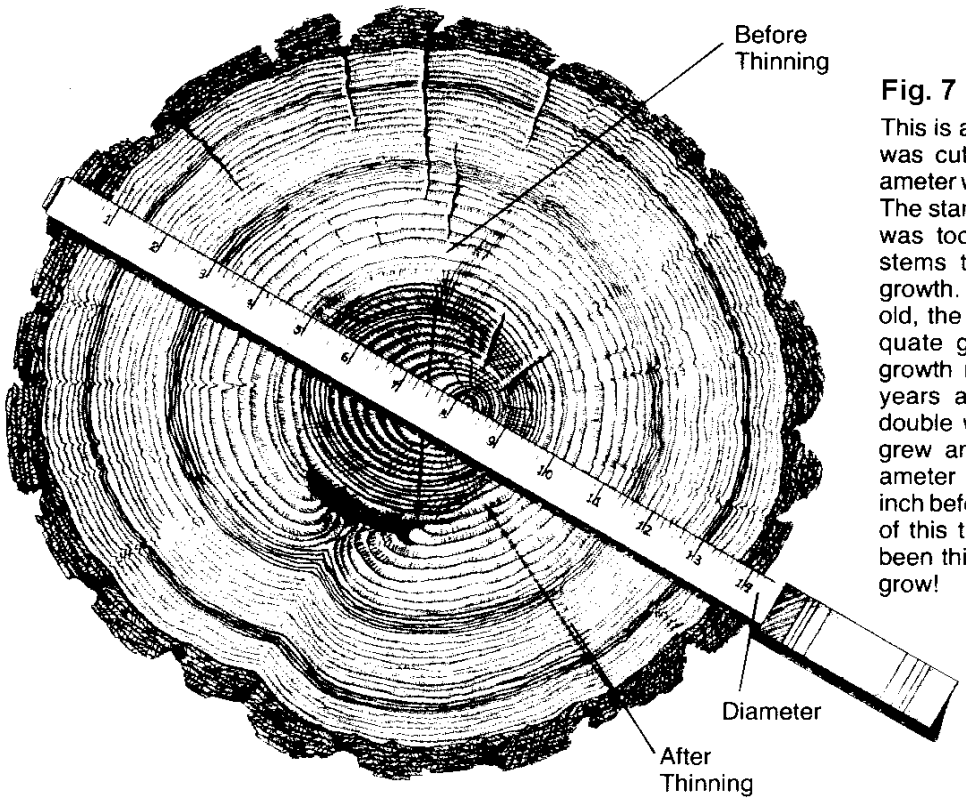

Fig. 7

This is a cross-section from a tree that was cut at 40 years of age. The diameter was 14-inches outside the bark. The stand where this tree was growing was too thick (i.e., it had too many stems too close together) for good growth. When this tree was 25 years old, the stand was thinned. With adequate growing space, the diameter growth rate of the tree during the 15 years after thinning was more than double what it was before thinning. It grew an average of 0.47 inch in diameter afterwards compared to 0.22 inch before. Imagine what the diameter of this tree might be if the stand had been thinned when the tree started to grow!

A2 How Trees Reproduce

Trees reproduce in several ways. Some ways are natural and some are artificial. Reproduction of trees by seeds is a natural way. Reproduction by grafting is artificial. This lesson is about the ways that trees reproduce.

Meeting 4
Natural Reproduction

Seeds - Trees bear fruit containing seeds. These seeds may grow into trees. Cones, beans, and nuts are tree fruits. As the fruits ripen, the seeds develop. Each tree seed contains an *embryo, which* will grow into another plant just like its parents.

When tree fruits are fully grown we say they are mature. The seeds may be released in various ways. Sometimes fruits with the seeds enclosed fall to the ground. Seeds of some species are very fight. They may be plumed or have wings. Seeds with wings may be carried long distances by the wind. Seeds that are too heavy for the wind roll downhill. These seeds are scattered by gravity, animals, birds and sometimes by water.

A tree seed settles on the ground. There it will germinate and grow if conditions are good. Some tree seeds mature in spring or early summer (as in willows, cottonwoods, and some elms). These seeds begin to grow quickly after settling in a good spot.

Seeds of most trees do not mature until late summer or early fall. These do not begin to grow untfl the next spring. Seeds of pines, spruces, oaks and ashes are examples. The seed has a covering. The covering or seed coat in some trees lets moisture through easily. Such seeds will germinate quickly. Others, such as the black locust, have hard seed coats, and will not grow unless the seed coat is broken or weathered. Moisture may be shut out for a long time.

Sometimes, we help scratch the seeds. Scratched seeds have been washed in acid. Or they may be tumbled with hard objects to make the seed coats thinner. Then the seed coats will let in moisture. Seeds of most conifers need a period of cool, damp weather before they germinate. The seeds may be mixed with a small amount of moist sand and kept in the refrigerator for six weeks or longer. Nature does this naturally on the ground over the winter.

Things To Do

1. You can learn more about seeds by germinating some where you can watch them. Select two or more kinds of tree or shrub seeds. Find some garden or crop seeds, such as beans, corn squash or peas. Check Figure 8 for the set-up and follow these instructions: Collect your materials (seeds, glass container, paper towels, moist peat moss, sawdust or garden compost to fill the container and water). A quart-size wide-top jar makes a good container. Use more than one jar if you want to experiment with more than four kinds of seeds. Line the container with paper toweling. Fill the container with peat moss or other material. Pour in enough water to fill about one inch in the bottom of the container.

Place the seeds between the paper and the glass just below the level of the peat moss or other filler. Put the container in a window where it will be warm and get some sunlight. Keep the inside material moist, but not wet Watch for first signs of growth in the different kinds of seeds. Observe the development of roots and leaves. Keep notes on what happens. Give the date of each observation note.

2. Collect at least five different kinds of tree or shrub seeds. Make an exhibit or chart to show how they might be scattered in nature. Show the action of wind, water, animals, birds and gravity.

3. Grow some tree seedlings. Germinate some of the tree seeds you collected. Remember, some must be treated six weeks or more, or over winter before germination. Keep a record on the germination time needed. Observe and write down the development of the tree seedlings for six weeks. If you have space where you can plant your tree seedlings, plant them so they will have the opportunity to become trees.

4. Stratify some seed of a forest tree species at least 6-8 weeks. (Stratify means to put the seed in a cool, moist place much like winter conditions.) Your leader, a forester or teacher may suggest seeds that need to be stratified or weathered.

5. Plant a sample (25, 50, or 100 seeds) of your stratified seed. At the same time, plant an equal sample of unstratified seed of the same species. Compare the germination rates of the two samples. Which started to grow first?

6. Make a graph comparing the germination rates of the stratified and the unstratified seed samples. Count the number that germinates at five day intervals.

Sprouts may grow into trees. Tops of some trees may be killed by fire or removed in logging or land clearing. Some stumps or roots have the ability to start new growth. The new stems that start from stumps or roots are called sprouts. If the sprouting starts from the wounded part of the tree, the new growth is called a stool shoot. If the sprouting starts from a hidden bud on the trunk or stump (that is, below the cut or wounded area) the new growth is called a coppice sprout or coppice shoot.

Many broadleaf trees will sprout quickly. Most conifers will not sprout at all. Most willows and poplars develop many sprouts. Black locust also produces strong sprouts on young stumps. Aspen trees will reproduce by sprouts when all the trees are cut. Redwood stumps also develop many sprouts. Redwood sprouts usually will grow faster than seedlings of similar age. Some species sprout naturally from the roots even though the parent trees are not harmed. These are trees such as quaking aspen, white poplar, black locust, honeylocust and bitter cherry.

Suckering is another form of new growth. It is similar to sprouts. It is not actually reproduction. *Suckers* grow on some species when the crown is severely hurt. The crown may be reduced by pruning or by natural causes. This new growth comes from buds hidden in the bark. The buds remained hidden because they were shaded and branch growth takes place in the crown. Branching may occur on some species when long-shaded tree trunks are suddenly exposed to sunlight. Very few species of conifers will develop these lower branches on older trees. But grand fir and shortleaf pine ar e two that will. Some species grow suckers much more quickly

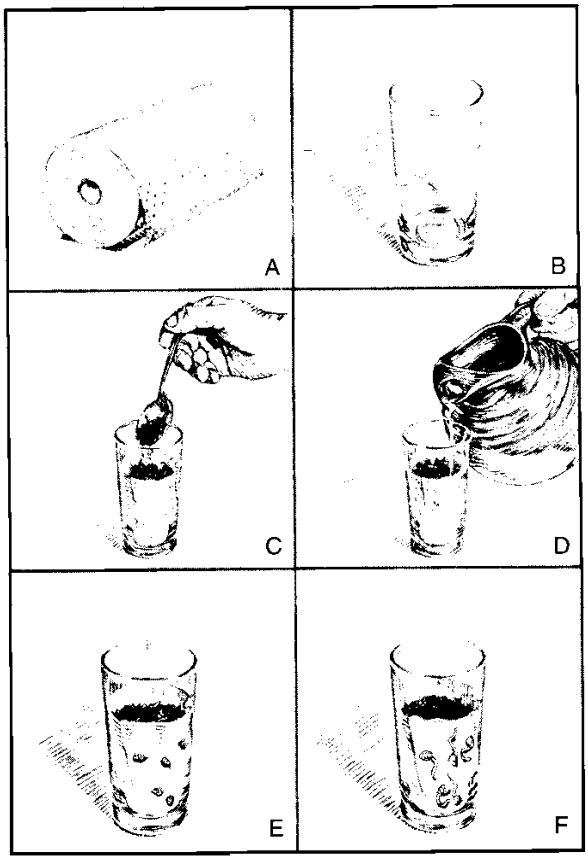

Fig. 8

than others.

Layering - A low branch may get covered by leaves, needles or soil near its tip. Roots may start at the covered point. The growing branch tip looks like the parent tree. In time, it may become a separate plant. Layering is like sprouting. It is not an important method of reproduction for trees. Layering is sometimes used by foresters to start new plants. The new plants will be exactly like the parent plant (See fig. 9).

Things To Do

7. Look for examples of sprouts and suckers along a city street, or in an orchard, park, or woodland. See if you can find both coppice sprouts and stool shoots. Take pictures or make sketches for your record.

8. If there is a wooded area, cut off a broadleaf sapling near the ground in late winter or early spring if you can obtain permission. Check the stump every month to see what progress it makes in sprouting.

9. If you can obtain permission, severely prune the top of a broadleaf sapling or a shrub in late winter or early spring. Then check it every month to observe the development of suckers or new branches.

10. In a park or woodland, look for a natural example of layering.

11. In the fall, cover a foot-long section of a broad leaf tree or shrub near its tip with soil. During the next growing season, check to see if the branch *layered.* Did it develop roots where it was covered?

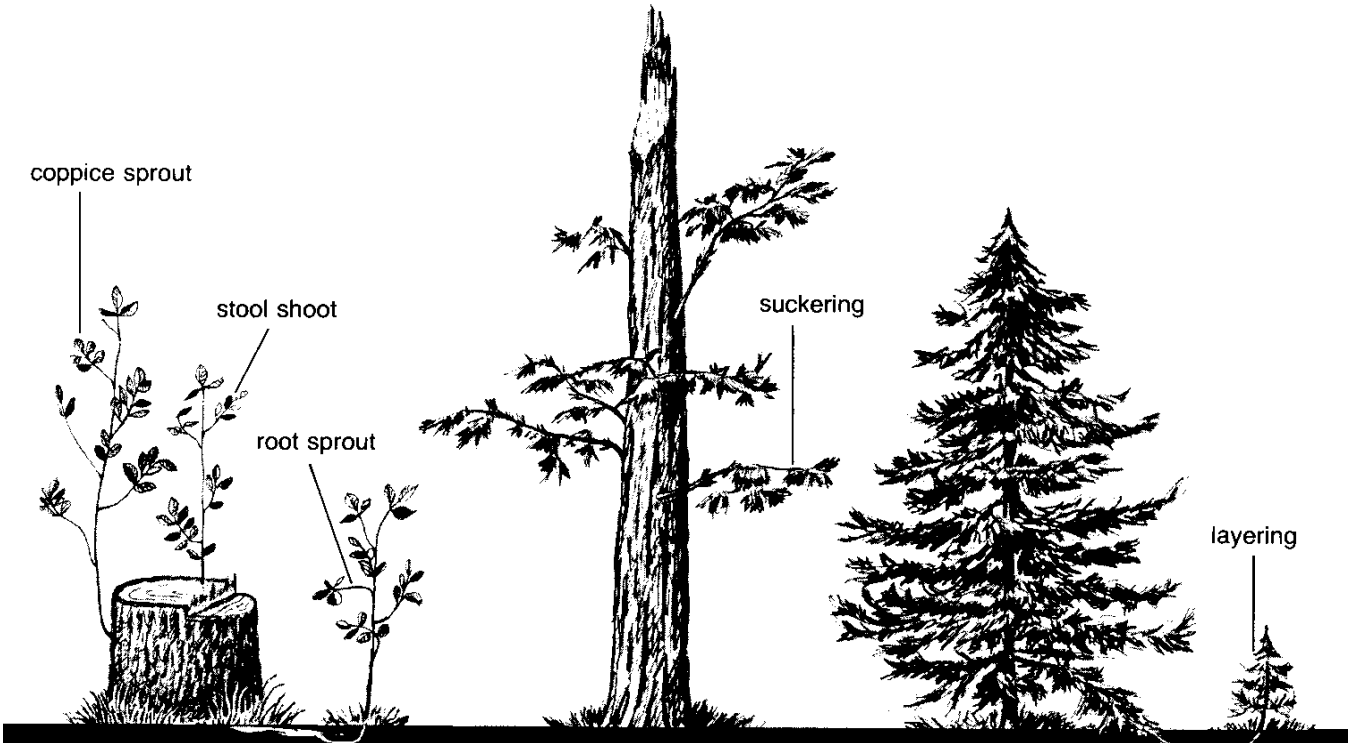

Fig. 9

Meeting 5
Artificial Reproduction

Cuttings - Most trees that *will* sprout will also grow from cuttings. A cutting is a short piece of a strong branch or stem of the past season's growth. Usually, a cutting is made about 9 to 11 inches or 25 centimeters long. It should be long enough to contain five buds. It is then planted with three buds under the ground and two above.

The buds above ground are to ensure a new stem. Roots develop at the buried buds and base of the cutting. Cuttings are a means of *artificial reproduction* of some kinds of trees and shrubs. Willows and poplars frequently are grown from cuttings. This is because the seed of these species are very light, difficult to handle, and short-lived. Cuttings from those trees quickly form roots and grow well. (See Fig. 10).

Things To Do

12. Make some cuttings. Plant them in a rooting medium made of 4 parts peat moss, 4 parts sand, and 2 parts top soil. Keep medium moist and observe the cuttings' development for eight weeks.

13. If you rooted a number of cuttings, plant them for a private or public purpose. Trees may be planted for beauty, shade, screen, wind protection and wildlife habitat. Obtain permission before you go on land that belongs to someone else.

Budding and Grafting - Another artificial means of reproducing trees is to select a bud or a strong twig. This is called a *scion.* Graft or attach the scion to another plant called the host. Many methods are used. Only the main ideas will be given here. If you are interested, there are Extension Service bulletins on grafting. **Information can** be found in almost any public library, too.

Two kinds of trees or species have to be nearly alike for grafting. Even within the same species, there will be some trees that are not enough alike. Tissues of the host tree and of the graft have to grow together. The host rootstock or tree must be able to unite with the tissues of the grafted scion from another tree.

The host tree should be trimmed for grafting just before the graft is made. The scions from another tree should be as fresh as possible. Never allow them to become dry. Match the inside bark edges on the scion and the host as carefully as possible. Give the new graft some protection against the weather. This is needed until the scion has united its host. (See Fig. 11)

Things To Do

14. Arrange to visit a nursery, park, orchard or estate. Study the different methods of artificial tree production that are used. Ask a nursery worker, horticulturist or gardener to explain why artificial reproduction is used. Ask them to demonstrate budding, grafting or other reproduction techniques.

15. Graft a bud from one tree to the rootstock of another. Observe it to see if it lives. Or, using the wedge graft technique, graft a scion from one tree to another. Observe it to see if the graft is successful and the scion lives. Some trees can reproduce in still other ways. A piece of fresh bark with the cambium still attached from the lower trunk of some trees will start new growth. In a few species, the leaves have the ability to root and start new plants. Root sections of several deciduous species will sprout and grow if kept in moist soil.

None of these methods are really important in natural tree reproduction, but are like insurance for those species that have the ability.

Cuttings are pieces of strong young branches that will take root if given good care. They need to be planted in moist soil. They should be kept well watered during the first growing season. Willows and some other species will root in water, but the roots are not as sturdy as those which develop in a soil mixture.

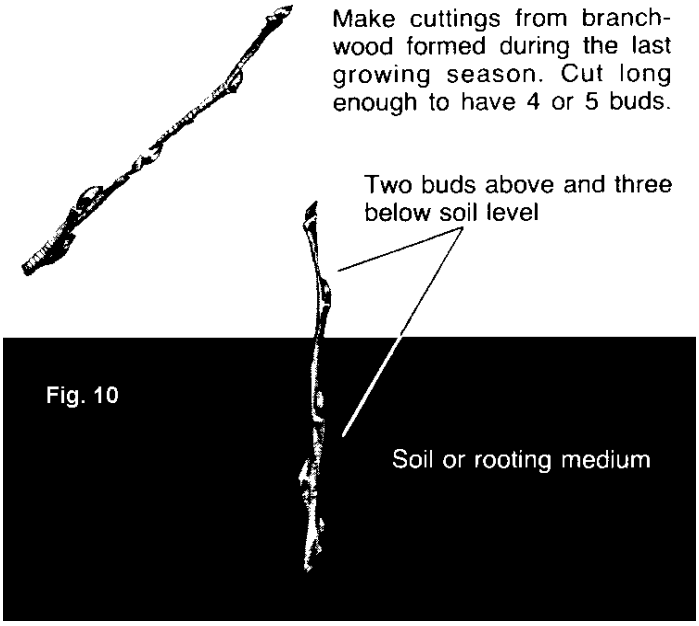

Fig. 10