

4-H FORESTRY PROGRAM Unit A

TREES



Member's manual

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GLOSSARY OF TERMS

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The National 4-H Forestry Program consists of three units. Unit A-Trees explains what trees are, how they grow and why they are important. Unit B-Forests--is about trees as a part of the forest. Unit C-Forestry-is concerned with how people manage trees and other forest resources so they will produce wood, protect soil and water supplies, provide wildlife shelter and recreational areas. The most logical way to use this program is to start with Unit A and take the lessons in order through Unit B. Then, select those lessons in Unit C in which you have the most interest.

A1 What a tree is and how it grows

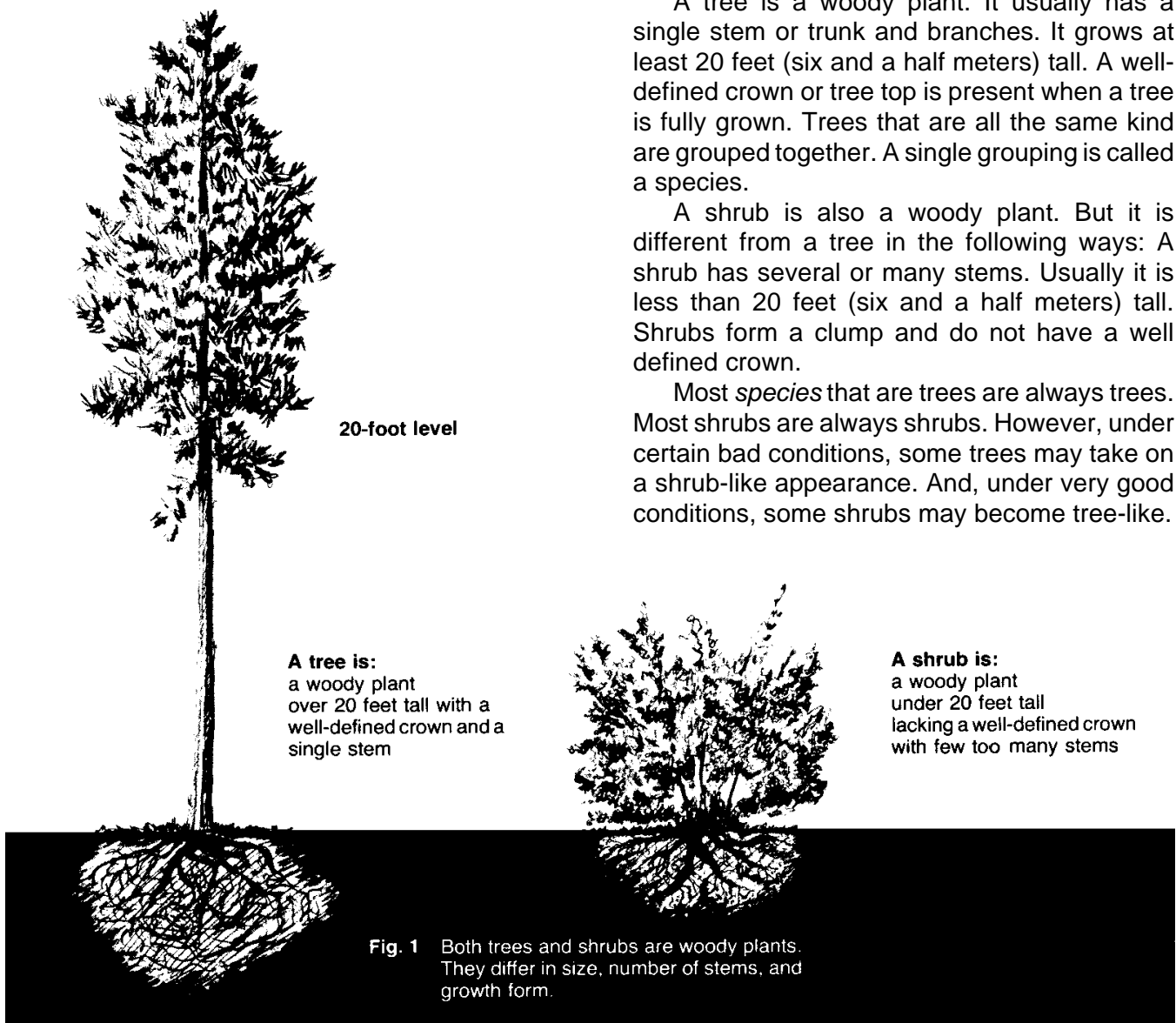
Unit A will help you to know how trees differ from other kinds of plants. You will know how they grow and reproduce. You will learn differences between trees so you can identify them. Get a notebook or recordbook. In it, keep a neat, complete and accurate record of all that you do in your 4-H forestry project. In your record, include the date you started and the date you finished each thing you did. Write a clear description of what you did and your results.

Meeting 1 WHAT IS A TREE?

A tree is a woody plant. It usually has a single stem or trunk and branches. It grows at least 20 feet (six and a half meters) tall. A well-defined crown or tree top is present when a tree is fully grown. Trees that are all the same kind are grouped together. A single grouping is called a species.

A shrub is also a woody plant. But it is different from a tree in the following ways: A shrub has several or many stems. Usually it is less than 20 feet (six and a half meters) tall. Shrubs form a clump and do not have a well defined crown.

Most *species* that are trees are always trees. Most shrubs are always shrubs. However, under certain bad conditions, some trees may take on a shrub-like appearance. And, under very good conditions, some shrubs may become tree-like.



Things to do

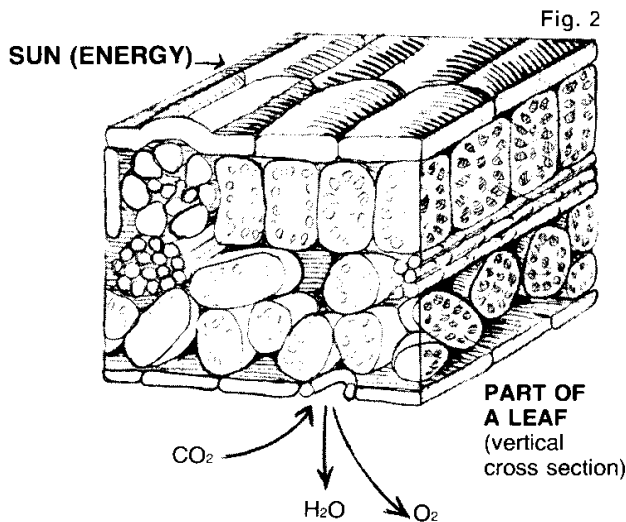
1. In a park, woodland or forest, take a walk with someone (club member, friend, member of the family). Select some plants. Decide whether each plant is a tree or a shrub.
2. Make a poster or three-dimensional exhibit. The poster should clearly show others what a tree is and how a tree differs from a shrub.

Parts of a Tree

There are three main parts or sections of a tree: the crown, the trunk and the root system. (See Fig. 2)

Crown:

The crown is the part of the tree that bears limbs or branches. The crown includes the twigs, buds, leaves, flowers and fruits. Sometimes, we may use the term live crown for the living branches. Dead crown is used for the part with dead branches. Sometimes, trees grow close together. Then, the upper branches may cause such dense shade that the lower part of a tree's crown will be dead and the upper part alive. Tree insects, diseases, old age and fire also may cause trees to have dead portions in their crowns.

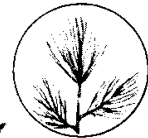


Leaves take in air through very small openings called *stomata*. Through a process called *photosynthesis*, leaves make food from water, soil nutrients, and carbon dioxide from the air. Light and heat from the sun furnish energy for this process. Leaves give off moisture and oxygen.

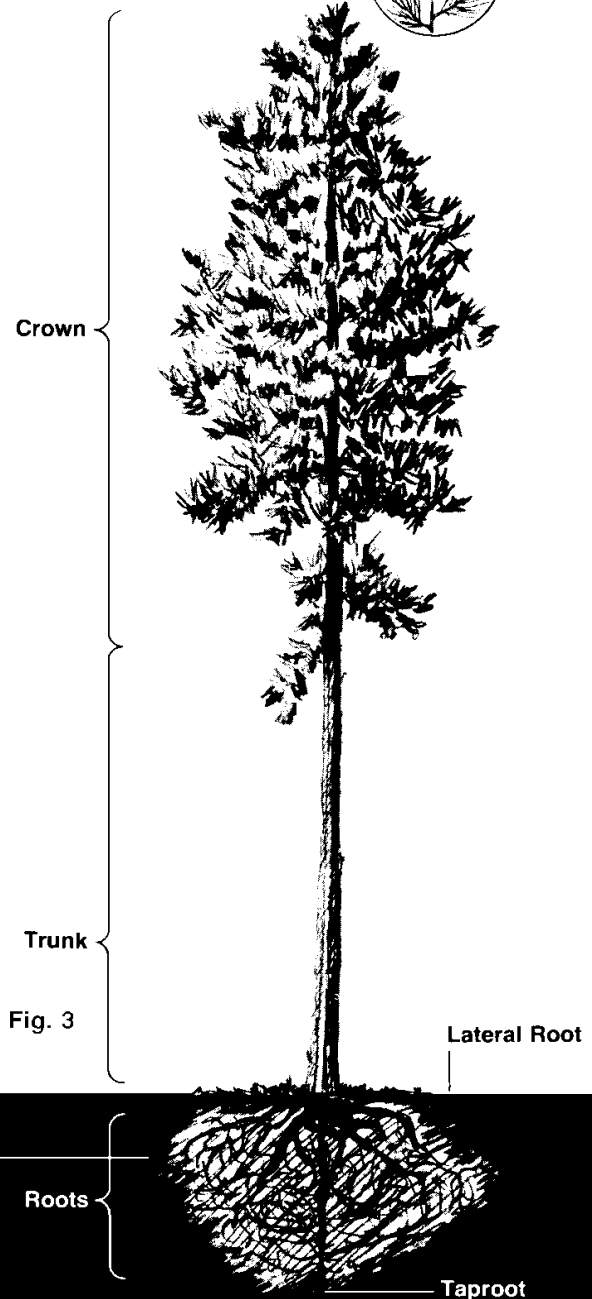
Trunk:

The trunk is the main stem or *bole* of a tree (See Fig. 3). In some trees, the trunk continues to the top of the crown. In others, the trunk divides into branches not far above the ground. Generally, coniferous trees have a central trunk that extends up through the crown. The trunks of many *broadleaf trees* divide into large branches if the broadleaf trees are not growing close together. We use trunks of trees to make lumber,

Buds at tips of branches and top of tree get longer, adding new growth to twigs and leader, thus increasing crown width and height.



Leader



Root hairs take up water and dissolved mineral nutrients from the soil. The nutrient solution is transported in the sapwood (xylem cells) of the roots, trunk, and branches to the leaves.



plywood and many other products. The stem, bark, branches and leaves can be made into some kinds of paper and particle board.

Roots:

We seldom see the root systems of trees. Some tree species develop a large main root that goes rather deep into the ground. Examples are the ponderosa pine and black oak. Side roots are called laterals. These divide many times until they are reduced to the size of hairs near the ends. A deep central root of a tree is called a *taproot*. Some trees have no main or central root. Examples are the Engelmann spruce and American elm. They have several roots of nearly equal size. These roots come from the bottom of the trunk at or just below ground level. Usually, none of these roots go deeply into the ground. If they do, they are not over two feet (60 centimeters) long. This root development is called shallow or *spreading* roots.

There is more to a tree than what meets the eye. The trunk of each tree has several parts. Each has its own job to do. The leaves of a tree are its food factory. The large roots of a tree are its anchor; the very fine roots gather moisture and nutrients.

Trees growing on moist land usually have shallow roots. These trees reach shallow soil moisture. Trees that grow on dry land usually have taproots. The upper soil may be dry for long periods. The long roots grow toward moisture underground. A few species have both kinds of roots. These have a shallow root system when growing on moist land. But they develop deep roots, sometimes a taproot, when located on dry land.

The roots of trees serve two main purposes:

1. Large roots hold or anchor trees firmly. Roots help protect them from blowing over or uprooting in ice, snow or strong winds. Roots also support trees in flood waters. Trees with taproots are more windfirm than trees with spreading roots. The large tree roots may be called *anchor roots*.

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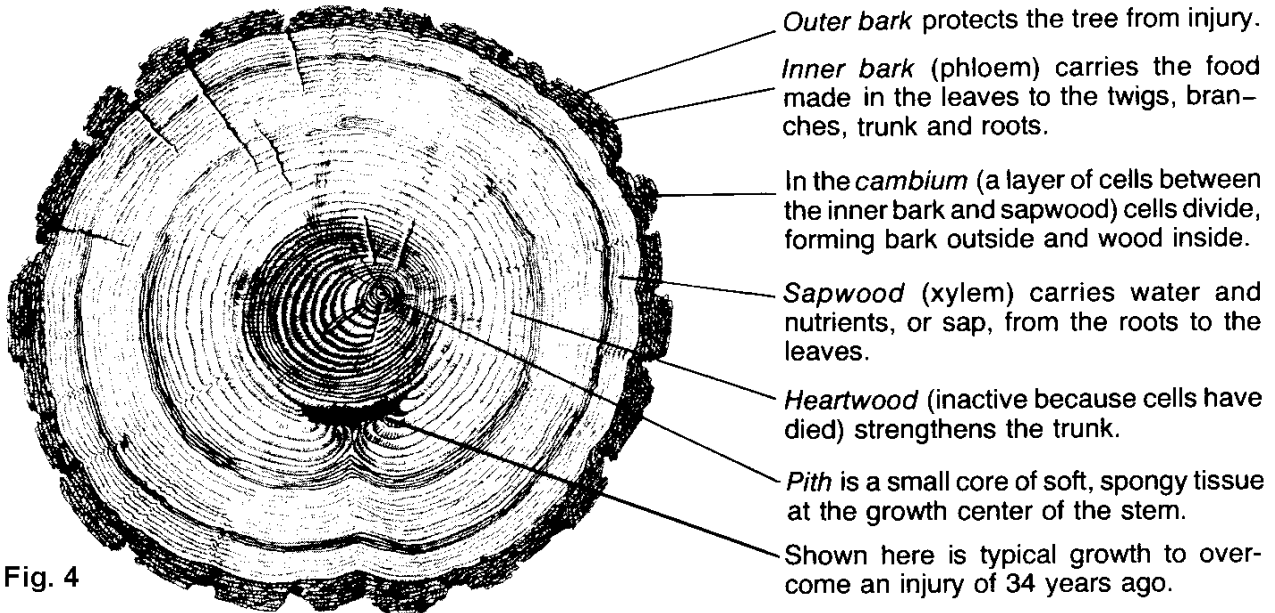


Fig. 4

The buds, cambium, and root tips are the growing parts of a tree. A tree has breathing pores over its entire surface (leaves, twigs, branches, trunk, and roots) through which it takes in oxygen.

2. Very small roots are called *feeder roots*. These absorb moisture and small amounts of dissolved mineral nutrients from the soil. These feeder roots help in the food-making process for the leaves. The very finest divisions of the roots are called *root hairs*. These are near the tips of the feeder roots. The roots of a tree may spread widely. Sometimes, the roots spread out farther than the edge of its crown. But usually the roots cannot go as deep into the ground as the crown grows above the ground. The roots of a tree are about one-tenth of the tree's total weight.

A tree will be hurt if its roots are mistreated. Roots may be harmed by compacted soil, prolonged flooding and deep burying. Roots can be hurt from exposure to sun and wind. Roots don't like being dug up, heavily pruned or broken.

Things to Do

3. Cut a cross-section of a tree stem or large branch. Label the parts and give the function of each part.

4. Give an illustrated talk on how a tree grows.

Meeting 2

How Trees Grow During Four Seasons

In seasonal climates, trees grow only part of the year. Their growth starts in the spring when the average daily temperature becomes warm enough. Not all kinds of trees begin their spring growth at the same time. Some trees, such as willows, start growth while the nights are still quite frosty. The black locust and other trees wait until warmer weather arrives. We first see the buds burst in the spring. Then, tree growth is usually fast for six to eight weeks. Growth continues on through the summer, but is slower because of hotter weather. Less water or moisture slows growth, too. In some places, the weather is warm year round. There, tree growth may be controlled by wet and dry seasons.

Cells are the building blocks of trees. The cells in the buds and root tips get longer. This growth adds length. The twigs, branches and roots get longer. The tree gets taller. Under the tree bark is a layer called the cambium. The cells in the cambium layer divide which makes new growth inside and outside the cambium possible. The new cells become bark cells when outside, and wood cells inside the cambium.

As the tree becomes older, the bark becomes thicker. As it grows, the stem, twig, and root become larger around. Cell division in the cambium really adds a thin shell of new wood. This covers all the tree's living wood. This new wood covering is called an annual ring. Each

annual ring has two parts: the springwood and the summerwood.

New wood cells and new bark cells are added by this cell division (See Figs. 4 and 5). When this happens, the tree gets larger around. The wood growth is called an annual ring. Trees usually have good growth conditions in the spring. Then, the cell divisions in the cambium go on at full speed. Fast growth continues until lack of moisture or hot temperatures slow it down. Through the summer, cell division in the cambium continues, but at a slower pace. This change in how fast the tree grows each year is what causes two parts of the growth ring. The springwood (or early wood) is formed during the early, rapid growth period. It is less heavy or dense than the summerwood (or late wood). The greater density of the summerwood is due to thicker cell walls. Due to its greater density, the summerwood usually is darker in color than the springwood. In some species, the annual rings may be very difficult to see. Examples are the yellow-poplar, aspen and cottonwoods. This is because their springwood and the summer wood look very much alike.

Check the Glossary of Terms with your leader. A science book or encyclopedia will help you learn some of these new words.

Things to Do

5. Make an exhibit that shows the growing parts of a tree - the buds, root tips and cambium. Also, show the meaning of: terminal bud, leader, whorl and internode.

6. Visit a park, woodland or forest and identify as many as you can of the following: seedling, pole, terminal bud, determinant growth, current growth, sapling, leader, mature tree, indeterminate growth, crown.

7. In early spring before new growth starts, plant three very similar tree seedlings in pots. Let them stand several days to see that they survive the transplant. Then, stand one upright. Place the second one in a horizontal position. Turn the third upside down. Keep them all watered. Note how they react as new growth develops. Try to find an explanation for what happens.

8. With the aid of a microscope or a 10-power magnifying glass, closely examine very thin cross sections of five of the following: inner bark, rootlet, bud, sapwood, softwood, leaf stem, cambium, leaf, heartwood, hardwood.

9. Determine the average height growth of 10 small vigorous trees of about the same size. Measure or estimate the leader growth by each tree during the last complete growing season. Express the average, current-height growth in inches or centimeters (1 inch = 2.54 centimeters).

Meeting 3

Finding The Age of a Tree

You may figure out a tree's age while studying how a tree grows. The pattern of growth rings also tells much about the tree's past. A tree's growth history is recorded in its annual rings. Let us look at various ways to tell a tree's age and read its growth history.

Ring Count

Trees add a growth ring each year. In most species, these growth rings are easy to see. We may look at a cross-sectional surface of the tree bole. The top of a fairly recent stump shows growth rings. On a stump, we can count the annual rings. We start from the pith and count to the inner bark. Then, we have the number of years the tree lived after it reached the height of the stump. We can get the total age of the tree. We estimate how many years it took the tree to grow to stump height. Then, we add this number to the count of annual rings to get the age of the tree when it was cut. (See Fig. 4)

There is also a way to count growth rings without having to cut down the tree. This is by use of an *increment borer*. Foresters use this tool often. The increment borer is an auger with a hollow tube. It bores into a tree. A core of wood is forced into the tube. The core can be removed to show the growth rings. These are counted to determine the tree's growth. Again, years are added to the count to allow for growth to the height of the boring. We usually add five to seven years. Taking a core from a tree does very little damage. (See Fig. 6)

Annual growth is reduced during periods of stress. Then, the rings will be narrow and appear crowded. During favorable periods, growth is increased and the rings are much wider. The record in the annual rings shows the tree's growth responses to changes. The most recent annual rings tell us how the tree is progressing at present.

Things to Do

10. Estimate the ages of five trees by counting annual rings on the stumps.

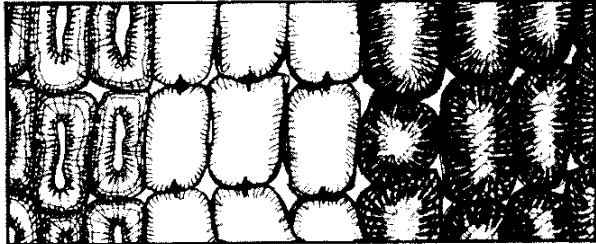
11. Estimate the current ages of five trees by counting annual growth rings on cores obtained by use of an increment borer.

12. Find five young coniferous trees that grow one set of side branches each year. Estimate their current ages by making whorl counts. Or, estimate the current ages of five deciduous trees by counting terminal bud scale scars.

13. Write a life history for a tree. Base the history on what you can assume has happened

Fig. 5

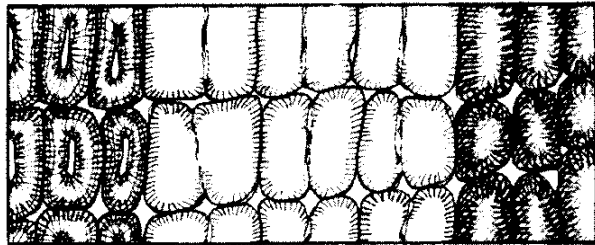
Cambium cells enlarge and divide during the growing season. New wood cells and new bark cells are added by this cell division activity of the cambium, resulting in diameter growth of the trees. (Pressure pushes out bark.)



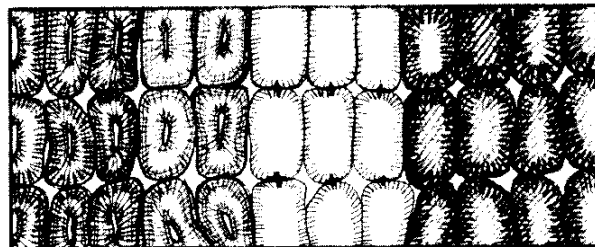
1. Cambium cells live between wood and bark cells and are visible only with a magnifying glass.



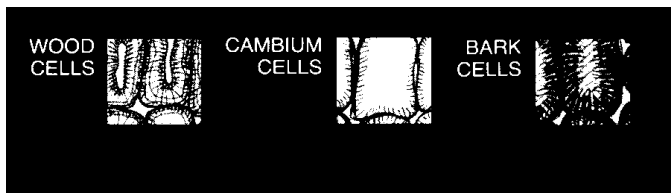
2. Cambium growth widens tree trunks, limbs, and roots.



3. Then cambium cells divide, forming wood cells toward the center of the tree and bark cells toward the outside.



4. The new cambium cells begin the growth process again.



as shown by the pattern of its annual growth rings.

Other Things to Do

Here are some other interesting things you can do in this lesson. Try some of them.

14. Using an increment borer, determine the average diameter growth rate of 10 trees about the same size. Express the average growth rate in the number of years it took to make the last two inches of diameter growth. (NOTE: In your sampling, count the number of growth rings in the outer inch of wood on one side of the tree). Why may trees of the same size have different ages? Ask an adult to help you with this activity.

15. Make a poster or 3-dimensional exhibit that shows the growth stages in the life of a tree. Before constructing it, list some important points to include in the exhibit.

16. Find an evergreen tree that has a color difference between the upper and lower sides of the leaves. In the early spring, before the tree has started growth, gently twist the end of a twig so that the undersides of the leaves are turned upwards. Carefully secure the twig in that position. Note what happens when the new growth develops on the twig. Try to find a way to explain what happens.

17. Demonstrate that a tree gives off moisture from its leaves during its growth processes. A clear plastic bag may be useful.

18. How would you demonstrate that trees must have light for growth? Try your idea and record the results.

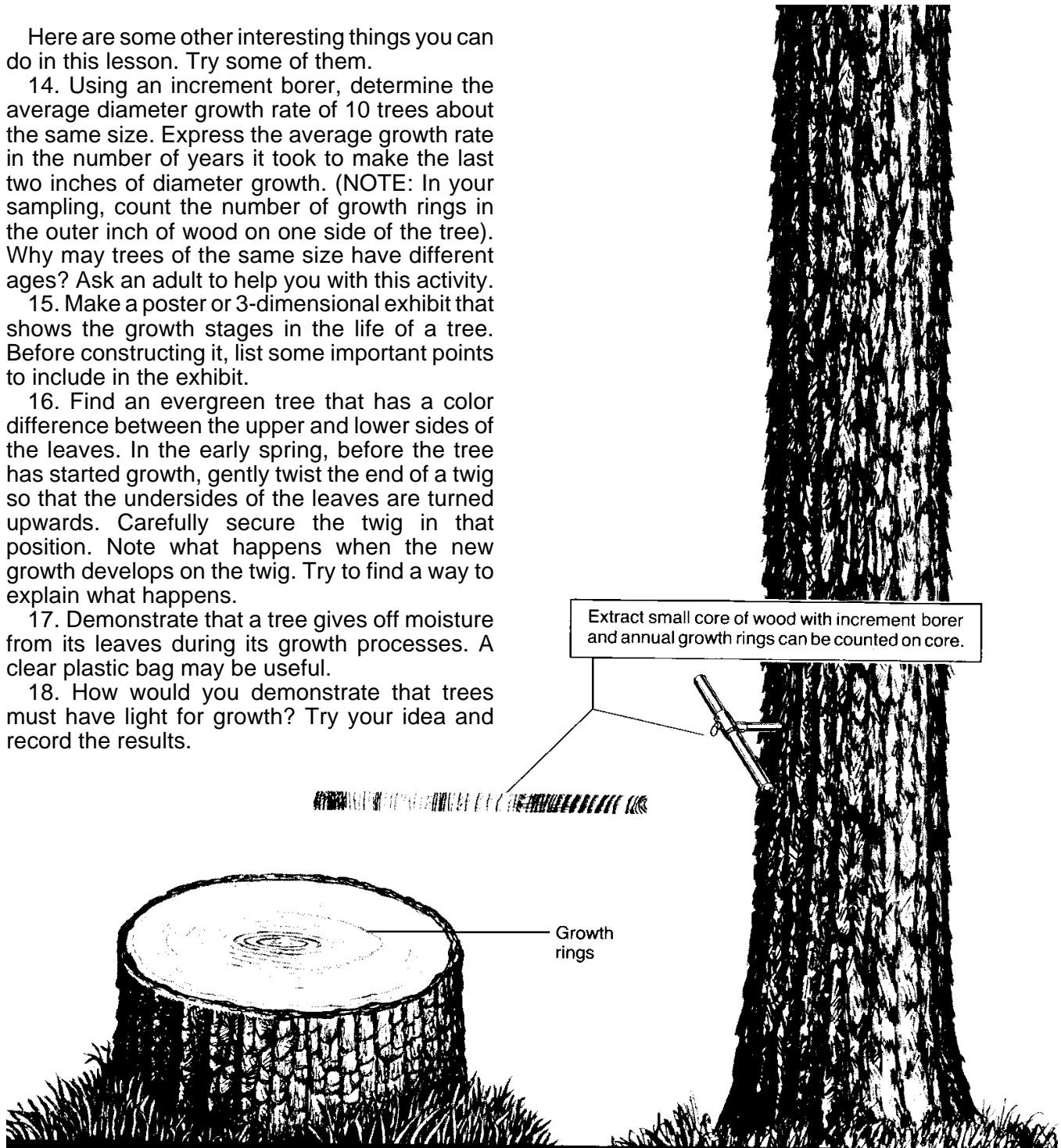


Fig. 6

A count of the annual growth rings in a stump or a log will give the age of the tree's stem at that point. An increment borer can be used to find the age of a standing tree.