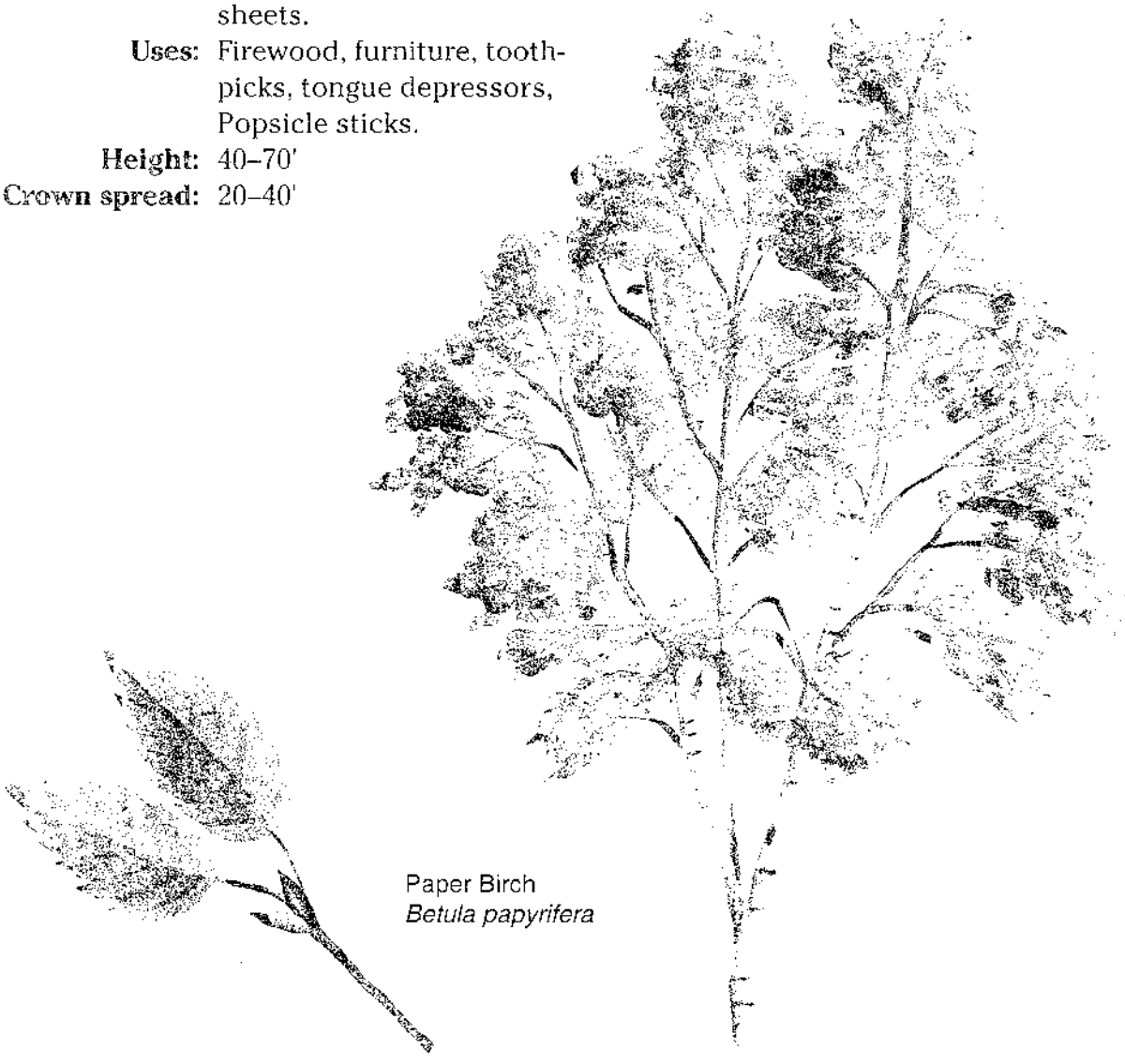
Black Spruce: Coniferous (evergreen)
Tree appearance: Shaped like a narrow triangle.
Leaf appearance: Needles are small and yellow-white in color. They are borne singly from the branch.
Seed: Small roundish cone.
Growing conditions: Moist soils and bogs.
Special feature: Also called bog spruce, swamp spruce.
Uses: Mostly for paper.
Height: 30–50'
Crown spread: 10–20'



Black Spruce
Picea mariana

Paper Birch
Betula papyrifera

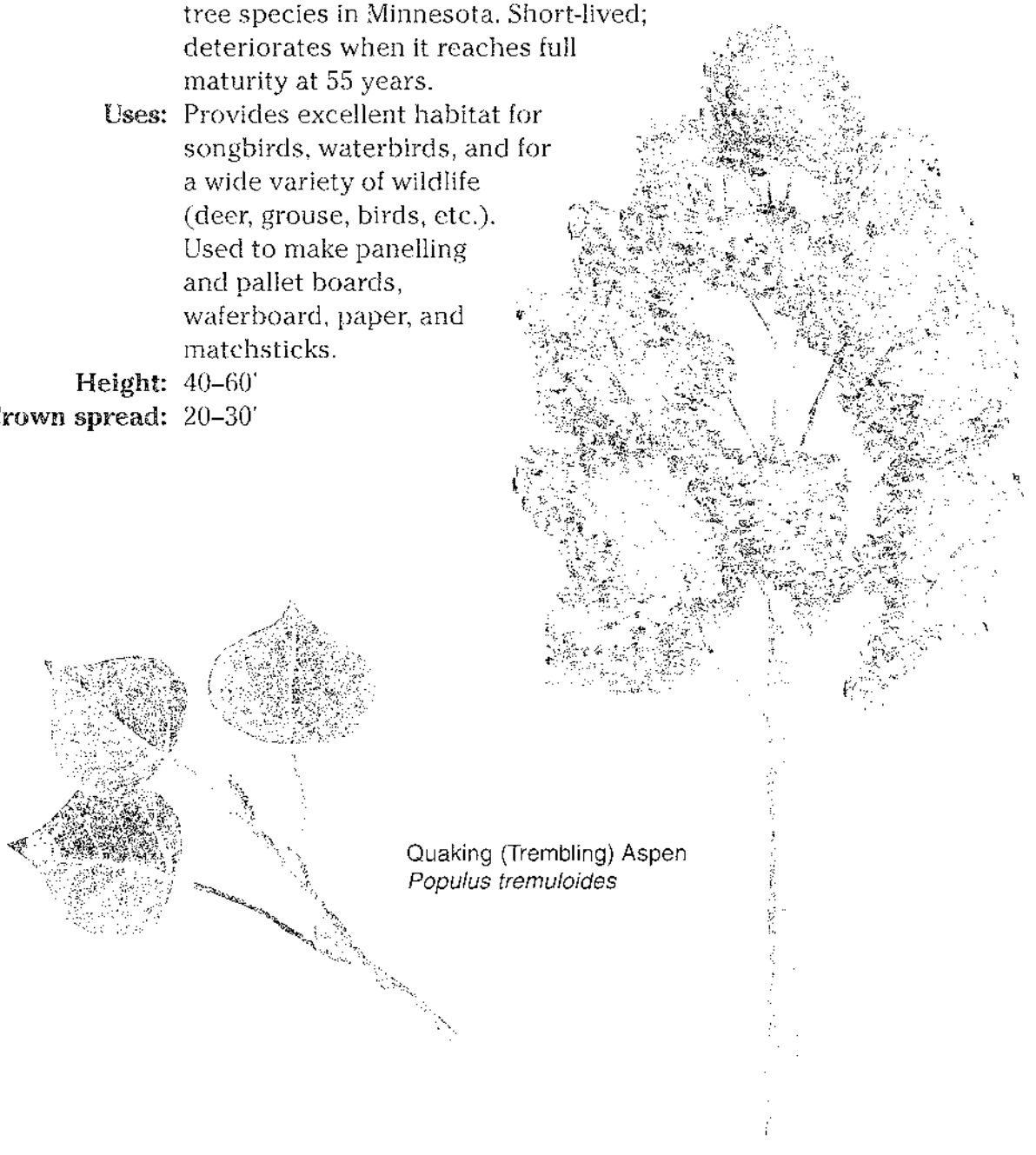
Paper Birch: Deciduous
Tree appearance: Attractive, smooth white bark; upright oval form.
Leaf appearance: Oblong leaf; edges of leaf have fine teeth.
Seed: Very small seeds are borne in catkins (flowering structure).
Growing conditions: Requires well-drained soil, cool soil temperatures, ample moisture, and full sunlight.
Special feature: As the tree gets older, the bark begins loosening from the tree in paper-like sheets.
Uses: Firewood, furniture, toothpicks, tongue depressors, Popsicle sticks.
Height: 40–70'
Crown spread: 20–40'



Paper Birch
Betula papyrifera

Quaking (Trembling) Aspen
Populus tremuloides

Quaking Aspen: Deciduous
Tree appearance: Attractive whitish bark; good yellow fall color.
Leaf appearance: Almost round, smooth leaf. Leaves are light green above, silvery green beneath and flutter in the slightest wind.
Seed: Fine cottony seeds borne in catkins (flowering structure).
Growing conditions: Prefers rich, well-drained soil.
Special feature: Fast growing tree that was once considered rather useless; now it is the most commercially-used tree species in Minnesota. Short-lived; deteriorates when it reaches full maturity at 55 years.
Uses: Provides excellent habitat for songbirds, waterbirds, and for a wide variety of wildlife (deer, grouse, birds, etc.). Used to make panelling and pallet boards, waferboard, paper, and matchsticks.
Height: 40–60'
Crown spread: 20–30'

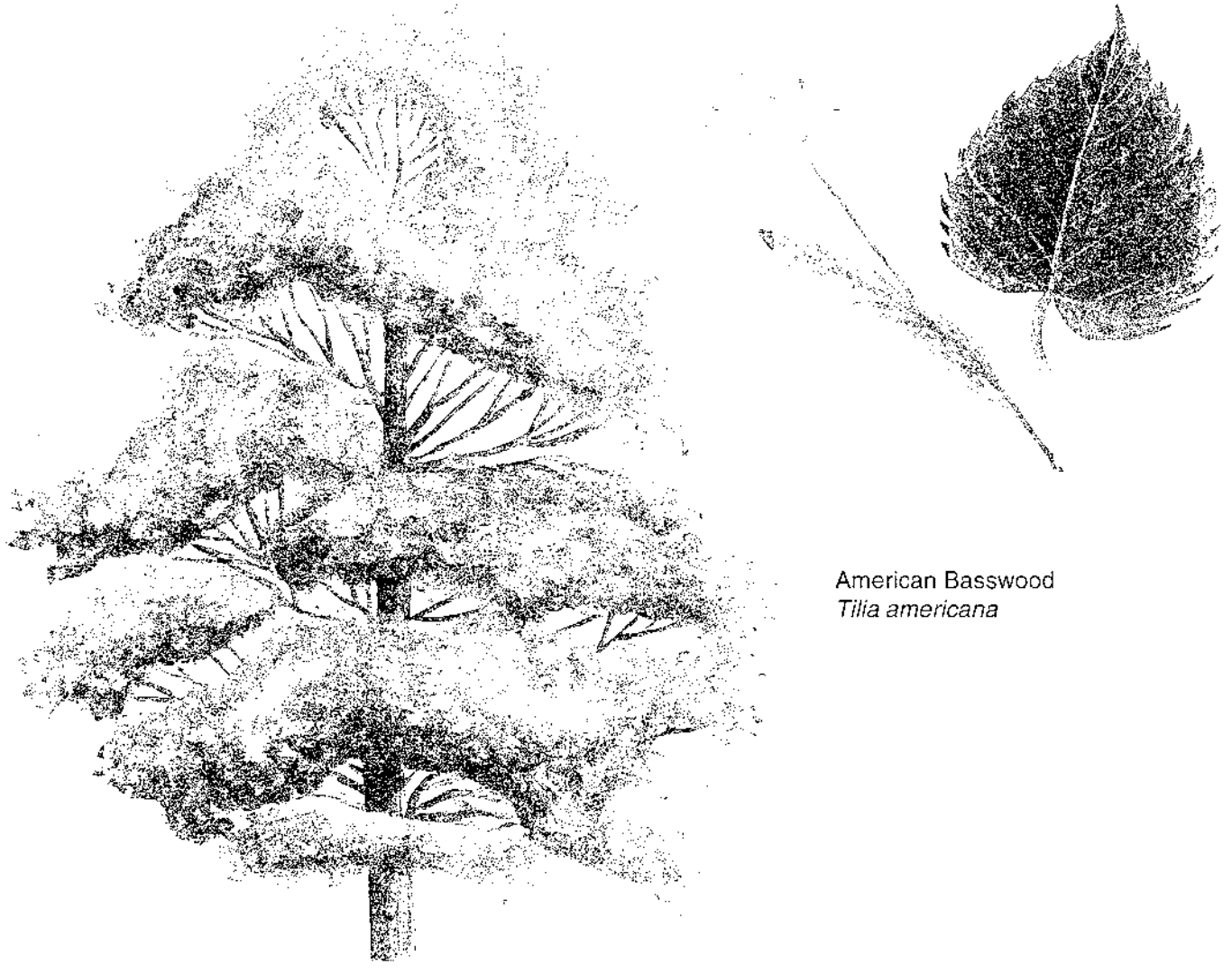


Quaking (Trembling) Aspen
Populus tremuloides

American Basswood

Tilia americana

American Basswood: Deciduous
Tree appearance: Oval.
Leaf appearance: Large oblong leaves; edges of leaf have fine teeth.
Seed: Finger-like leaf coming from branch produces a stem-like structure with about a dozen seeds.
Growing conditions: Grows best in moist soils.
Special feature: Develops from sprouts as well as seeds.
Uses: Seeds and twigs eaten by wildlife. Planted as shade trees. Favored by wood carvers.
Height: 50–70'
Crown spread: 20–40'

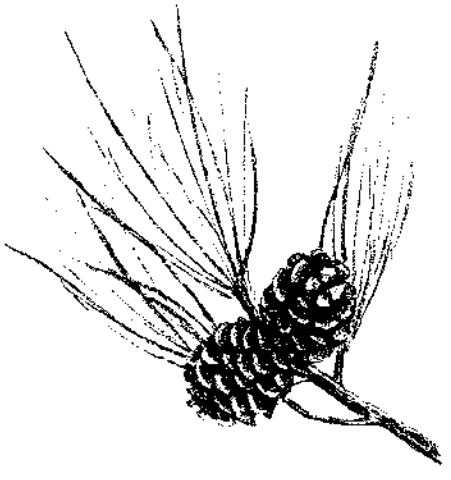


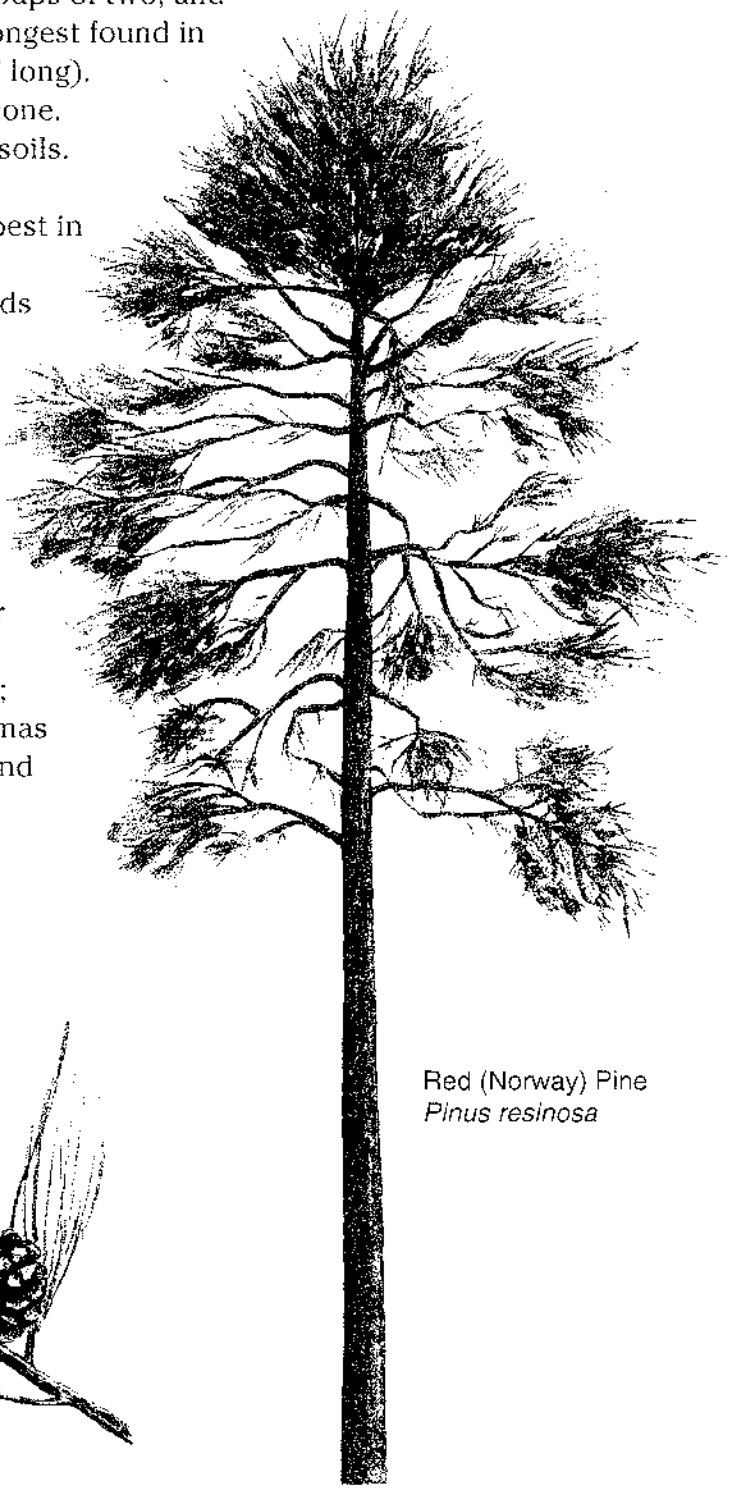
American Basswood
Tilia americana

Red (Norway) Pine

Pinus resinosa

Red (Norway) Pine: Coniferous (evergreen)
Tree appearance: Pyramid; reddish-to-orange bark.
Leaf appearance: Needles are medium green to yellow green, are in groups of two, and are about the longest found in Minnesota (5-6" long).
Seed: Medium-sized cone.
Growing conditions: Tolerates poor soils. Fairly drought tolerant. Does best in northern Minnesota. Needs full sunlight to grow.
Special feature: Minnesota's state tree. Extremely hardy.
Uses: Provides nesting sites for osprey, eagles, and other birds; used for Christmas trees, lumber, and paper.
Height: 60–80'
Crown spread: 25–30'

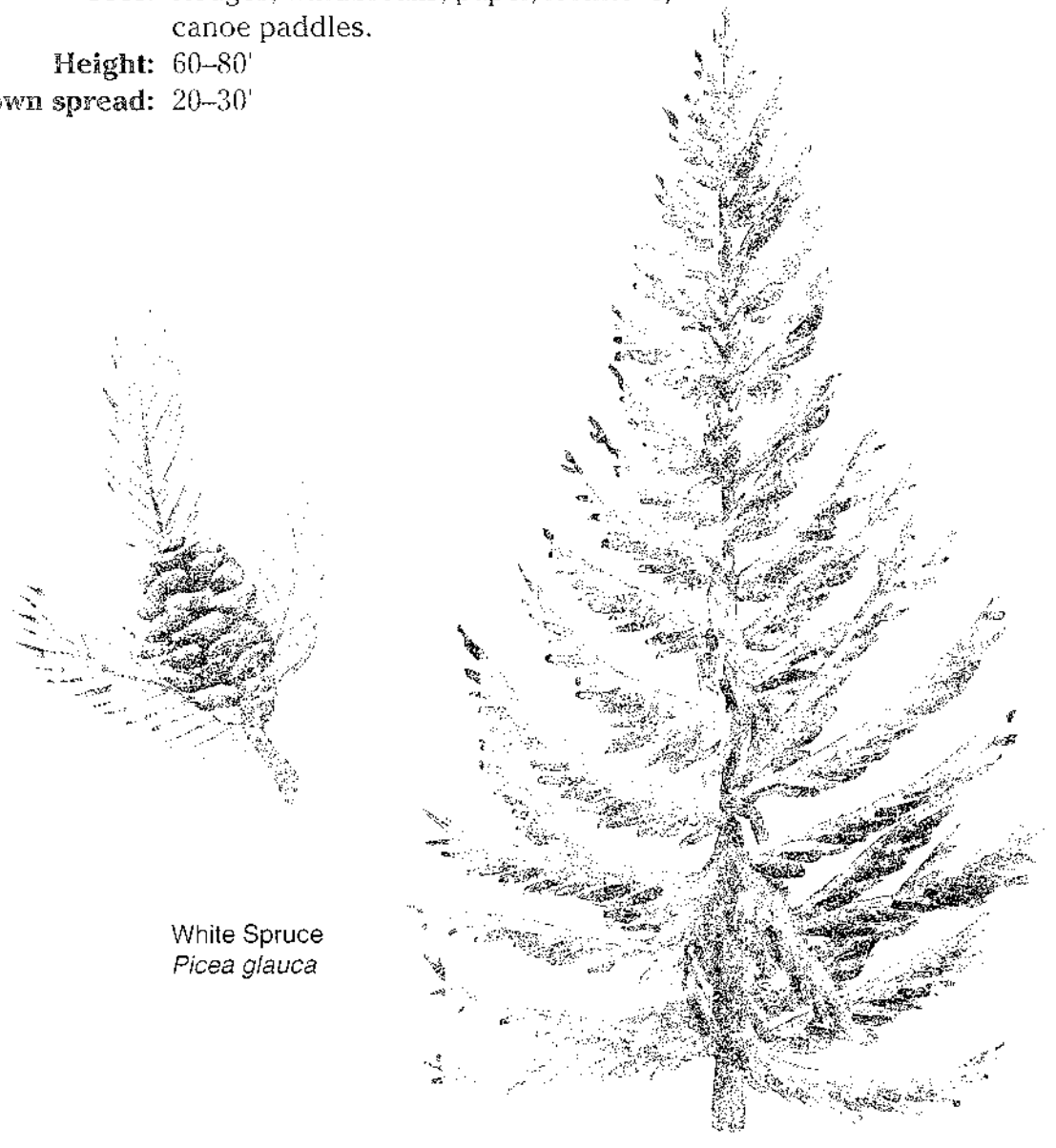




Red (Norway) Pine
Pinus resinosa

White Spruce
Picea glauca

White Spruce: Coniferous (evergreen)
Tree appearance: Large triangle. Full branching appearance.
Leaf appearance: Medium length needles that come out singly from the branch. Needles are dusty green to blue in color.
Seed: Medium-sized cone.
Growing conditions: Likes full sunlight to grow, although is quite tolerant of partial shade.
Special feature: Very hardy; adaptable to difficult conditions such as heat, cold, and drought.
Uses: Hedges, windbreaks, paper, furniture, canoe paddles.
Height: 60–80'
Crown spread: 20–30'

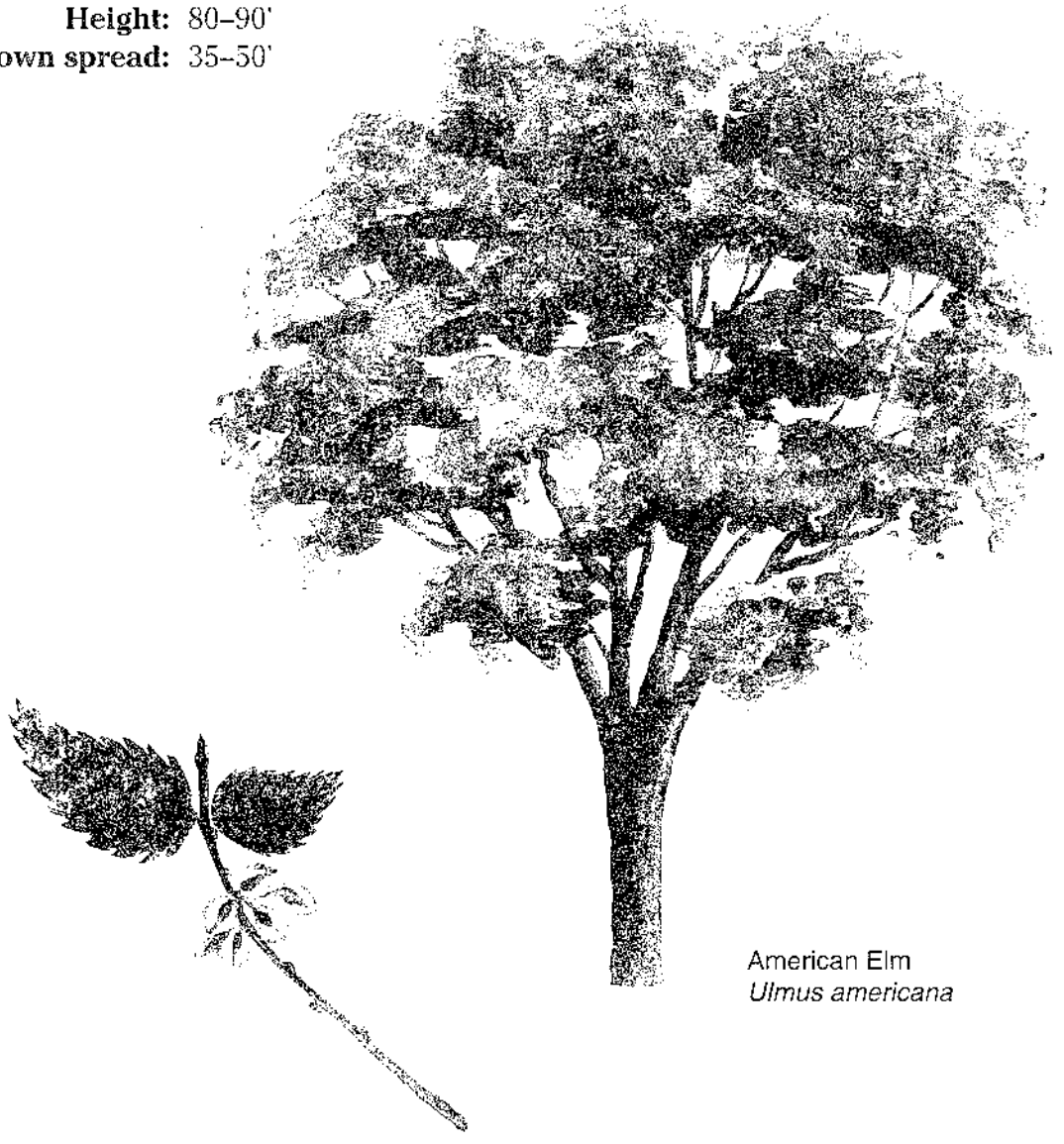


White Spruce
Picea glauca

American Elm

Ulmus americana

American Elm: Deciduous
Tree appearance: Large, fast growing tree. Excellent vase shape makes it an ideal street tree.
Leaf appearance: Oblong, rough leaf; edges of leaf have coarse teeth. Leaves are medium green, turning yellow in the fall.
Seed: Small double-winged seed borne in clusters.
Growing conditions: Very tolerant of city conditions.
Special feature: Prior to Dutch elm disease, it made up a high proportion of street trees. Has shallow roots that may damage sidewalks and drain tiles.
Uses: Seeds are food source for birds. Favorite for furniture and boat building.
Height: 80–90'
Crown spread: 35–50'



American Elm
Ulmus americana

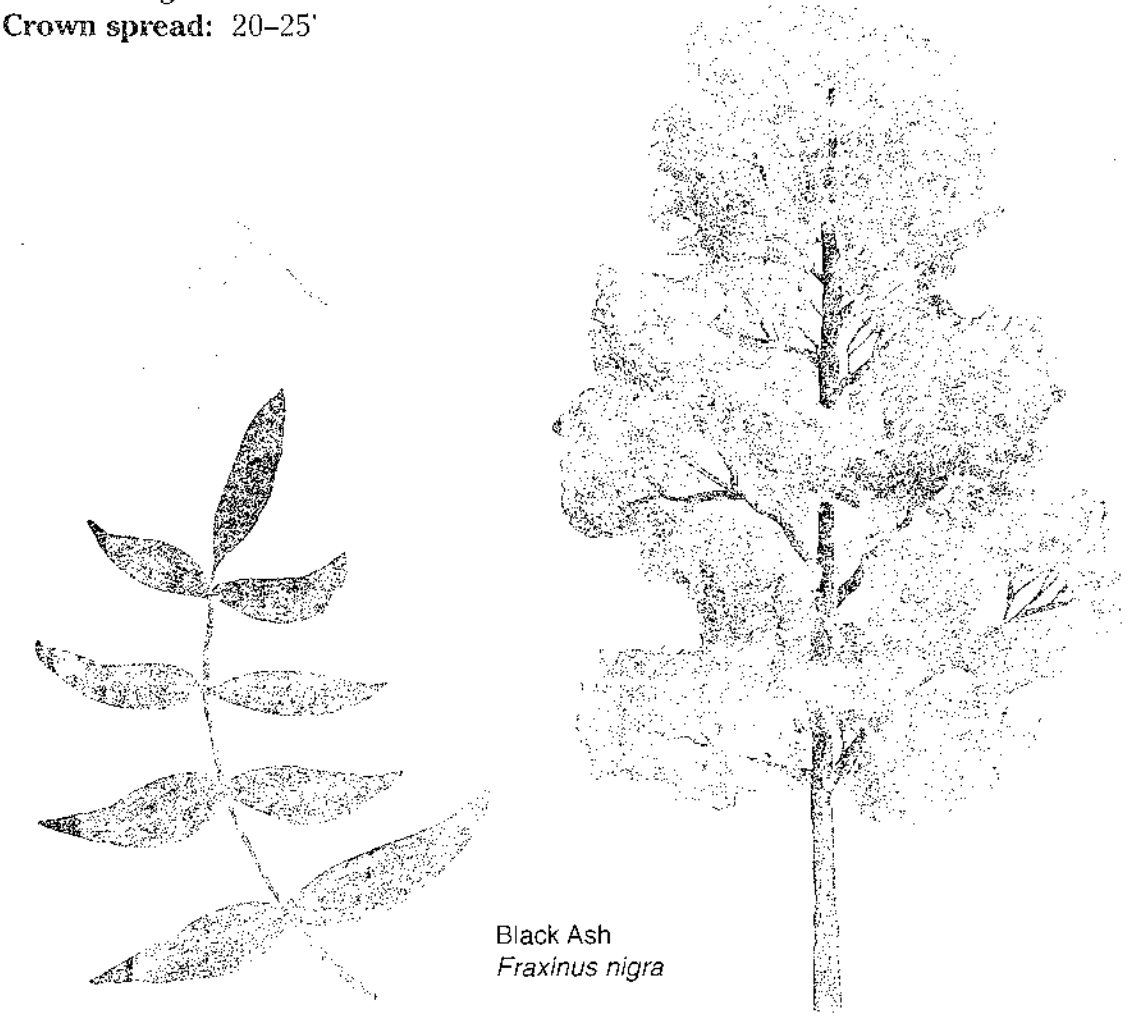
Balsam Fir
Abies balsamea

Balsam Fir: Coniferous (evergreen)
Tree appearance: Triangular shape; trunk is gray.
Leaf appearance: Needles are dark green with bands on the underside.
Seed: Unique feature is that the cone stands up on the branch and this dark sticky cone comes apart before falling from the tree.
Growing conditions: Prefers rich, well-drained soil. Performs best in cool climates. Very hardy evergreen.
Special feature: Trunk has raised blisters full of fragrant resin.
Uses: Provides cover (protection from weather and predators) for various birds; used for Christmas trees and in making paper.
Height: 40–75'
Crown spread: 15–25'

Balsam Fir
Abies balsamea

Black Ash
Fraxinus nigra

Black Ash: Deciduous
Tree appearance: Upright oval crown.
Leaf appearance: 7 to 13 leaflets; dark green with lighter green underside.
Seed: Narrow tear-shaped winged seeds.
Growing conditions: Grows along stream banks or the borders of swamps; requires full sun.
Special feature: Overall, tree looks somewhat like a black walnut from a distance. Bark light gray with orangish streaks; surface easily rubbed off, feels like powder.
Uses: Shelterbelts and/or windbreaks; some birds use them for nesting and some eat the seeds; some mammals browse on seeds and buds; pulpwood, saw wood, veneer; excellent material for baskets, hoops, etc.
Height: 30–50'
Crown spread: 20–25'



Black Ash
Fraxinus nigra

Bitternut Hickory
Carya cordiformis

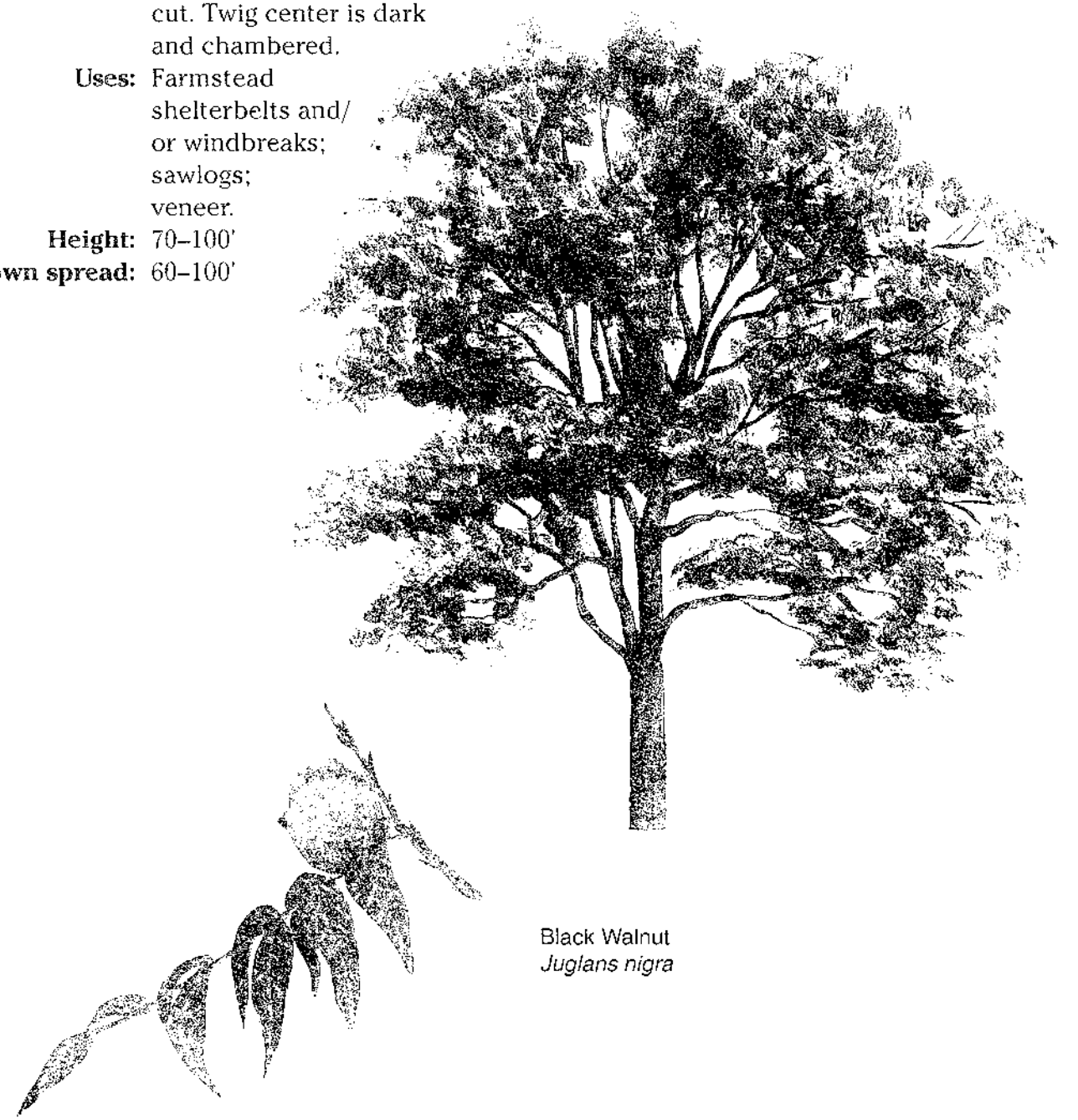
Bitternut Hickory: Deciduous
Tree appearance: Full rounded crown.
Leaf appearance: Usually 7 to 11 leaflets.
Seed: Round light green nut, tip of nut is sharply pointed.
Growing conditions: Needs full sun.
Special feature: Grayish, smooth, thin, tight, hard, tough bark.
Uses: Shelterbelts and/or windbreaks; wildlife, veneer, sawlogs, fuel.
Height: 40–75'
Crown spread: 30+'

Bitternut Hickory
Carya cordiformis

Black Walnut

Juglans nigra

Black Walnut: Deciduous
Tree appearance: Fairly spreading crown.
Leaf appearance: Compound, smooth leaves.
Seed: 2-inch nut (large), usually green.
Growing conditions: Grows rapidly; needs full sun.
Special feature: Dark sharply ridged bark; can readily be cut with a knife; chocolate color when cut. Twig center is dark and chambered.
Uses: Farmstead shelterbelts and/or windbreaks; sawlogs; veneer.
Height: 70–100'
Crown spread: 60–100'

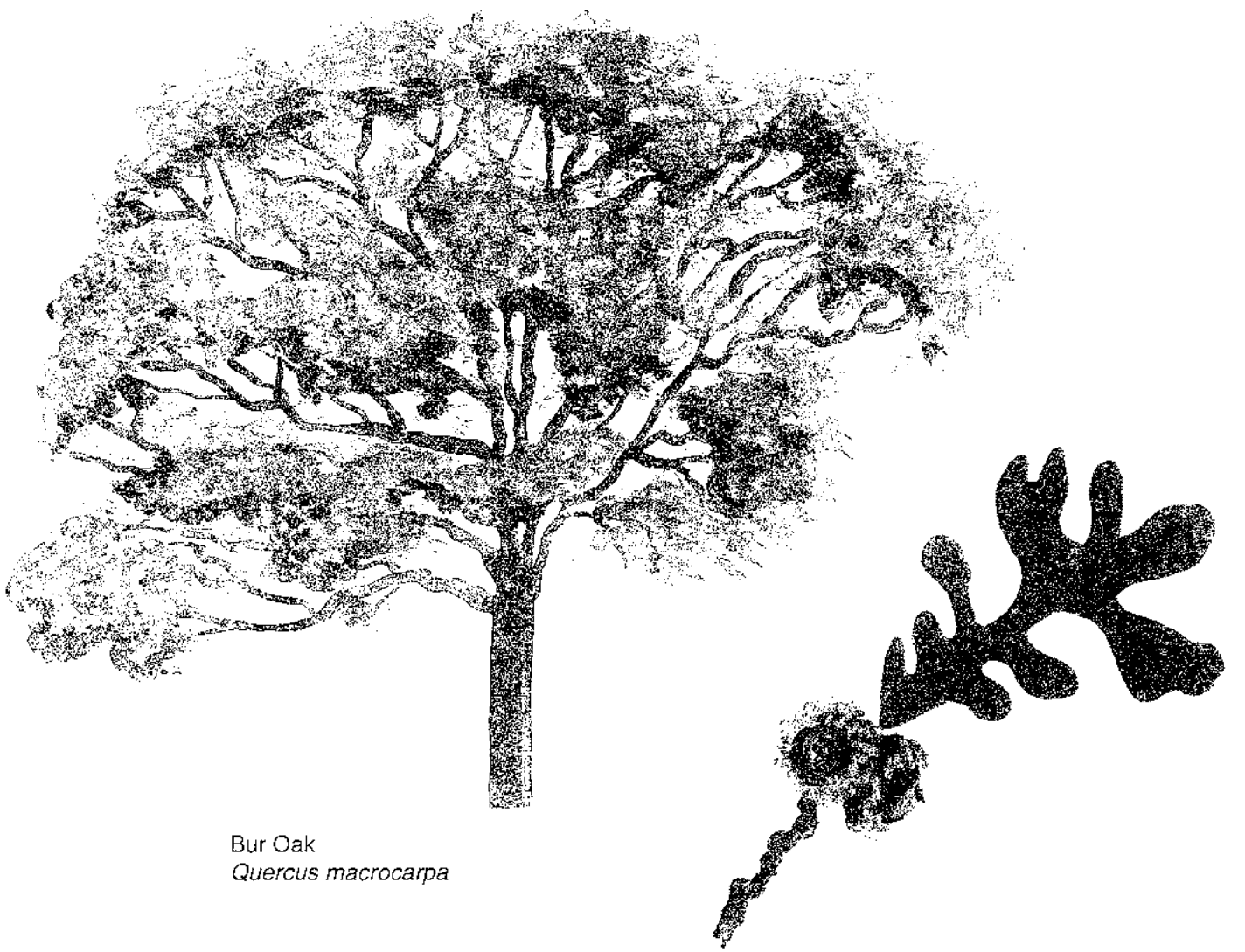


Black Walnut
Juglans nigra

Bur Oak

Quercus macrocarpa

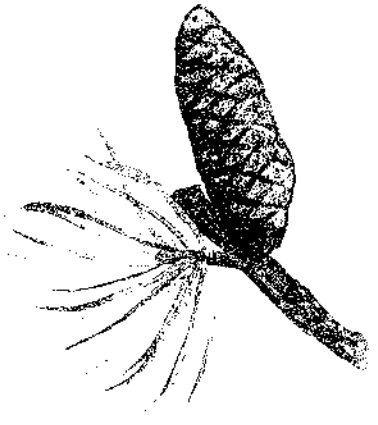
Bur Oak: Deciduous
Tree appearance: Majestic, spreading form.
Leaf appearance: Large leaves with deeply indented centered lobes.
Seed: Large acorn in a fringed cup.
Growing conditions: Has tolerance for poor soils; extremely adaptable. Likes full sun but is tolerant of partial shade; needs room to spread.
Special feature: Corky twigs; entire tree has rough bark; can readily be cut with a knife. Fall color is yellow-green to brown.
Uses: Important food tree for wildlife; nuts readily available to deer and squirrels; furniture, ships, railway ties, construction.
Height: 50–80'
Crown spread: 40–80'

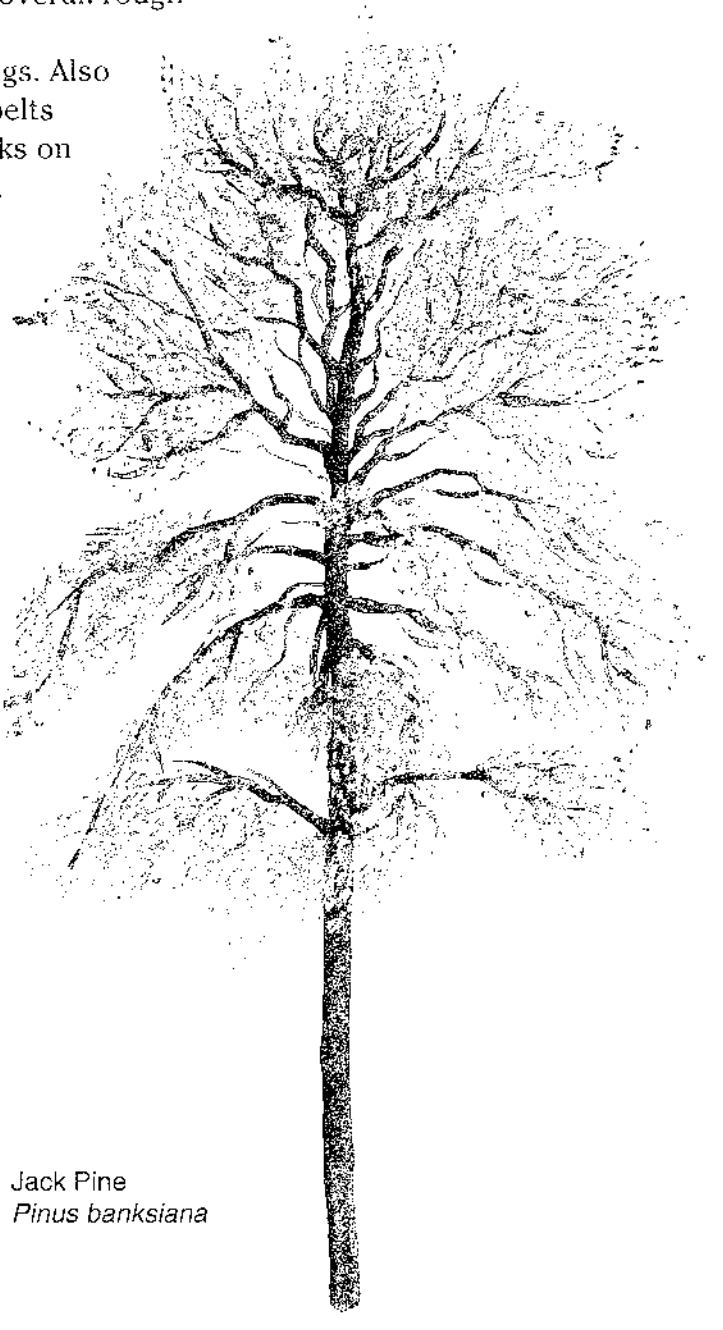


Bur Oak
Quercus macrocarpa

Jack Pine
Pinus banksiana

Jack Pine: Coniferous (evergreen)
Tree appearance: Triangular-shaped crown.
Leaf appearance: Short needles, two in a cluster; forked like jackrabbit ears.
Seed: Closed, persistent cones that point to the end of the branch; may remain closed for many years.
Growing conditions: Needs full sun; prefers well-drained soils.
Special feature: Dark scaly bark; overall rough appearance.
Uses: Pulpwood; sawlogs. Also used for shelterbelts and/or windbreaks on poor sandy soils.
Height: 30–80'
Crown spread: 20–30'

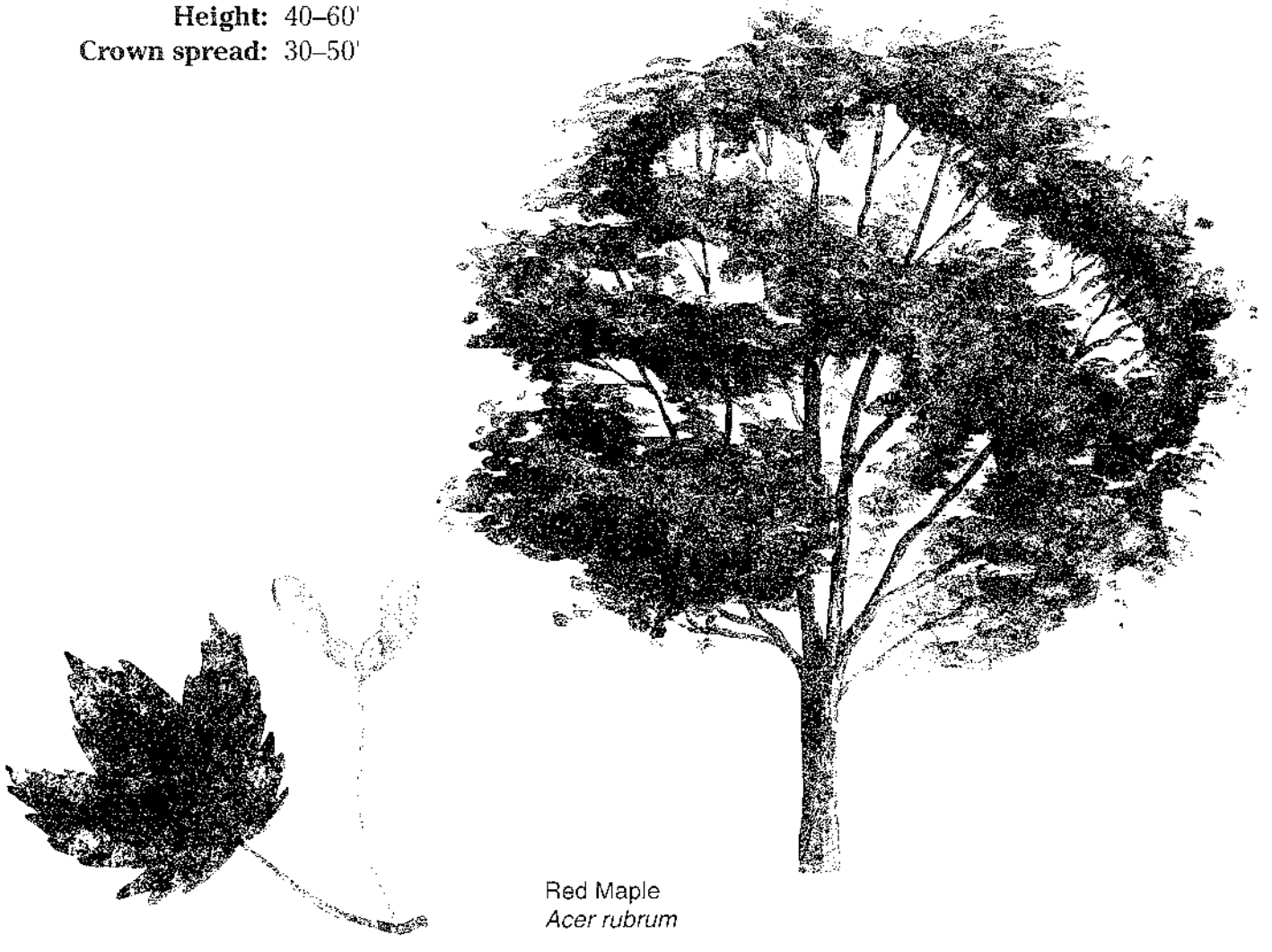




Jack Pine
Pinus banksiana

Red Maple
Acer rubrum

Red Maple: Deciduous
Tree appearance: Oval to round crown with red flowers in very early spring.
Leaf appearance: Nice bright green. Three-lobed leaves that are whitish below, dark red twigs and buds.
Seed: Pairs of winged, V-shaped seed; distinct round seeds at base of wings, ripen in spring.
Growing conditions: Likes full or partial shade; needs well-drained soil with ample moisture.
Special feature: Smooth gray bark that breaks up into flaky strips. Brilliant yellow, orange, and red fall color.
Uses: Excellent landscape tree in situations to which it is adapted.
Height: 40–60'
Crown spread: 30–50'



Red Maple
Acer rubrum

UNIT FIVE:
PEOPLE AND THE WEB—LIVING TOGETHER AND HOW IT WORKS

UNIT FIVE DISCOVERIES

Students will be introduced to some of the ways people and trees relate to each other. For background see the introduction and Chapters One, Two, Three, and Four in *Where Are All The Trees? A Minnesota Primer.*

KEY

- (P) Primary Students
- (I) Intermediate Students
- (A) Advanced Students

We have spent a great deal of time in the previous units learning about one particular member of the web of life: TREES! We've learned that trees, like all living things, exist in an area because it provides all the essentials for their life. When those essentials are no longer provided, their very existence is threatened or destroyed.

People are the only members of the web that can profoundly change the whole environment when it does not or can not provide for us. We can remove soil, water, plants, and animals to meet our needs (to build houses, provide food, farm, collect water, etc.) or we can add soil, water, plants, and animals to provide for our needs (food, windbreaks, shade, landscaping, etc.). This gives us a unique advantage in choosing our living options and an awesome responsibility to do that job wisely. We have, in effect, become stewards of spaceship earth.

The following activities will explore how we do that job and what effects our changes have on the environment around us.

> "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 Seattle

Activity 1: Points of View

(P) (I) (A)

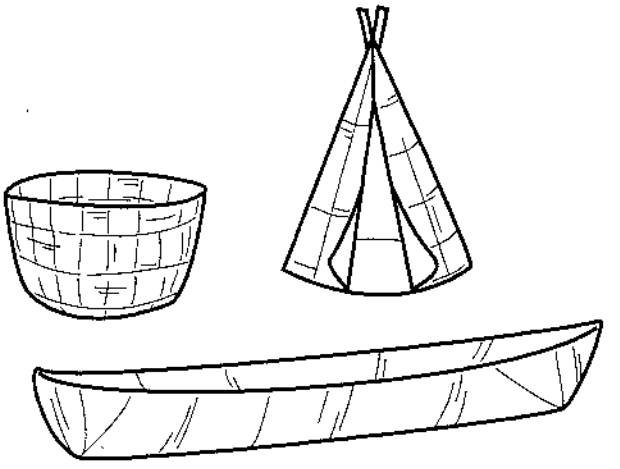
How we look at something and perceive its usefulness dictates how we treat it. For example, an old fallen log would look perfect to a skunk looking for a place to live. It would look like an eyesore to a homeowner cleaning up his or her yard.

Using the following list as a starter, make a list of people and animals that might relate to trees differently.

- an artist
- an ecologist
- a landscape architect
- a forester
- a bird that lives in a tree
- a tree farmer
- a tree inspector
- a homeowner
- a gray squirrel
- a logger
- a camper

Now ask the students to pick one and draw pictures of how their choice might view or use trees at different times in the tree's life cycle. For example, a woodpecker would love to make its home in a hollow, standing dead tree. A forester might clear the dead tree out to make room for saplings.

Used with permission from A Teachers' Guide to Arbor Month, *Minnesota Arbor Month Partnership, 1990.*



Activity 2: Home, Sweet Home

P I A

Trees find a home and exist in a place that will sustain them. Once there, they go on to provide a home to many creatures —including us! If you could create different kinds of housing units for different species, how would you make a comfortable home for the plants and animals in:

1. A tree farm along the banks of the Mississippi or up along the North Shore
2. A reptile house in Minnesota
3. A home for tropical plants in the Twin Cities (example: Como Conservatory)
4. A nature preserve for wild songbirds
5. An animal wildlife refuge
6. A people house: on the prairie; on the farm; in the woods; on the North Shore; by a lake near Mora.

What trees and plants would grow naturally? What plants would need help to stay alive? What kind of space would the trees and animals need to exist?

American Indians inhabited our Minnesota forests long before European settlers arrived. Their love of nature and attitude of respect for all of it showed how keenly aware they were that everything they needed had to come from the world around them. Pick a part of the state, think about what natural resources might have been present long ago, and draw or construct houses and other items the Indians might have made (for example, a tepee out of buffalo hides and poles, a dugout canoe or a birch-bark canoe, eating appliances, wooden bowls, woven reed baskets). Check out *Steven Caney's Kids' America,* an excellent resource on how to make many of these items. See the bibliography.

In pioneer times, people had to use what they found around them to build their homes—everything from caves to prairie sod houses to log cabins. With the seemingly endless bounty of the land, the necessity of the times, and the lack of awareness of long-range consequences, the settlers logged their way into the new world. Have the students construct a model of a house using materials that would be available to them in a particular area of the state.

Activity 3: Being Good Neighbors

P

Most of our personal relationships with trees take place in our own back yards and neighborhoods. Weather permitting, take the children outside and have them lie down and look up through the leaves. Talk about and make a list of some of the things trees give to us.

Read *The Giving Tree* by Shel Silverstein. Over the years, what did the tree give to the boy?

With the help of Activity Sheet 5A, list some of the things we can do for trees. Start to create lifelong good habits by making some of those things a regular part of your outdoor activities with the children.

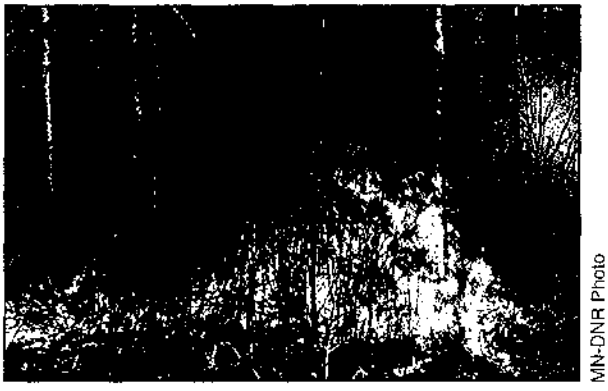
I A

Take the same awareness inventory (things we can do for trees) as above. Now look at Activity Sheet 5B. As our awareness grows with age, we realize that our relationship with trees goes far beyond the neighborhood. We need to take care of them so that they can be enjoyed by all creatures—including us! Ask students to list the different ways we and other animals benefit from the wise management of this precious resource in the different settings pictured.

Join a local project (park maintenance, nature center volunteer, etc.) or create one of your own for managing and maintaining your yard. Perhaps make a picnic area for you to enjoy nature-watching, or make a feeding station for the animals to enjoy people-watching!

Activity 4: Is There a Doctor in the Forest?

Trees have many things that can hurt them, both natural and human: disease (Dutch elm, oak wilt), insects, fire, wind, lightning, lack of proper moisture, poor growing conditions, pollution, construction, vehicles, animals, etc.



MN-DNR Photo

Wildfires are one threat faced by trees in a forested area.

P I A

Go on a discovery hike and hunt for tree problems. Use Activity Sheet 5C to help students figure out what happened to the tree. What caused the problem? Is the tree still alive? Can it survive the problem?

What can you do to help trees stay healthy? (Ideas: Protect them from forest fires; remove diseased trees so that they can't infect others; water and mulch trees regularly; don't hang on the lower branches.) Have students make a list of the things they can start doing right away to help their adopted trees and any others.

Activity 5: Build a City, Park, or Forest

I A

Have students think of what it would be like to be given a tract of land that they could develop any way they chose. First have them decide what kind of environment they are going to create.

Go back to the maps in Unit Four and the activities of Units Three and Four for a refresher on the information you've learned about tree needs (soil, water, space, etc.). Use that information to plan what trees students would put in the areas they are creating. For those planning a city, *The Right Tree Handbook* would be helpful (see bibliography). For those planning a park, check out Activity Sheet 5D to see the kinds and numbers of trees people would see if they were to visit it.

How will people relate to the trees and use them in each of the different places?

See Activity Sheets 5E and 5F for how to plant a tree.

Call your local extension office or DNR forestry office and see if there is a planting project you can actually take part in.

Activity 6: What a Difference it Makes—with and without Trees

P I A

Without good stewardship and management, whole environments are permanently altered or destroyed.

Read *The Lorax* by Dr. Seuss. Discuss what happened to all the living things, including the Once-ler. Role-play the story, creating costumes and props.

Editor's note: In Laytonville, California, an attempt was made to ban *The Lorax* from the schools as an anti-logging book. Discuss why the book was perceived as a threat. Discuss what positive messages the book has to give.

I A

There is currently much discussion about what is happening to ecosystems in different parts of the world: the Pacific Northwest old-growth forest, home of the spotted owl; tropical rain forests, etc.

Have students research one of these areas and what is happening there. Discuss what the area might be like five to 10 years from now. What global impacts might these changes have? What suggestions do the students have to manage the situations in a positive way?

Find out about a reforestation project near you. Call your DNR forestry office or your county extension office. (Many times scout groups or 4-H groups get involved.)

Learn what has happened to an area that has been through a natural disaster (the Hinckley fire; the Springbrook Nature Center tornado in Minneapolis) or has been harvested and then replanted. Go to visit the area if you can. Draw a picture of what the area might have looked like before it was disturbed. Then draw a picture of what the area looks like now. If new trees have been planted, find out how long it will take them to grow to maturity.

Activity 7: Plant, Animal, Rock Game

P E

Gather all of the collected items you can from your hikes. Draw three circles on the ground: one for rocks, one for plants, one for animals. Ask the children to sort out their nature items and put them in the appropriate circle. Now bring out a bag of other collected items from your walks (pop cans, bottles, foil candy wrappers, etc.). Which circle can you put these in? Discuss the fact that there is no appropriate "nature" place for these items. This game is a great discussion starter on pollution and recycling. If you have not read *The Lorax* by Dr. Seuss, please do so now. It fits in perfectly.

A

As a group, join a local effort to clean up a park, river, or roadside area.

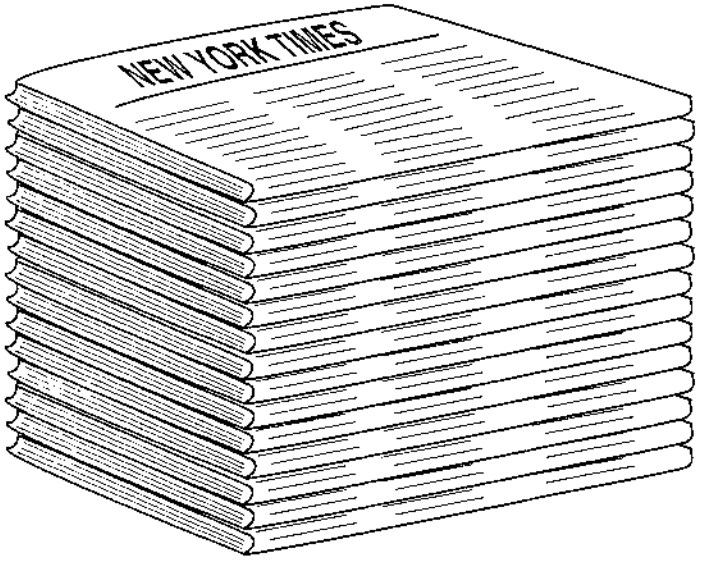
Everyone bring newspapers from home for one week. Weigh them at the end of the week to see how much paper was used. Then recycle them!

Activity 8: Reduce and Reuse—What's Garbage and What's Not

A step vital to the preservation and wise use of our natural resources is the development of a good working system to reduce, recycle, and recover usable natural materials from the waste we have already generated. In other words, it's time to put that garbage back to work! Share the following facts with the students:

- Each Minnesotan produces an average of 2 1/2 to 4 pounds of garbage every day.
- Up to 3 percent of the state's garbage (about 100,000 tons a year) could be eliminated by using waste-reducing techniques such as reusing office paper as scratch paper, leaving grass clippings on the lawn, and not buying disposable products.
- The United States is the major exporter of wastepaper in the world.
- By weight, 37 percent of our garbage is made up of paper, 18 percent is glass, 10 percent is metal, 8 percent is food waste, 7 percent is plastic, and 10 percent is other miscellaneous items.

Source: Minnesota Office of Waste Management.



TREE FACT: Recycling just one Sunday edition of the New York Times newspaper would save 75,000 trees!

Now, let's concentrate on what can be done with just paper.

For one week ask the students to save all of the different kinds of wastepaper they have left over after their projects. Separate the papers into two stacks each day: one for paper that is completely used up; one for paper that could be used for something else. At the end of the week, compare the two stacks and help the students decide whether they are wasting paper.

Now give everyone some of the reusable paper and something else that is made out of paper (for example, a grocery bag, shoe box, magazine, greeting card, newspaper, lunch sack, milk carton). Ask everyone to think of ways to reuse their item. Decide which ideas would work best for you and make them a part of your group's daily routine.

Maintain a room recycling center. Make gifts, models, table decorations, collages, bookmarks, name tags, and anything else students can suggest out of products for recycling from school and from home. Recycle unused materials through your local recycling center. (Call your county or city offices to find out where to recycle.)

Try this to experience what pioneer children might have done. Give each student a 12-by 12-inch piece of hardboard (painted a slate color) to use instead of paper for writing and drawing. Use chalk and erase the markings with a damp cloth when done.

Use the back sides of paper to do another exercise.

Send for a paper-making kit and use some of your recycled material to make new paper. Write or call:

Minnesota Forest Industries
1015 Torrey Building
314 West Superior Street
Duluth, MN 55802
Phone: 218-722-5013

"Man is tinkering with his environment, and the absolute requirement of intelligent tinkering is to save all the parts."

—Aldo Leopold

These activities are beginning stages of awareness of the stewardship role we need to play as part of the delicate cycle of any environment we live in. With the realization that trees are a necessary part of our lives in many ways, Minnesota is a leader in developing management practices that help maintain a balance and harmony within that interrelationship. Use the following activities to explore the many ways people can be a part of the stewardship process.

Activity 9: How Do We Use Trees?

The variety of Minnesota's ecosystems provides an ideal home to many species of trees. Let's look at some of the products our state's trees give to us.

Paper Birch: This tree has a white, papery bark that stands out against the dark bark of other forest trees. It's used for firewood and furniture.

Ash: Strong, hard wood. Green ash is an athlete's special friend. Used for baseball bats and hockey sticks, as well as handles and firewood.

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

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

Maple: A beautifully grained hardwood, popular for furniture and moldings. The sugar maple provides sap for maple syrup and is one of fall's most colorful trees.

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

Black spruce: Grows in moist soil and bogs. Used mostly for pulp.

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

White spruce: Used for paper and for things that must be strong such as 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 Christmas trees.

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

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

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

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

Let's follow some of the steps that it takes to keep Minnesota trees truckin' from the forest to the consumer and finally through the disposal process. The following list shows some of the wood products that are manufactured and transported in Minnesota:

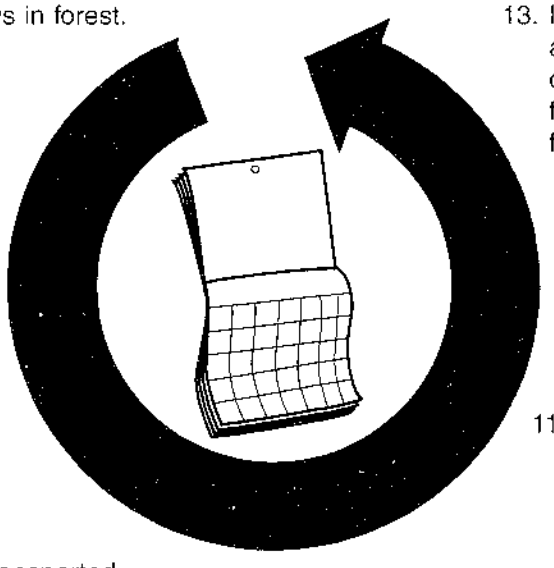
airplane parts
boats
boxes and crates
building materials
cabinets
clocks
docks
doors
fencing
fishing tackle
furniture
ladders
lamps
lumber
mobile homes
musical instruments
oriented strand board (OSB)
paper
parallel strand lumber
picture frames
playground equipment
shingles, shakes
signs
sporting goods
stairs
tools
toys
waferboard
windows (wood-framed)

Ask each student to bring three items that are products of the Minnesota forest ecosystem. These could be wood products, or they could be things such as maple syrup or buckskin gloves from deer that lived or grazed in the forest.

Each student chooses one of the items to research, identifying all of the steps necessary to produce the finished product from the raw material. Next, students identify all of the steps necessary to "cycle" the finished product through the disposal process. Finally, they draw and label the points in the product's life cycle on a large sheet of paper or on a chalkboard. For example, a student might draw the poster below to illustrate the steps in the cycle of a calendar.

STEPS IN THE CYCLE OF A CALENDAR

1. Tree grows in forest.
2. Logger cuts tree.
3. Trucker hauls tree to mill.
4. Mill makes tree into paper.
5. Paper is transported to printer.
6. Paper is made into calendar.
7. Calendar is packaged and prepared for shipping.
8. Calendar is transported to retail stores.
9. Calendar is sold to consumer and transported to home, business, school, etc.
10. Calendar is used.
11. Used calendar is discarded or transported to recycling center. Some non-glossy papers can be put in a compost.
12. If discarded, the calendar is transported to a landfill. If taken to a recycling center, it's made into a new product.
13. If the calendar was non-glossy and decomposed in a compost, it could possibly become a nutrient for a new tree, thus completing a full "back to nature" cycle.



Activity 10: It Takes All Kinds—Forestry-Related Careers

P I A

It takes a partnership of all kinds of people and jobs to help trees get through the growth process to the wood shop or construction site. Make a list of some that you can think of and compare it to the following:

forest soil specialist
insect and plant disease specialist
silviculturist
timber buyer
forest hydrologist
logger
fishery specialist
forest products sales representative
cabinet and furniture maker
urban forester
wildlife specialist
conservation officer
forest products production manager
forester
chemist
plant geneticist
professor
paper process engineer
computer specialist
park ranger
forest firefighter
wood carver
paper buyer
tree service specialist
heavy machine operator
geologist
consultant

Discuss what each of these people have to do with the trees and wood products.

Have the students draw pictures, write stories, or role-play about the jobs.

Create dioramas of different scenes relating to some of the jobs (tree farm; saw mill or logging camp; managed park area for use by people and animals).

Are there places nearby you can visit to learn more about any of the jobs?

nursery
state park or forest
lumberyard
construction site
wood shop
furniture store

Make sure to stress the importance of the renewable part of the process. The lesson of the Once-ler in Dr. Seuss' *The Lorax* is very clear here: What we use, we must replace and use wisely.

Adapted with permission from Project Learning Tree.

Activity 11: Who's Minding the Trees?

All those people who manage the growth and processing of our trees do so based on personal reasons and decisions made at all levels of the governmental process. Many facts and needs must be continually assessed in order to assure that we steward our state's precious resources wisely. Read the background information in the *Minnesota Primer,* Chapter Five, about some of the ways our state is doing this. Now let's get a feel for how this partnership works.

I A

Create a forest by passing out the tree cards (cut out the cards on the next page and put on index cards). Have the student "trees" make a mixed stand. Make sure all members of the ecosystem understand the vital role they play as part of the stand.

Select one student to be the forester. Give that student one of the three management cards (also included) and turn him or her loose in the stand to do his or her job, based on the information on the card. As he or she

"harvests" (taps on the shoulder) the necessary trees, move these "trees" to one side.

Now ask for reactions from the harvested trees. Any ideas why you may have been harvested? Any idea as to the forester's overall goal? Do you consider this a wise management decision?

Then ask the forester to read what the management card directed.

Repeat the process using a different management card and forester.

TREE CARDS

One of each on 3" x 5" cards.

Dead Tree

Many insects live beneath the bark and inside the wood of dead trees. Birds eat these insects. Birds also peck large holes in the wood to create nests for raising their young. Dead trees do not interfere with the growth of living trees around them.

Sugar Maple

The wood from sugar maple trees can be sawed into lumber. Maple syrup can be made from the sap. Maple sap can be collected in early spring by drilling a hole in the tree, inserting a hollow tube into the hole, and placing a bucket beneath the tube. Sap then is boiled to evaporate water and concentrate the sweet syrup. Leaves on sugar maple trees turn brilliant red or yellow in the fall. Sugar maple trees can grow in dense shade and can regenerate in small forest openings.

Aspen

The wood from aspen trees is used for paper, particleboard, and lumber. Leaves on aspen trees turn bright yellow in the fall. White-tailed deer eat twigs on young aspen trees and ruffed grouse feed on aspen leaves, buds, and flowers. When aspen trees are harvested, thousands of root suckers sprout up to regenerate the forest. Aspen trees regenerate best in large forest openings such as clear-cuts.

White Pine

The wood from white pine trees is used for lumber. White pine trees hold their needles year around providing some green color in the woods even in winter. Young white pines can tolerate some shade and reproduce in small forest openings.

Animal Den Tree

A tree with a hole in its trunk or in a large branch may provide shelter for squirrels, raccoons, and cavity-nesting birds such as woodpeckers.

Oak

The wood from oak trees can be used for lumber, veneer, and railroad ties. Acorns are eaten by many animals including deer, grouse, wood ducks, and turkeys. Young oak trees do not grow well in the shade. Oaks reproduce best in large forest openings.

MANAGEMENT DECISION CARDS

One of each on 3" x 5" cards.

Forester #1

You are working for a family that wants to produce maple syrup to sell. This syrup is made by collecting sap from sugar maple trees and then boiling it to evaporate the water and concentrate the sweet syrup. Sugar maple trees with big trunks and crowns produce the most sap.

(back)

Cut all trees except the sugar maples. This harvest will reduce competition from undesirable trees and allow sugar maple trees to grow larger. Cut dead trees because they could fall at any time and injure one of your family members while they are collecting sap.

Forester #2

You are working for a landowner who has to pay a large medical bill. He needs all the income he can earn. This woodland has many big trees in it.

(back)

You are to cut all the trees in the woods and bring them to the edge of the woods. Remove dead trees too, because they can be sold for firewood.

Forester #3

You are working for a landowner who needs to earn some periodic income from the woodland, but she also likes wildlife and she wants a variety of trees in her woodland for their beauty.

(back)

Cut about one-third of the trees. Leave some trees of each species (sugar maple, oak, aspen, and white pine). Do not cut animal den trees or dead trees. Dead trees provide insects for birds to eat.

Possible effects of harvest by Forester #1: It will provide immediate income from selling the harvested trees. Annual income will be earned by producing and selling maple syrup. Wildlife habitat will be greatly reduced. There will be no dead trees, animal den trees, or acorns for wildlife.

Possible effects of harvest by Forester #2: The owner will earn income necessary to pay medical bills. The forest will regenerate overtime, but there will be a loss of habitat for wildlife that depend on dead trees, animal den trees, and acorns. Wildlife that prefer young, dense stands of trees will benefit when the forest regenerates. The forest will regenerate mostly aspen because root suckers will sprout by the thousands and occupy most of the growing space.

Possible effects of harvest by Forester #3: The owner will earn some periodic income. The forest will regenerate mostly sugar maple and white pine because they grow well in small openings created by harvesting groups of trees. All tree species will be represented in future stands. Animal species that need acorns or that prefer young, dense tree stands that often occur following a clear-cut will not benefit.

Activity 12: Respect and Responsibility—Global Stewardship

Did you ever think about the fact that what we do with our trees in Minnesota affects what happens to trees in other states or even other parts of the world? If we don't manage our trees to provide for all the things that the forests can give us (products, recreation, wildlife habitat, soil and water quality) we have to go elsewhere to get them. To be good stewards of all the resources we have to work together statewide and globally.

> "The earth does not belong to man; man belongs to the earth."
>
> —Chief Seattle

Go back to Activity 11 and the *Minnesota Primer* (Chapter Five) to review some of Minnesota's policies. What do Minnesota's forests and the rain forests have in common? (They are both being harvested for human needs.) What don't they have in common? (Minnesota's forests are being replaced at a greater rate than they are being used; the rain forest is not.) James Bowyer, a forest products researcher at the University of Minnesota, emphasizes that we must use our resources here wisely so that we don't have to deplete resources elsewhere on the globe where management practices are not as well developed.

Divide everyone into three groups and assign each group a different part of the state (for example, an oak forest in the southern part of the state, a mixed forest of the central region of the state, a pine forest of the Arrowhead region). Each group is to form a stewardship committee for its area. Study your area using some of the following questions to get started:

1. What does the area provide (recreation, wildlife habitat, etc.)?
2. What needs to be monitored (water quality, soil erosion, human use, etc.)?
3. What do you want it to provide (five years, 10 years from now)?

Devise a plan of careful management of your area. Possible references for further study:

Forest Inventory and Analysis
USDA Forest Service
North Central Forest Experiment Station
1992 Folwell Avenue
St. Paul, MN 55108
Phone: 218-649-5139

Forest Resource Assessment and Analysis Program
Department of Natural Resources
Division of Forestry
2002 Airport Road, Suite 204
Grand Rapids, MN 55744
Phone: 218-327-4449

Based on their activities and readings, have the students discuss the issues involved to accomplish wise stewardship and draw conclusions about responsible environmentalism.

Have them send their concerns and priorities to Project Learning Tree. It is important to start to stress that people's opinions can't be heard until they are spoken and that they do make a difference.

Project Learning Tree
Department of Natural Resources
500 Lafayette Road
St. Paul, MN 55155-4044

Finally, brainstorm about possible economic solutions for the people and trees in the rain forests (new sources of income, food, etc.).

Activity 13: Swing Dingles and Sweat Pads—Logging in Minnesota

The work was hard, the days long and cold. And if the food was no good, you found yourself a new camp. So were the times and conditions of a lumberjack's day in the late 1800s. Though how it's done and why it's done have changed, logging continues to be an important part of Minnesota's history and economy.

P I A

Use the information from the *Minnesota Primer* (Chapter Four) and Activity Sheet 5G to introduce the students to the colorful life of the old-time logging camp.

Divide students into groups of "then" and "now." Ask each group to prepare a skit about a typical day in the life of a logging camp. Encourage them to use costumes, props, words from this unit's "loggers' lingo" list, etc., to bring the story alive.

STEPS IN HARVESTING	THEN	NOW
1. Choosing the area and the trees to harvest.	Forest companies bought timberland and harvested as they wished.	Forest managers and loggers work with landowners to harvest trees in ways that leave the forest healthy.
2. Felling (cutting), limbing (taking off branches), bucking (cutting off at certain lengths).	Loggers used hand tools such as axes, wedges, and crosscut saws.	Loggers use power saws and sometimes hydraulic shears.
3. Skidding or yarding.	Horses or oxen moved logs.	Huge tractors and skidding machines move logs.
4. Loading and unloading.	Horses or oxen loaded logs on sleighs.	Front-end loaders or special cranes load logs on trucks.
5. Transportation to mill.	Logs were floated on rivers.	Trucks and rail cars carry logs.
6. Preparing the land for new trees.	Not done.	Clearing brush, planting seedlings.

P I A

Speaking of sweat pads, let's make some! Let's take a swing over to the cook's shanty and whip up some real camp food. Using the following recipes, make the starter and let set three days. Then fire up the stove, pass the axle grease, and chow down!

Source: Forest History Center, Grand Rapids, Minnesota.

SOURDOUGH STARTER

Mix equal portions of potato water (water left after cooking potatoes) and flour. Put in a crock or glass container. Let stand about three days until it smells "yeasty." When starter is used, replenish with equal portions of flour and water. It is not necessary to use potato water for replenishment—only if it is on hand. Let starter sit about 24 hours before it is used again.

LOGGING BERRIES

Simmer dried prunes, covered with water, for 20 minutes. Serve cold.

SWEAT PADS

1 cup sourdough starter
3 Tbsp. melted lard or margarine
1/2 cup sugar
1 tsp. salt
1-1/2 tsp. baking soda

Stir together lightly. Do not beat. Mixture will bubble. Bake on a greased griddle. Turn once and serve with margarine and syrup.

SHOE PACK PIE—LARRIGAN PIE

1 cup sugar
3 Tbsp. cornstarch
3 Tbsp. cider vinegar
3/4 cup water
1/2 tsp. lemon extract

Mix thoroughly and put in unbaked pie shell. Bake in moderately hot oven (350°) for 45 minutes or until mixture sets and pie is browned.

P I A

No story about Minnesota forests is complete without the inclusion of Babe, the Blue Ox, and his mighty friend, Paul Bunyan. Paul and his stories are typical tall tales, stretching the truth and full of fun and tomfoolery as they try to explain a situation or solve a problem. These are usually told in the first person and the storyteller claims to personally know Paul.

Read or have the children read some of the stories about Paul and Babe's adventures (see the bibliography). Reenact some of the stories. Then have the students write some of their own tall tales about different interesting features of the Minnesota landscape (see the list of some Minnesota landmarks on the next page). For example, how did Minnehaha Falls get smack dab in the middle of the city? Why aren't there any trees on that prairie? How did Lake Pepin get in the middle of the river?

SOME MINNESOTA "NATURAL" LANDMARKS:

1. Boundary Waters Canoe Area—In the Arrowhead region of Minnesota. One million acres of lakes, trees, and rivers.

2. Chimney Rock—South of Hastings off Highway 61. Turn west at 220th Street and continue two miles to a T intersection. One-half mile farther north is Chimney Rock, a 34-foot formation surrounded by oak and birch trees. This sandstone rock is capped by a thin layer of limestone that protects it from rain.

3. Devil's Kettle Waterfalls—In Judge C. R. Magney State Park on Highway 61, 42 miles southwest of Grand Portage. A mysterious geological wonder. The Brule River divides, and one side tumbles 50 feet to a pool below. The water from the other side plunges into a huge pothole never to be seen again. That is the mystery of Devil's Kettle.

4. Gooseberry Falls—Gooseberry Falls State Park. On Highway 61, 15 miles northeast of Two Harbors. Visible from the Highway 61 bridge. A spectacular series of waterfalls on the Gooseberry River. The first fall is above the bridge. It drops 30 feet into a pool that flows under the bridge to the 60-foot, two-tiered lower falls, and on to Lake Superior.

5. Interstate State Park—One mile south of Taylor's Falls on Highway 8. Interesting geological rock formation and "potholes" not found anywhere else.

6. Lac Qui Parle Lake—In the Minnesota River just west of Milan.

7. Lake Pepin—In the Mississippi River between Red Wing and Wacouta.

8. Lake St. Croix—In the St. Croix River at Stillwater. *Lac Qui Parle Lake, Lake Pepin, and Lake St. Croix are each within a river. These lakes have been formed by other rivers carrying sediment and depositing it into the three major rivers. The deposits create sandbars that back up the water and form lakes.*

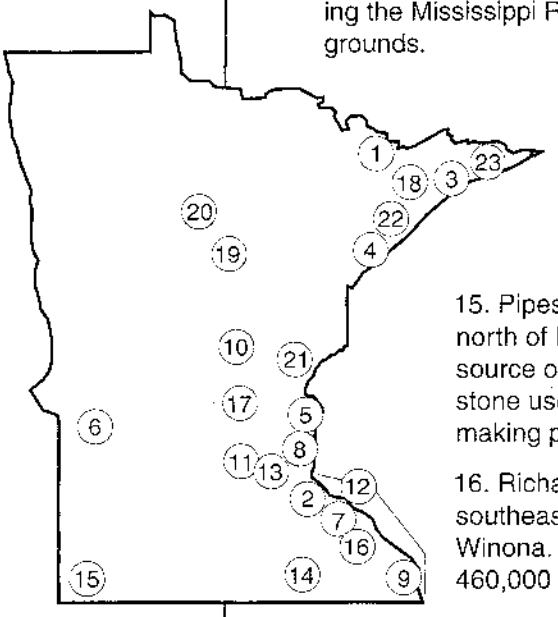
9. Le Crescent—Town in the southeastern corner of the state. Called the apple capital of Minnesota because of all the apple orchards in the area.

10. Mille Lacs Lake—North of the Twin Cities area on U.S. Highway 169. One of the largest lakes in Minnesota—18 miles long, 14 miles wide.

11. Minnehaha Park—Minnehaha Creek is in Minneapolis. Spectacular Minnehaha Falls and walking trails to the Mississippi River.

12. Mississippi River—Forms the eastern boundary of Minnesota from Hastings south.

13. Mounds Park—East side of St. Paul overlooking the Mississippi River. Sacred Indian burial grounds.



14. Mystery Cave—Off Highway 63 near Spring Valley. Minnesota's largest underground caves with fossils, stalactites, a lake, and a river.

15. Pipestone Quarry—Sixteen miles north of Luverne. This quarry is the source of unusual reddish-colored stone used by American Indians for making pipes.

16. Richard J. Dorer State Forest—In southeastern Minnesota, west of Winona. An area of two million acres, 460,000 of which are hardwoods.

17. Sand Dunes State Forest—West of Zimmerman. During the "Dust Bowl" of the '30s, the light soil in this area drifted like snow over roads and front porches. Concerned citizens began to plant trees there.

18. Sawtooth Mountains—In Superior National Forest off Highway 61. Forests of maple, aspen, oak, and pine.

19. Schoolcraft State Park—Located along the banks of the Mississippi River near Deer River. Indian wild-ricing site surrounded by a forest of giant pines.

20. Star Island—In Cass Lake in Chippewa National Forest, north of the Twin Cities off Highway 371 between Bemidji and Grand Rapids. Star Island is the largest island in the lake. It has its own lake!

21. St. Croix Valley—Located along the St. Croix River on the eastern side of the state. A mix of hardwood and pine forests.

22. Tettegouche State Park—Off Highway 61 near Silver Bay. Rugged, semimountainous terrain. Has four wilderness lakes within the park.

23. The Witch Tree—A 300-year-old gnarled and twisted cedar tree grows out of the rocks and is located a few feet above Lake Superior east of Grand Portage.

Let's add some fun to those tall tales. Look at the list of "logger's lingo." Have the students liven up their stories by including some of the terms (for example, "The belly robber loaded the swing dingle with the sweat pads and vegetable fireworks")!

Loggers' Lingo

axle grease:	butter
belly robber:	poor cook
blackjack:	coffee
cookee:	cook's helper
gazebo:	wood worker
greenhorn:	new logger
logging berries:	prunes
lye:	lousy coffee
nosebag:	lunch bucket
overland trout:	bacon
river pig:	man who drove the logs downstream to a sawmill
road monkey:	man who kept the logging roads in good condition
sweat pads or liver pads:	pancakes
swing dingle:	sleigh taken into the woods carrying lunch
the push or the big push:	camp foreman
vegetable fireworks:	beans

"Man can no longer live for himself alone. We must realize that all life is valuable and that we are united to all life. From this knowledge comes our spiritual relationship to the universe."

—Albert Schweitzer

Activity 14: Tree Treasures!

P I A

A treasure is something precious that we value and protect. Trees are one of our most precious natural treasures. We have spent a great deal of time learning that even though they are a renewable resource, they need our protection and wise use.

Read about two men who appreciated the outdoors and spent a great deal of their lives working to create awareness and protection for our vast resources. John Muir's love of nature helped persuade President Teddy Roosevelt to set aside 148 million acres of forest reserves. Our very own Minnesotan, Sigurd Olson, helped create the BWCA (Boundary Waters Canoe Area).

Find out about conservation groups. (National Audubon Society, American Forestry Association, Izaak Walton League, Greenpeace, National Wildlife Federation, Sierra Club, The Wilderness Society, The Nature Conservancy to name a few.) Contact one of the groups and have someone come to talk to you. Join a group or start one of your own!

Start to become aware of what you use, how you use it, and how that use affects other living things. That knowledge will lead to an attitude of respect and a change of habits. Those changes will create a strong and healthy web of life for all living things!

Poetry is the music of the soul. Its simple rhythm and meter touch us like no other type of writing.

Read or listen to the following poems. "Feel" what they have to say. Draw pictures of what they say to you. Create your own poems of what trees mean to you.

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

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

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.

—Source unknown

What does he plant who plants a tree
He plants, in sap and leaf and wood,
In love of home and loyalty,
And far-cast thought of civic good
His blessing on the neighborhood.

—Charles Lathrop Pack

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 of the Fragrant Forest

(For six children. As they take their places upon 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!"

—Source unknown

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ACTIVITY SHEET 5A

HELPING HANDS FOR TREES

Trees in our cities and near our homes need special care. Here are some ways you can help.

DO

Water and fertilize trees.

Trim off dead branches.

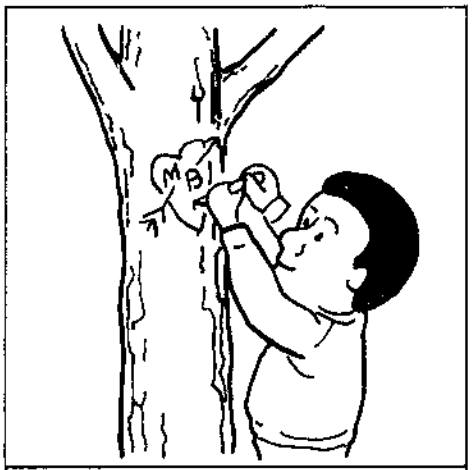
Be sure the soil under trees doesn't get too packed down.

Protect trees from injury.

Call your local forester if you see a tree that seems diseased or badly injured.

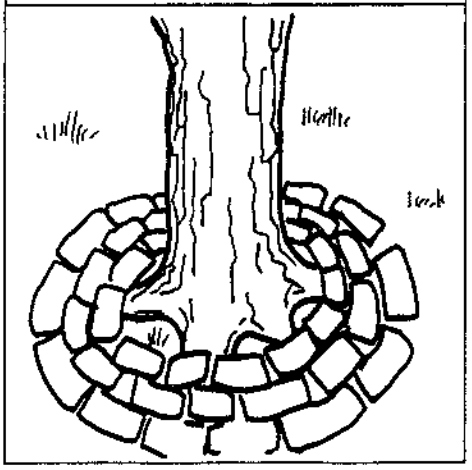
DON'T

Carve on a tree, break its branches, or peel off its bark.



Climb or pull on small trees.

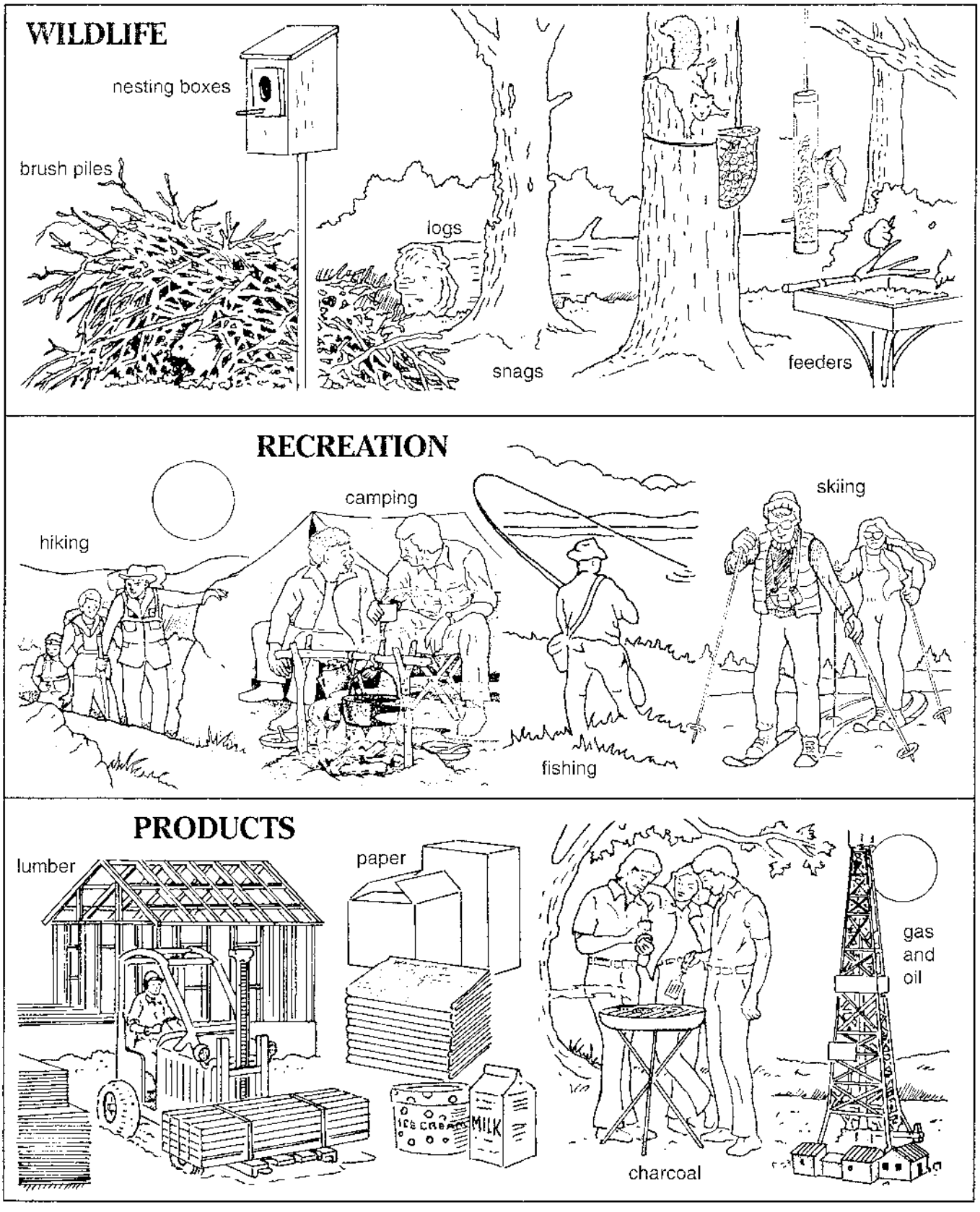
Cover the soil around trees with bricks, patio blocks, cement, asphalt. Roots need water and air!



Adapted with permission from Supplement to Teachers' Guide to Arbor Month, *Minnesota Arbor Month Partnership, 1993.*

ACTIVITY SHEET 5B

WE ALL NEED FORESTS



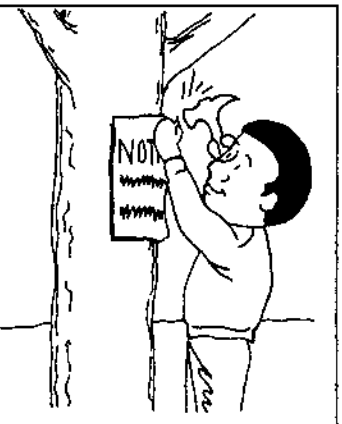
Reprinted with permission of National Wildlife Federation from the Trees Are Terrific *issue of* NatureScope, *©1992.*

ACTIVITY SHEET 5C

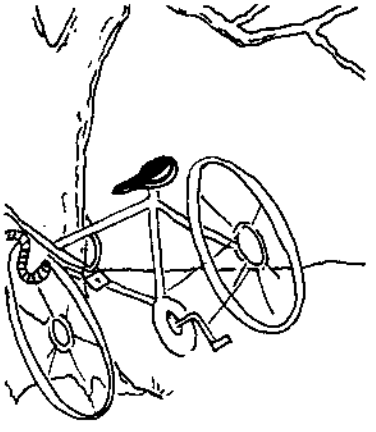
HOW DO PEOPLE WOUND TREES?

What happens to the tree?

What happens to the tree?



What happens to the tree?



What happens to the tree?

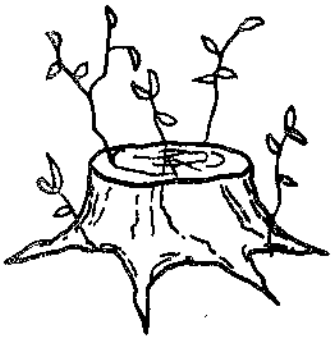
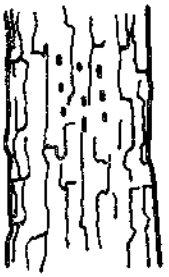
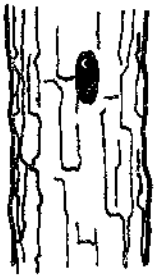
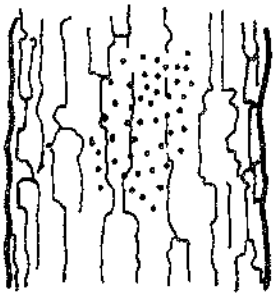
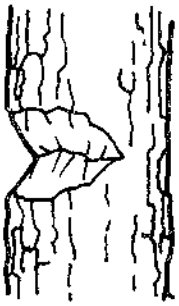
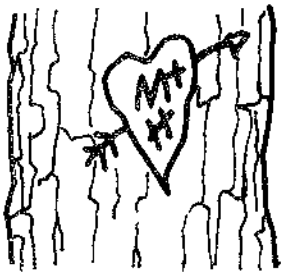
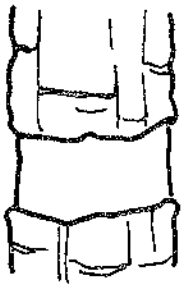
What happens to the tree?

What happens to the tree?

Adapted with permission from A Teachers' Guide to Arbor Month, *Minnesota Arbor Month Partnership, 1990.*

ACTIVITY 5C CONTINUED

HEALTHY AND UNHEALTHY TREES

Stump regeneration 	Broken off 	Sap-sucking bird holes 
Woodpecker holes 	Insect holes 	Stump 
Ax 	Bark scraped or torn away 	Human damage 
Fire scar 	Tree bark removed around entire tree 	Stump left by a beaver 

Used with permission of Mary Beth Blomeke, Camp Courage.

ACTIVITY SHEET 5D

A FOREST IN YOUR YARD

If the average-sized yard (75 feet by 150 feet) was planted as a representative cross section of Minnesota's forest land, it would be crowded with 108 trees!

Used with permission, Forest Resource Assessment and Analysis Program, *Minnesota Department of Natural Resources—Division of Forestry.*

ACTIVITY SHEET 5E

LET'S PLANT A TREE

Why Plant Trees?

All it takes is to look at a tree, or to sit under one on a hot summer day, to appreciate this unique plant. A tree is a beautiful living thing. Our peace of mind, our emotions, and our spirits are affected by what our eyes see. The pleasing look of trees makes them one of the most important, beautiful things in our environment.

But we receive many benefits from trees other than those we see. Trees make important contributions to the ecology and economy of wilderness, rural, and urban areas.

Forests protect the water supply by preventing runoff and erosion. They also purify the air, provide habitat for wildlife, and occupy places where we can go to "get away from it all" by camping, hiking, and skiing.

Commercial forests in our state provide the nation with hundreds of tree products, including paper, film, turpentine, plastics, and many chemicals. Minnesota's forest industries make an important contribution to the state's economy.

Where proper ground cover is lacking, rural areas in the United States lose over $1 billion worth of precious topsoil every year. The planting of field windbreaks and farmstead shelterbelts helps prevent this kind of costly erosion in our state. Windbreaks and shelterbelts also reduce the effects of summer and winter winds on humans and animals; cut down on heating costs in homes; protect feedlots, gardens, orchards, and crops; and beautify homes and farmsteads.

Trees make commercial and residential areas in Minnesota's cities and towns more beautiful and valuable. But they do much more than make our urban areas pleasant places to live. Trees are one of nature's most efficient dust traps. Their leafy surfaces keep a steady flow of dust and dirt from saturating the air we breathe. They relieve sound pollution by breaking up and reducing sound waves; tests have shown that proper landscaping can reduce traffic noise, too. Trees keep cooling costs down in summer, and so conserve precious energy resources. They absorb carbon dioxide from the atmosphere and give off oxygen.

In a single day, each full-grown adult inhales 35 pounds of oxygen—and we get it all from green plants on land and in the sea. Planting trees is not only a matter of comfort, beauty, and economy. They help us survive!

How to Plant a Tree

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

Twin Cities: 454-0002
Greater Minnesota: 800-252-1166

While waiting for the utility locator, select a tree that will grow well on the site you've selected. Consider the soil type. Is it sandy and well drained? Or heavy clay, and so perhaps wet and possibly compacted? Be sure to choose a tree that will grow in the soils of your site. For help, check with your local nursery or garden center, city forester or tree inspector, DNR Private Forest Management forester, county extension agent, or Soil and Water Conservation District technician.

LET'S PLANT A TREE *continued*

Planting Your Trees

When choosing and planting a tree, remember there are a number of different growing regions in Minnesota (see Unit 4, Activity Sheet 4B). Some species of trees do better in one region than another. Before choosing a tree, find out what kinds of trees do well in your part of the state, and also at your chosen planting site.

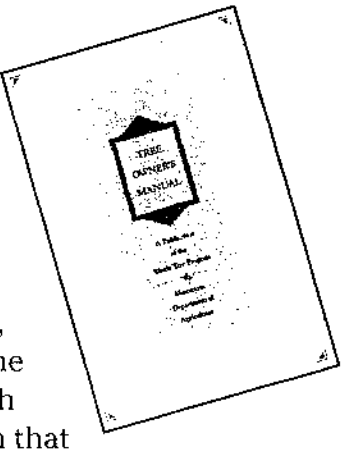
The root systems of both seedlings and saplings must be protected before the trees are planted.

The roots of some saplings are already protected in containers or large clumps of dirt surrounded by burlap. Some saplings are purchased bareroot, however. If seedlings are bareroot, they must be kept in water, and not exposed to wind and warm temperatures for more than 3 to 5 minutes before they are planted, or the roots will be damaged. All young trees, especially the bareroot trees, must be protected from extreme hot and cold. Their roots must not be allowed to dry out.

It's important to plant your trees properly. See Activity Sheet 5F.

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

Resource



"Tree Owner's Manual" by the Minnesota Department of Agriculture, Shade Tree Program, (1990) is a 24-page guide to proper tree selection, planting, and care. The manual is packed with the latest information that any prospective tree owner will want to have as a reference. To get your copy send $1.20 (plus tax) to:

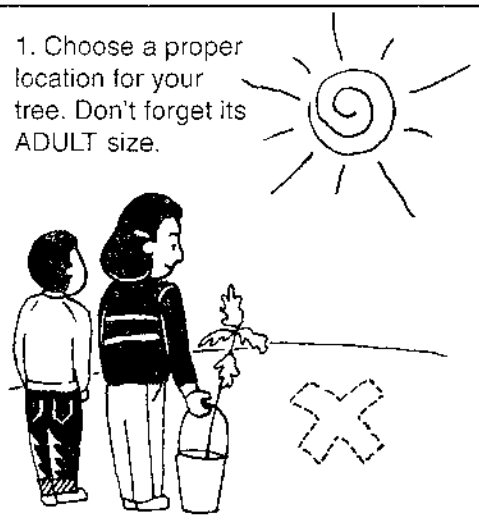
Minnesota Extension Distribution Center
Room 20 Coffey Hall
1420 Eckles Avenue
St. Paul, Minnesota 55108

Ask for *"Tree Owner's Manual,"* bulletin number AG-MI-3898.

ACTIVITY SHEET 5F

HOW TO PLANT A TREE

1. Choose a proper location for your tree. Don't forget its ADULT size.

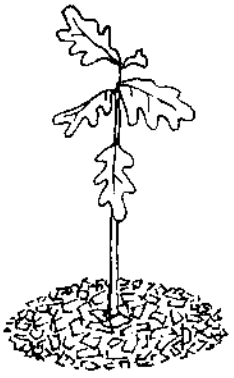


2. Keep your roots moist at all times. Dry roots die.

3. Dig a hole large enough to spread the roots apart.

4. Place the tree in the hole at the proper depth. (See "How Deep" illustration.) Gently add loose soil.

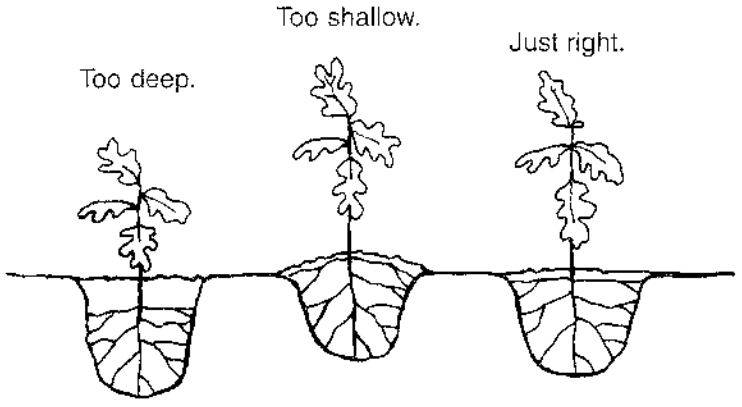
5. Add more soil and firm with foot.



6. Mulch with wood chips.

7. Water regularly.* Wait for shade!

HOW DEEP?



* Consider what care besides watering your tree will need in the months and years to come: protection from people, animals, machines such as lawn mowers, wind, disease, smothering by grass and ground cover, etc. How will the tree get this protection?

Adapted with permission from A Teachers' Guide to Arbor Month, *Minnesota Arbor Month Partnership, 1990.*

ACTIVITY SHEET 5G

LOGGING IN MINNESOTA

Minnesota's lumber industry played a big part in the development of the state. The first major harvesting of timber is thought to have been by army troops at Fort Snelling where the area's first sawmill was built in 1821. By the 1830s logging had spread along the St. Croix River Valley; the state's first commercial sawmill was built at Marine-on-St. Croix in 1839. For many years, sawmill operations in the Twin Cities were the largest in the United States. Sawmills were built near rivers because logs were floated to the mills. Logging in Minnesota was heaviest between about 1890 and 1930.

White pine was the most popular timber tree, and Minnesota had plenty of those. Some were so big around, it would take five people to circle them. A few reached as high as a 10-story office building.

Most of Minnesota's first loggers or lumberjacks came from the eastern United States or Canada. They were much like migrant workers, following the timber harvest as it moved from settlements in the east through the forest wildernesses to the west. The forests were harvested for two main reasons: to provide wood and timber to meet the building and other needs of a growing United States population, and to clear land for fields to grow agricultural crops. Loggers didn't think about conservation. There seemed an endless supply of timber, and fields were thought to be more important to a growing country than forests.

As more land was cleared, settlers began arriving in Minnesota from the European countries, especially Scandinavia. These immigrants often headed for logging camps to find work.

Between 60 and 90 men usually lived in a camp. There were no women in these early camps, but later, some had women cooks.

Logging took place in winter. Logs were skidded to the river by horse-drawn sleighs over the ice. Then in the springtime when the rivers thawed, logs were floated downstream. You may have seen pictures of logjams showing what happened when logs became tangled. Sometimes dynamite was needed to break up the jams.

MN-DNR Photo

Logs were pulled by horse-drawn sleighs to the river.

A lumberjack's day started at sunrise and ended at sundown. It was hard, strenuous work. After working all day in the cold woods, the jacks headed for the cook shanty for a hot meal. Then it was on to the bunkhouse where they hung up their wet clothes to dry and settled down to relax a little while before going to bed. Bedtime was early, and the men slept two or even three to a bunk on straw-filled mattresses.

Most of the lumberjacks stayed at the camp all winter. The weeks were long and boring, and the jacks became experts at entertaining themselves. Fast-moving card games, dances (some wore flour sacks around their waists to take the ladies' parts), and tall tales were favorite activities.

LOGGING IN MINNESOTA *continued*

Mealtime was an important part of each day. Other than the foreman who was in charge of everything, the cook was the most important person in the camp. Because the camps were far from supply stores and had no way of preserving food, the cook usually wasn't able to make many different kinds of food. But what he did make had to be good or the men would move to another camp or have him fired. In most cook shanties no talking was allowed except to ask that food be passed.

Life in a logging camp wasn't easy. There was no electricity, running water, indoor bathrooms, power tools, or machines.

About 5,000 people still work as loggers in Minnesota today. They no longer live in logging camps; most live at home and drive to work in the forest each day. (If a logging site is a long way from home, some rent rooms in a nearby town until a particular job is finished to save time during their busy workdays.) Most loggers pack their lunches and eat in the woods.

The jobs loggers do today are the same things loggers did at the turn of the century to harvest wood, but the tools and ways of doing it have greatly changed.

RESOURCES

The following people, places, and things can help you continue your exploration of trees and how we relate to them.

RESOURCES FOR INFORMATION

Project Learning Tree: This project is filled with tree- and forest-related activities and crafts for educators of elementary and secondary students. Write or call:

Project Learning Tree
Department of Natural Resources
500 Lafayette Road
St. Paul, MN 55155-4044
612-297-2214

Trees Are Terrific!
National Wildlife Federation
1400-16th Street, NW
Washington, DC 20036
800-432-6564

MINNESOTA RESOURCES

General Reference:
Minnesota Department of Natural Resources
Information Center
500 Lafayette Road
St. Paul, MN 55155-4040
612-296-6157 (Metro Area)
800-766-6000 (MN Toll Free)

Minnesota Department of Agriculture
Shade Tree Program
90 West Plato Boulevard
St. Paul, MN 55107
612-296-3349

Will answer questions related to oak wilt, Dutch elm disease, ash yellows, gypsy moth, Japanese beetles, and other municipal pests.

Specific Forest Information:
Minnesota Department of Natural Resources
Division of Forestry
500 Lafayette Road
St. Paul, MN 55155-4044
612-296-4491

Extension Forest Resources
University of Minnesota
1530 North Cleveland Avenue
St. Paul, MN 55108
612-624-3020

Extension Forest Products
University of Minnesota
2008 Folwell Avenue
St. Paul, MN 55108
612-624-7712

North Central Forest Experiment Station
Forest Service-U.S. Department of Agriculture
1992 Folwell Avenue
St. Paul, MN 55108-6148
612-649-5000

State Forests and State Parks:
Minnesota Department of Natural Resources
Information Center
500 Lafayette Road
St. Paul, MN 55155-4040
612-296-6157 (Metro Area)
800-766-6000 (MN Toll Free)

National Forests:
Chippewa National Forest
Supervisor's Office
Route 3, Box 244
Cass Lake, MN 56633
218-335-8600

Superior National Forest
P.O. Box 338
Duluth, MN 55801
218-720-5324

RESOURCES CONTINUED

National Park:
Voyageurs National Park
Route 9, P.O. Box 600
International Falls, MN 56649
218-283-9821

Arbor Day Celebrations:
Minnesota Arbor Month Partnership
500 Lafayette Road
St. Paul, MN 55155-4044
612-772-7925

Reference Materials:
Minnesota Extension Distribution Center
University of Minnesota
Room 20 Coffey Hall
1420 Eckles Avenue
St. Paul, MN 55108

Places to Learn More:
Forest History Center
2609 County Road 76
Grand Rapids, MN 55744
218-327-4482

Hinckley Fire Museum
106 Old Highway 61
Hinckley, MN 55037
612-384-7338

Minnesota's Bookstore
117 University Avenue
St. Paul, MN 55155
612-297-3000

Minnesota Landscape Arboretum
3675 Arboretum Drive
Chanhassen, MN 55317
612-443-2460

Minnesota Forest Industries
1015 Torrey Building
314 West Superior Street
Duluth, MN 55802
218-722-5013

Minnesota Forestry Association
26 Exchange Street
Suite 507
Exchange Building
St. Paul, MN 55101
612-290-6266 (Metro Area)
800-821-TREE (Greater Minnesota)

FILM RESOURCES

Source for Rental Films:
University Film and Video
University of Minnesota
313 Fifth Street Southeast
Suite 108
Minneapolis, MN 55414
612-627-4270

Free Loan:
Minnesota Department of Natural Resources
Film Library
500 Lafayette Road
St. Paul, MN 55155-4046
612-296-0899

A $4 catalog lists available films, filmstrips, videos, and slide/tape programs.

Any Minnesota organization may borrow DNR films. Films are sent UPS by the DNR and must be returned pre-paid. Order films by number and title at least three weeks in advance of the date on which the film will be shown.

RESOURCES CONTINUED

OTHER SOURCES FOR INFORMATION

Local DNR forestry offices
City foresters
County extension offices
Local arboretums and botanical gardens
Local libraries
Local natural history museums
Local nurseries
National, state, and local parks
Nature centers
State forester
University departments of biology, botany, conservation, and forestry