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# FORESTRY FOR BOYS AND GIRLS

(A 4-H Forestry Handbook)



UNIVERSITY OF MISSOURI    COLLEGE OF AGRICULTURE  
AGRICULTURAL EXTENSION SERVICE

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### The Cover Page

Polk County 4-H'ers at Camp 2-C, Lake of the Ozarks, learn to identify the various kinds of trees as the first step in the appreciation of the forests.

# Forestry for Boys and Girls

## (4-H Forestry Projects)

### SECTION I

#### FOREST APPRECIATION

Until recent years our country has had adequate forests of great variety and fine quality. Early American history had as its setting a vast forest which extended in unbroken cover from the Atlantic seaboard to the prairies beyond the Mississippi River. The pioneer was confronted on all sides by forests which seemed to have no end. It required many centuries of nature's best efforts to produce these matchless primeval forests. Untouched by the axe of man, the forest afforded a wonderful environment for the pioneer family.

#### What Is Forestry?

Forestry is concerned with groups of trees and with the life of trees, rather than with the planting and care of individual ornamental trees and shrubs. Trees in time grow old and die; but forests need not. For thousands of years the same forest may live on, one generation of trees succeeding another. Forestry then is the science which studies this life and the art of applying the knowledge so obtained for whatever purposes man desires.

Trees ripen at a certain age and can be harvested just like farm crops, but if others take their place the result is not greatly different from letting the old trees die and fall where they grow as occurs in nature.

The farmer grows crops upon tillable land; but the forester usually grows trees upon land which is not suitable for agricultural crops.

Forestry involves cutting and using trees as well as growing them. The land must be protected from fire and the trees cut in such a manner that young trees will take the place of the old and provide us with perpetual supplies of wood products.

A nation-wide program for the conservation of forest resources is being developed through the cooperation of many agencies. Because of the number of years required to grow a crop of wood, farm boys and girls as future land owners will reap direct benefits from having some of the basic principles of forestry in this project.

This publication contains revised sections of 4-H circulars 45, "Forest Appreciation," and 52, "Forest Seeding and Planting," now out of print. Also, a new section of woodland management has been included.

Revision and new material were prepared by L. E. McCormick, Extension Forester.

### Forest Influences

In addition to their importance as producers of wood products, the forests are essential to human welfare, due to the beneficial effect of forest cover in regulating stream-flow and preventing erosion. Practically everywhere in the world, the destruction of forests on steep mountain slopes has resulted in destructive floods. The forest has aptly been called the "Mother of Waters." There must be a steady and adequate supply of water for drinking and other domestic uses, for power and for navigation. In order to maintain our fine streams, rivers, and lakes we should keep the headwaters of some streams covered with forests. Other headwaters should be protected through better soil and water management.

The forest also offers opportunities for pleasure and recreation. It is an ideal camping place; it furnishes playgrounds and shaded resorts for picnics and excursions; its streams and lakes are the delight of the fisherman; its dusky recesses are the Mecca for the naturalist. The beauty and splendor of the forest, its atmosphere and quiet, and the glimpse of wild life have an irresistible appeal to all.

### Wild Life

Not only does the forest contain many varieties of plant life, but also it is the home of many members of the animal kingdom. Wild game and fur-bearing animals, which the forest harbor, are valuable resources.

All wild life has a place in nature's scheme. At various times and in special places, certain kinds of birds and animals seem to get out of control and become harmful to man. A careful study of the whole situation, however, has shown that it is unwise to completely destroy all individuals of any species of wild life, since many of them prey upon one another and help men to keep them in check with nature balanced.

The forests provide natural refuges, breeding places, food and water, and thus help preserve wild life.

### Appreciation Background

To have a real appreciation of the forest is to know the importance of the forest to agriculture and industry, to have a thorough knowledge of the trees which make the forest, and to know the relative values of these trees in producing crops of timber. The first step, then, in the appreciation of the forest is to know the various kinds of trees. They must be met at home, in the forest, under conditions most natural to their growth. Each kind of tree has certain characteristics that distinguish it from other trees. No two species have bark, leaves, or fruit exactly alike. The wood of trees varies as much as these external characteristics, and upon the characteristics of the wood depends its use. In growing timber for a definite use, or in choosing trees to be cut for a certain purpose, it is

important to know what woods can be put to that use or will answer to that purpose.

There are probably a hundred distinct varieties of trees native in Missouri, but some of them are so small they are scarcely more than shrubs and do not deserve to be classed as trees. No attempt has been made, therefore, to give in this circular an all-inclusive list of trees, but rather to pick out and describe the commoner trees distributed throughout the state and that are likely to be found in the average woodlot.

With this circular and the Missouri Conservation Commission's bulletin number 7 entitled "Forest Trees of Missouri" as guides, any boy or girl may become familiar with the forest trees in the neighborhood. As future woodland owners, this basic knowledge of forest trees will help them manage wisely and well to bring about better forests.

### **Identification Characters**

The place to study the trees is in the woods. Take your circulars along with you and look for the characters—bark, twigs, buds, leaves, fruit—which will help you distinguish one tree from another.

Pay considerable attention to the bark. It is always present, summer and winter, and even in the log you can easily identify the tree if you know the bark. Keep in mind such characteristics as color, texture, whether smooth or furrowed, scaly or firm, etc.

For those just starting in the study of our forest trees, leaves are the easiest approach. As you study the leaves and compare them, look for the following points: Are they simple (one leaf to a stem) or compound? Are they arranged opposite on the twig or alternate? How is the margin of the leaf shaped? This is very important. In some leaves the margin is entire (no breaks at all); in some, it is like the fine teeth of a carpenter's saw, these we have called serrate (saw-like); still others are doubly serrate; in others, the margin is more deeply notched, as in the chestnut and beech; these we have called toothed. Then we come to the maples and some others on which the margins are deeply cut and the leaves are described as lobed. The hollows between the lobes are called clefts.

Trees have flowers as do most of our green plants, but as a rule they are inconspicuous and high up in the tree tops where they cannot easily be obtained to aid in identification. To use available space for more important features, the description of flowers has been omitted.

Fruit of the tree is an important item in the appreciation of the forest, not so much as a means of identifying the tree, but as recognition of the origin from which the different forest trees spring. The term fruit, it should be remembered, does not necessarily mean fleshy, edible products such as apples or cherries, but includes any seed and the covering in which it develops, whether cone, pod, samara (winging-seed), burr, or husk. Make careful note as to the time of year the seed matures.

### Summer Key

As a further help in identifying the common forest trees of Missouri, a simple key has been included in this circular for your use in identifying summer foliage.

A key is a scheme for easily and quickly identifying any unknown object under observation. It is based usually upon the most striking similarities and differences shown by the various parts of the object. The leaves and fruits have been selected for the summer key as these are the most easily available parts of the tree showing differences and similarities upon which to base the key.

You pass by a succession of steps from the beginning of the key to a point where the name of the tree is found, just as you might go from the bottom floor of a large building to any room you wish by choosing properly labelled stairways and corridors. Two alternatives are usually presented, either a character is or is not present; these are the only choices possible. Those two opposed characters are preceded in the key by the same numbers (1 and 1, or 2 and 2) and are set at the same distance from the left-hand margin of the page. 1 and 1 are subdivided further into other groups on the basis of other differences, the characters of which are opposed (with several exceptions which are evident in the key). If the desired character is found in the first group (1), there is no need to look in the second group (1), and your study need be confined to the subdivisions of the first group only.

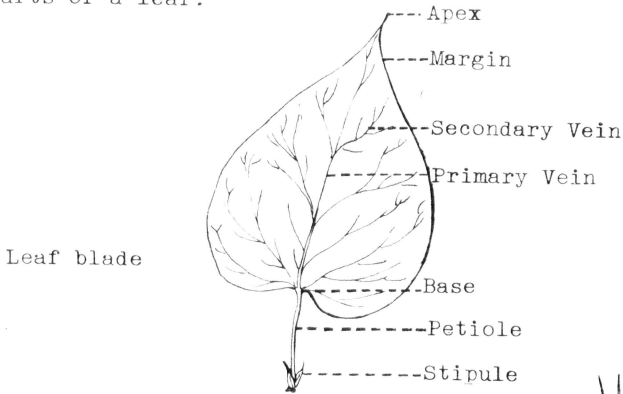
By way of further explanation, let us take the leaf of the Yellow-Poplar or Tulip Tree:

The leaves of our specimen are not evergreen as required in the first group (1), we drop straight down on the second group (1); they are not small and narrow as required in the first group (2), so we drop down to the second group (2); since there are neither three nor two, but only one leaf at a joint of the stem, the plant must be confined to the third or last subdivision of group (3); the leaves are not "compound" like those of the locust or a hickory in the first group (5), we confine ourselves to the next subdivision directly beneath, or the second group (5); the margin of the leaf is neither entire, first group (8), nor toothed, second group (8), but cut more deeply, (lobed), which takes us down into the third group (8); the leaves have several ribs or veins radiating from the base, first group (13); the absence of a milky sap, the broad leaves, and the fact that they seem to have been cut off in a shallow notch at the end leads unquestionably to the name of the tree, Yellow Poplar.

To verify and substantiate your key work, turn to your Conservation Commission bulletin "Forest Trees of Missouri" and check up by comparing the leaf with the illustration and description given there.

A key not only makes it easier to trace and identify an unknown ob-

Parts of a leaf:



Leaf Characters:

A. Kind



Broadleaf



Scale-like



Needle-like

B. Arrangement



Whorled

(Leaf-scars at node)



Opposite



Alternate

Fig. 1.—Summer key characters.

ject (leaf or winter twig), but also serves to arrange in a condensed form the outstanding characteristics by which any one object may be distinguished from all other objects in the same group. Once mastered, the key enables you to quickly trace and identify trees without referring to the long descriptions found in the text. For instance—leaves broad, arranged opposite, compound, leaflets spaced along the stalk serve to identify the ashes from all the other trees in this circular. Others may not be so easy, but practice and study will help you master the entire key.

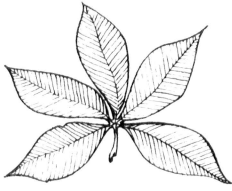
In order to familiarize you with the characters of leaf, fruit, twig, and bud used in the key, these charts are included (pages 7, 8, 9).

C. Form or Composition:

Simple



Compound



Palmate



Pinnate

Twice-Compound



D. Margin:



Entire



Serrate



Doubly-Serrate



Toothed

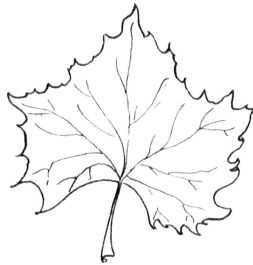


Lobed

E. Lobes:



Pinnate



Palmate

Fig. 1.—(Continued) Summer key characters.



F. Shape:



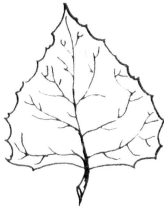
Ovate



Heart



Linear



Triangular



Lanceolate

G. Base:



Oblique



Rounded



Square

H. Apex:



Blunt



Sharp



Truncate

Fig. 1.—(Continued) Summer key characters.

A NON-TECHNICAL SUMMER KEY TO THE COMMON FOREST TREES OF MISSOURI

Page\*

1	Leaves evergreen; needle-like, awl-shaped, or scale-like.		
	Leaves long, flexible, needle-like; borne in clusters; fruit a cone.....	<u>Shortleaf Pine</u>	4
	Leaves short, stiff, awl-shaped or scale like; fruit a dry berry.....	<u>Eastern Red Cedar</u>	5
1	Leaves deciduous (falling in the autumn).		
	2 Leaves small and narrow, tiny, borne singly on opposite sides of the twig; fruit a small cone.....	<u>Southern Cypress</u>	4
	2 Leaves broad, and fruit never a cone.		
	3 Three large, simple, heart-shaped leaves at each node; fruit a long slender capsule.....	<u>Hardy Catalpa</u>	59
	3 Two leaves at each joint (node) on opposite sides of the stem.		
	4 Leaves simple (of one blade.)		
	Margin of leaf entire; fruit scarlet, berry-like...	<u>Dogwood</u>	54
	Margin of leaf not entire (lobed); winged fruit....	<u>Maples</u>	47-48
	4 Leaves compound (of several leaflets).		
	Pinnately compound, leaflets spaced along the stalk; winged fruit.....	<u>Ashes</u>	56-58
	Palmately compound, leaflets all from one point; fruit a large woody capsule.....	<u>Ohio Buckeye</u>	50
	3 One leaf at each joint (node) on alternate sides of the stem.		
	5 Each leaf with several blades or leaflets (compound).		
	6 Margins of leaflets entire; fruit a pod.		
	7 Prickles or spines present.		
	Two short prickles at base of leaf; leaflets simple.....	<u>Black Locust</u>	44
	Branched spines on stem, long; often doubly- compound (leaflets again compound).....	<u>Honey Locust</u>	43
	7 Prickles or spines absent; double compound...	<u>Coffee-tree</u>	42
	6 Margins of leaflets not entire, but serrated; fruit a nut.		
	Leaflets 5 - 11; pith solid .....	<u>Hickories</u>	12-15
	Leaflets 11 - 23; pith chambered.....	<u>Walnuts</u>	11
	5 Leaves simple (of one blade).		
	8 Margin of leaf entire, that is, not lobed or deeply cut.		
	Sap milky; twigs spiny; fruit orange-like.....	<u>Osage Orange</u>	35
	Sap not milky, nor twigs spiny.		
	Leaf as long as broad, heart-shaped, fruit a pod.....	<u>Redbud</u>	42
	Leaf longer than broad.		
	Aromatic odor when crushed; fruit a dark blueblack berry.....	<u>Sassafras</u>	37
	Aromatic odor absent.		
	Leaves more than 6 inches long; narrow scar around twig at each node; fruit a dry cone-like structure.....	<u>Cucumber Magnolia</u>	35
	Leaf widest above the middle; fruit edible, banana-like.....	<u>Papaw</u>	36
	Leaf widest at or below the middle.		
	Pith with cross plates; fruit a small dark blue berry.....	<u>Black Gum</u>	51
	Pitch without cross plates; fruit a 1-inch orange colored berry.....	<u>Persimmon</u>	55

\*Refers to page number in "Forest Trees of Missouri"

8 Margin of leaf toothed.		
9 Leaf with several strong veins from the base.		
Sap milky.....	<u>Red Mulberry</u>	34
Sap not milky.		
About as long as broad, heart-shaped; fruit nut-like..	<u>Basswood</u>	52
Longer than broad; twig containing chambered pith;		
fruit berry-like.....	<u>Hackberry</u>	33
9 Leaf with only one strong vein from the base.		
10 Twigs rather spiny; fruit a small apple.		
Spines 2 - 3 inches long.....	<u>Scarlet Hawthorn</u>	39
Stubby spurs, 1/2 inch long.....	<u>Sweet Crab Apple</u>	39
10 Twigs not spiny.		
11 Leaf-margin single-toothed (the teeth entire).		
12 Teeth coarse.		
Leaf about as broad as long, triangular; fruit		
a catkin.....	<u>Southern Cottonwood</u>	9
Leaf longer than broad.		
Buds long, sharp; fruit a small prickly burr..	<u>Beech</u>	18
Buds short		
Leaves widened upwards; fruit an acorn...	<u>Oaks</u>	19-29
12 Teeth fine.		
Leaf-stalk with small glands; pronounced odor		
when crushed; fruit a drupe .....	<u>Cherries</u>	41
Leaf-stalk without glands; no pronounced odor		
Leaves 5 x as long as broad; fruit a catkin.....	<u>Black Willow</u>	7
Leaves broader.		
Bark scaly; fruit blue-black, berry-like.....	<u>Serviceberry</u>	40
Bark not scaly; fluted, muscular appearing;		
fruit a nut within an envelope.....	<u>Blue Beech</u>	17
11 Leaf-margin doubly-toothed (teeth again toothed).		
Leaf base inequilateral (oblique). winged fruit....	<u>Elms</u>	30-31
Leaf base symmetrical; fruit a catkin.		
Bark scaly.....	<u>Hop Hornbeam</u>	17
Bark thin, papery, orange.....	<u>River Birch</u>	19
8 margin of leaf cut more deeply (lobed).		
13 Leaf with several strong veins from the base.		
14 Sap milky; fruit black, juicy.....	<u>Red Mulberry</u>	34
14 Sap not milky		
15 Margins of lobes entire.		
2 - 3 lobed when not entire; aromatic odor;		
fruit a blue-black berry.....	<u>Sassafras</u>	37
3 - 4 lobed; leaves notched or truncate at apex;		
fruit cone-like.....	<u>Yellow Poplar</u>	36
15 Margins of lobes not entire, but toothed.		
3-5 shallow lobes, sparsely toothed; narrow		
scar around each node; fruit a "Button-ball" of		
light brown seeds.....	<u>Sycamore</u>	38
5 - 7 definite lobes with margins sharply		
serrated; no such scar as above; leaf star-		
shaped; fruit armed with incurved spines.....	<u>Red Gum</u>	37
13 Leaf with only one strong vein from the base.		
Mucilaginous and aromatic; fruit a blue-black berry..	<u>Sassafras</u>	37
Not mucilaginous nor aromatic		
Pith round; twigs with spines; fruit a small apple...	<u>Scarlet Hawthorn</u>	39
Pith star-shaped when cut across; twigs without		
spines; fruit an acorn.		
Lobes rounded, not bristle-tipped; acorn matur-		
ing in one year.....	<u>White Oak</u>	26-29
Lobes pointed, bristle-tipped; fruit an acorn matur-		
ing in two seasons.....	<u>Black Oaks</u>	20-25

### Making a Tree Collection

The first requirement of the Forestry project is to make a collection of (1) a winter twig, (2) a leaf, and (3) a fruit of at least fifteen of the native forest trees in the locality. We hope you will want to know all the forest trees of your section, but as evidence of your year's work a collection of only fifteen is required.

#### Collecting Specimens for Mounting

**1. Twigs.**—The twigs may be collected in the fall, anytime after the leaves drop. Using a sharp knife, cut a section about five inches long from the end of the twig; take the twig from a side branch, never from the top shoot. Do not take the twig from a stump sprout or a very vigorous-growing young sapling as it will not be average; on the other hand, do not collect from a small lower branch that is dying back. Cut the end of the twig slanting to show a section of the pith. This is particularly important in the case of the walnut, gum, hackberry, and others. In collecting a number of twigs in any one day, tag each twig to avoid mistakes in identity later.

**2. Leaves.**—If the project starts in the fall, there will be many deciduous-leaved trees whose leaves cannot be collected until the following spring, but by the end of May most leaves will be out in an average season. Here again, avoid taking specimens from little seedlings or sprout growth. Have a good-sized notebook along when making a leaf collection so that the leaves can be spread out flat and carried home in that condition. In the case of compound leaves, such as locust, ash or walnut, remember that the whole leaf must be shown, not just a single leaflet. Many such leaves are longer than the 8½ x 11 inch standard paper used for the collection, but usually a typical, though somewhat smaller sized leaf can be found.

**3. Fruit.**—Begin looking in the autumn for the fruit of some of the trees. If you wait until June of the following year, the collection will be incomplete.

#### Preparing Specimens for Mounting

**1. Twigs.**—After collection, store the twigs in a cool, dry place where they will dry out gradually with the least amount of shriveling and consequent destruction of distinguishing characters. Write the name of the tree on a piece of paper and stick the twig through the paper. This keeps the twigs separate.

**2. Leaves.**—Carefully dry leaves for mounting and press as soon as brought from the woods. For this, use a press made by alternating newspapers and blotters between two flat surfaces, and held down by a board and weights. Place the specimens between the two blotters, slip the blotters between the newspapers, and add the weight on top of the

pile. For the best success move the specimens around on the blotters each day or every few days, so the blotters may completely dry out the leaf and preserve the natural color as much as possible. Allow the leaves to remain in the press several weeks, until they are thoroughly dry.

**3. Fruit.**—Fruit and seeds need not be pressed, but should be kept in envelopes or paper sacks with the name of the tree written on the outside.

### Mounting Specimens on Paper

Heavy white paper or light cardboard, either white or buff, is preferred for mounting the leaves, twigs, and seeds. Mount your specimens on one side of the page only, so all will appear on the right-hand page as you open the book in which they are bound. (See page 14.)

**1. Twigs.**—Mount twigs on the right-hand side of the page. Each should be turned and mounted to expose the slant cut through the twig and the central pith. Use stout thread to hold the twig in place. Punch tiny holes with a needle on either side of the twig, both near the top and bottom of the specimen. Insert the thread through the holes, and bind it on the back side of the page.

**2. Fruits.**—Fruits which are small and more or less flat, such as those of the black locust, maples, ashes, elms, blue beech, basswood, and poplars can be mounted easily on the cardboard below the twig. A seed which is easily separable, such as the black locust or the blue beech, should also be mounted alongside the fruit. Sometimes it is difficult to mount the fruit because of its shape, size or condition, but the seed may be mounted easily. This applies to the evergreens, birches, hop hornbeam, sycamore, cherries, cucumber and others. In these cases the fruit may be cut in half lengthwise and glued securely to the sheet, cut-side down. As a substitute, draw a sketch of the fruit, first in pencil, then inked in, making it as nearly natural size as possible. Large-seeded species, such as the walnuts, oaks and hickories also may be sketched. In some cases, too, the nut may be put in a vise and a thin cross-section made with a saw, which may be glued on the cardboard.

**3. Leaves.**—Have on hand a supply of gummed-cloth mending tape or adhesive transparent mending tape which may be bought at any five and ten cent store. Cut across the tape, making little strips about one-eighth inch wide. Place the mounting paper on a flat surface and spread the leaf out on the central and left portion of the sheet, leaving at least two inches of space below for the name of the tree and its principal uses. In cases of larger leaves, especially compound leaves, only one can be placed on the sheet, but two average-sized leaves can be mounted usually, one above the other, showing both the upper and lower surfaces. Do not fail to have all the leaf stem along with the leaf.

To hold the leaf in place, paste strips of gummed cloth across the stem

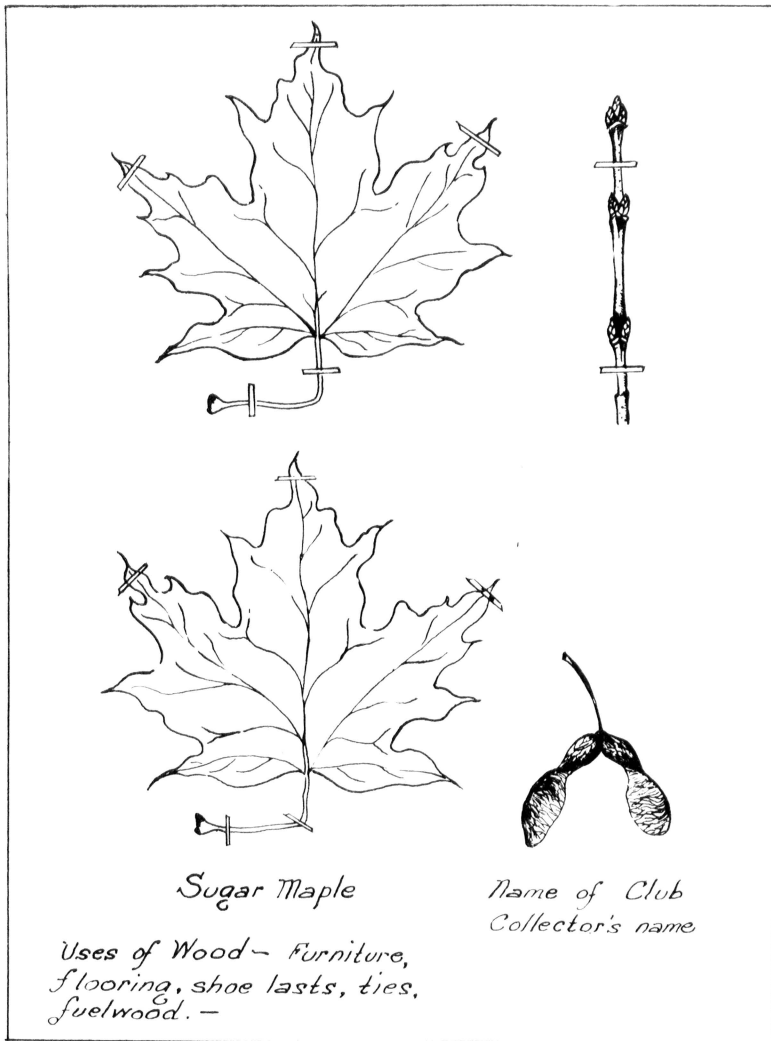


Fig. 2.—Mounted leaf, twig and fruit.

and points of the leaf. Use as few gummed strips as possible to hold the leaf firmly in place; too many strips spoil the neatness of the mount. In the case of the needle-leaved southern cypress and shortleaf pine, it will be necessary to glue each needle to the mounting paper; otherwise, the needles will eventually fall off and leave the twig bare.

**Labeling the Mounted Specimens**

In the space left at the bottom of the mounting paper, neatly write in ink the common name of the tree from which the specimens were

taken, together with the most important uses of its wood. Trees must be labeled by their full names. For example, it is not enough to write maple for sugar maple, or oak for white oak. Learn and use the common names given in the circular even if you have known the tree by other names. Do not depend on what is written in the circular for the uses of the tree. If you know of other uses, by all means put them down. Make inquiries in your neighborhood from lumbermen and find new uses in that way.

Having collected, identified and mounted the twigs, fruit and leaves of the trees, and having properly labeled them, you will want to make a suitable cover for the collection. You might place a four-leaf clover emblem on the cover, with the name of your club, your name, address, together with other designs and information. A logical arrangement of the sheets would follow the arrangement of trees in your bulletin, "Forest Trees of Missouri." At least, all needle-leaved trees and board leaved trees should be grouped separately. All trees in the same family should be together, as the oaks, or the maples.

When you have finished your collection of twigs, fruits, and leaves, some of you may wish to further increase your knowledge of these trees by mounting wood specimens.

### **Mounting Wood Specimens**

This exercise has been written for those 4-H Farm Forestry Club members who may wish to complete their leaf, twig and fruit collection with a collection of mounted wood specimens.

The *purposes* of this exercise are:

1. To enable the boys and girls to identify logs and sawed lumber by the appearance of the wood.
2. To instill in them an appreciation of the many and varied uses of wood products in our everyday lives.
3. To have something of beauty and value for exhibition purposes.

Wood products always have been indispensable in our civilization, and as one of the renewable natural resources, wood always will continue to be a necessity. We need trees to construct houses and buildings; to burn as fuel; to make furniture, vehicles, barrels, crates, boxes, tool handles, paper, agricultural implements, toys; for various medicines, naval stores, wood tannins, maple sugar and syrup, oils and chemicals, and a practically endless variety of articles which we need in our everyday lives.

Wood in one form or another is either used or plays an important part in producing, manufacturing, or transporting our food, clothing and shelter—the three essentials of life. Wood is the most widely used single commodity we have. When you consider the many ways in which we depend upon wood, you will realize why we can not get along without it.

Farmers as a class are the greatest users of wood products. It is therefore important that boys and girls on the farm know more concerning lumber products and their uses, and appreciate the value of a good farm woodlot.

Collect and mount wood specimens of those trees identified, for which you have the leaves, fruits and twigs. Cut specimens from the live trees, taking sections 6-12 inches long from limbs  $1\frac{1}{2}$  to 2 inches in diameter. Choose specimens of uniform size and character from the same parts of trees of the same ages. Retain the bark and cut the ends square across. Specimens may be collected at any time of the year, preferably during the winter.

Place the specimens in a vise, and saw through the heart, down about  $1\frac{1}{2}$  inches. Then turn the specimen on its side and saw on a bevel to meet the first cut at a forty-five degree angle. Cut off the bottom squarely, making all the specimens the same length, about 4 inches.

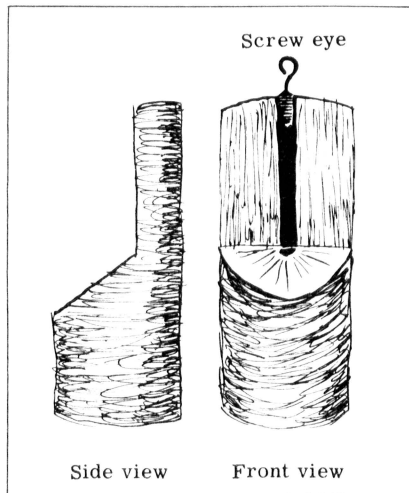


Fig. 3.—Correct mounting.

After drying in a cool, dry place for a month, smooth the specimens with chisel, block plane, wood rasp, broken glass edge, or sandpaper. Treat one-half of the smooth surfaces with two coats of white shellac or spar varnish. The purpose of this is to contrast the "grain" or "figure" of the wood before and after it is varnished or shellaced. The untreated surface will appear dull and indistinct in contrast to the treated surface.

Mount the specimens on a  $\frac{1}{4}$ - $\frac{3}{8}$  inch dressed board large enough to hold the whole collection. Insert a small screw-eye in the top of each specimen, and suspend them from rows of hooks in the board, with the



varnished surfaces in front. Just below each specimen place a small white slip of paper neatly labeled with the name of the tree and a few of the principal uses of the wood.

Be very careful to properly label each specimen. When the sections are collected and first cut, they should all be either marked or tagged, so they may be correctly identified later.

A neat collection of wood specimens, mounted leaves, prints and twigs, make a good exhibit for local, state and county fairs.

### **Making a Collection of Leaf-Prints**

This exercise has been written for those 4-H Forestry Club Members who may wish to know more of the forest trees of Missouri in addition to the fifteen trees required, for which you have made leaf, fruit and twig collections.

**Collecting the Leaves.**—Collect the leaves in the spring, selecting a small though typical leaf showing average or representative characteristics. Spread the leaves carefully between the pages of your field notebook so they may be carried home in good condition. Take several leaves of each tree, as you may spoil one or two of them in making a good print.

**Making the Leaf-Prints.**—As soon as you get home with the leaves, and before they have a chance to dry out and wrinkle, begin making the prints. Have on hand a quantity of good-grade white paper, letter size (8½ x 11 inches). Have also a self-inking stamp pad, size 3 x 6 inches or larger if possible, which may be purchased from a book store or perhaps a printer or hardware store. A stamp pad consists of a small metal box with a cover, containing an absorbent cloth pad saturated with printer's ink.

Remove the leaf from the notebook and place it on the stamp pad, putting the lower side of the leaf in contact with the ink. Gently press the leaf down upon the pad, cover it with a piece of newspaper, and rub it lightly with a circular motion. If the pad is smaller than the leaf, move the leaf about until every part of the bottom surface has come into contact with the ink.

Lift the leaf from the pad and spread it out with the inked surface touching the paper. Cover it with a newspaper and lightly rub it. Your first print will in all probability be nothing but a large smeary blot. Here are some of the reasons why:

1. Too much ink.
2. The paper or the leaf moved slightly, causing a smear.
3. The leaf was crushed and pressed too lightly against either the pad or the paper.

Experiment a little with some scrap paper. If there seems to be too much ink in the pad, soak a little out on a blotter. Perhaps the blot was caused by pressing too tightly. Examine the under side of the leaf. You

will notice that the veins are prominent and raised a little above the leaf surface. The principle involved in making a leaf-print is simply to get ink on all the veins, without touching the portions between the veins. Then, when the leaf is transferred to the paper and pressed lightly, only the veins will print.

After you have smeared several prints because the paper or the leaf moved a little, you will see that one obviously cannot make an exact print unless the paper is held firmly and the leaf kept from moving across the paper while printing. In time, you will have better luck, and after several attempts you will be making clear-cut prints of your collection. Label the leaves neatly and arrange them in groups following the order given in "Trees of Missouri." Bind the sheets together and make a suitable cover to hold the collection.

When completed, you will have a permanent trophy of which you may justly be proud. You will have eliminated all the trouble involved in pressing and mounting the leaves. Mounted leaves make a bulky collection, and are apt to fade after several years. In time they become brittle and fall from the sheets. Leaf-prints, on the other hand, may be bound in book form, preserving for all time the chief distinguishing characteristics of leaves—outline and veination.

## SECTION II

### FOREST SEEDING AND PLANTING

#### Why Plant Forest Trees

Throughout the entire period of agricultural development of our country, farmers have been clearing away the native forest. It was generally understood that all land which could be plowed would be used for agricultural crops, and lands too steep and rocky for cultivation would be used for stock grazing.

Modern agricultural methods, improved and imported plant species and varieties, and substitution of farm machinery for hand labor, resulting in heavier yields, have changed the situation, and now it is known that only the more productive farm areas are needed to produce all marketable crops. Moreover, areas of low fertility, such as steep slopes and rocky, shallow, sandy or poorly-drained soils, have proved unprofitable for cultivation.

Other areas, originally fertile and productive, have deteriorated through erosion and leaching, following continuous cultivation, to the point where they no longer show a satisfactory return. These factors have resulted in many adjustments, including abandonment of entire farms, change of use of large areas from cultivation to grazing and the retirement of small areas from both crop production and grazing on many farms.

The present outlook for this land is that part of it will never again be used for crop production, and it needs to be put to some profitable use. Planting to forest trees for the production of wood crops is a use which should not be ignored. Since the benefits and returns of trees planted today will be enjoyed chiefly by the present generation it is a responsibility of the youth of this state to promote forest planting of idle farm lands.

### **Farm Areas Suitable For Forest Planting**

Generally speaking, only areas of waste farm land should be reforested. Such areas include gullies and other eroded hillsides, steep rocky slopes, unproductive sandy or gravelly fields and wornout pasture land too rough for improvement. Occasionally, small areas of fertile soil, separated from larger fields by new highways, creeks, etc., are too inconvenient for modern methods of cultivation and find their most profitable use in woodlots. Also, the average farm woodlot, often overgrazed and understocked with desirable trees, can be greatly improved by first eliminating all grazing and then interplanting with either seed or seedlings of valuable timber species. Only in the planting of windbreaks should better soils be reforested, and then the location is definitely fixed in relation to farm buildings or other improvements over which protection is desired.

### **Source of Planting Stock**

Most of the tree seedlings used for planting on farms in Missouri are purchased from the Missouri Conservation Commission through the County Extension Agent's office in each county. These trees are sold to farmers, youth and conservation groups and other landowners at a very low cost to encourage tree planting on areas best utilized by producing timber crops. Tree seedlings obtained from the state can be used for erosion control, woodlot plantations, Christmas tree plantations and for planting pond or wildlife areas; but federal regulations prohibit their use for ornamental purposes such as shade trees or shrubbery for the lawn. The application blanks for ordering seedlings from the Conservation Commission can be obtained from your county agent any time between October 15 and February 1. The seedlings are always delivered to the county at the proper time for planting each spring.

Several of the commercial nurseries in Missouri and adjoining states have planting stock suitable for use in various types of farm planting. All of these companies will be glad to furnish current species and price lists upon request.

A third, and certainly the most interesting and educational way for 4-H boys and girls to obtain tree seedlings, is to grow their trees from the seed in a small forest nursery seed bed.

### Sources of Tree Seed

Tree seed may be obtained in one of the following ways:

1. By personal collection.
2. By exchange with clubs in other sections.
3. By purchase from seed dealers.

Native tree seed often may be collected in nearby fields or woodlands and cleaned at home. Seeds of walnuts, hickories and oaks are available in all sections of the state during good seed crop years and require practically no cleaning. Seeds of other trees may be available only in certain seed years. Before plans are completed, therefore, the club member must find out whether or not the desired seed is available and where and when it may be collected. Seed collection data for some of our more important Missouri trees are given below.

Table 1.--Data Pertaining to Collecting, Cleaning and Sowing Native Tree Seed.

Species	Collection Date	Cleaning Necessary	Av. No. lbs. Clean Seed per bu. Fruit	Av. No. Clean Seed per lb.	% of Seed Expected to Germinate
E. Red Cedar	Sept.-Dec.	None	1.75	18,000	50
Shortleaf Pine	October	Dry and Extract	1.25	65,000	60
Southern Cypress	October	Dry and Extract	3.00	3,000	65
Black Walnut	October	None	40.00 (hulled)	28	80
Black Locust	Oct.-Jan.	Dry and Extract	1.25	26,000	85
Hickories	October	Hull	35.00	100	85
Oaks	October	Hull	50.00	150	75
Catalpa	Oct.-Jan.	Dry and Extract	1.50	19,000	85
Osage Orange	Oct.-Nov.	Macerate	1.25	12,000	75
Sugar Maple	October	None	15.00	7,000	55
Ash	Sept.-Oct.	None	12.00	6,000	80
Hackberry	Oct.-Dec.	None	15.00	2,500	85
Black Cherry	June-Sept.	Macerate	8.00	4,500	75
Tulip Poplar	October	Dry and Separate	13.00	16,000	15
American Elm	May 20-June 10	None	15.00	90,000	70

Methods of collection vary with tree species and type of seed produced. Cones of evergreen trees must be collected while attached to the trees, before they open and discharge the seed. This can best be done when trees are being cut and cones can be gathered from tops lying on the ground. Otherwise, trees must be climbed and the cones picked and dropped. Seeds of nut and oak trees may be gathered from the ground after the first frost. Fruit and berry or pod-producing trees must be picked from the tree when mature, while winged seeds, such as ash, elm and maple may be picked from the tree or raked from the ground after falling. Seeds raked from the ground must be cleaned carefully to avoid a mixture of several species.

In collecting, get the best seed available. Cull out poor seed or fruit and save only plump, large fully mature seed from well-formed, healthy,

mature trees. Trees which are either too young or too old, poorly formed, diseased or otherwise unhealthy do not as a rule produce satisfactory seed.

After seed has been cleaned, put it into tightly covered cans or fruit jars and keep in a cool, moist place until time to sow.

Clubs in different sections of the state often will find it possible to collect surplus quantities of seed of a certain tree species, while other desired species are unavailable. County agents can furnish assistance in such cases through contacting other agents in counties where the desired seed is obtainable and arranging exchanges, based on market value of the various species.

If the season for collecting native seed is past, seed is not available, or you want seed of trees not native, you can buy it from dealers and professional collectors. County agents can obtain lists of agencies dealing in seeds and prices at which they may be obtained.

### Operating a Tree Nursery

A small tree nursery on the farm, producing enough trees to reforest several acres of idle land each year, requires very little space, labor and equipment and no expense unless seed has to be purchased. Besides forest planting stock, trees for windbreak or hedge planting, shade and ornamental trees and stock for Christmas tree plantations may be grown at home with little expense within two to five years. Trees grown in nurseries, where soil is generally fertile, and where they receive cultivation, weeding and water if necessary, grow faster, produce better developed root systems and are of better form than wild stock. Because of these advantages, they are more likely to survive when transplanted to permanent sites, continue to grow faster and develop into superior trees. Seeding data for various Missouri native trees are shown in Table 2.

Table 2.--Seeding Data For Native Species.

Species	Recommended Seeding Date	Lbs. of Seed Per 100 sq. ft. of Seedbed	Seeding Depth	Yrs. required in Nursery	Region
East. Red Cedar	Oct. 1-Dec. 1	1.0	$\frac{1}{8}$ "	2	Entire State
Shortleaf Pine	Early March	0.25	Barely Cover	1-2	So. Missouri
Southern Cypress	Early March	3.0	$\frac{1}{8}$ "	1	S. E. Missouri
Black Locust	June 15-July 15	0.25	$\frac{1}{8}$ "- $\frac{3}{4}$ "	1	Entire State
Hardy Catalpa	March-April	0.25	Barely Cover	1	Entire State
Osage Orange	Fall or Spring	0.50	$\frac{1}{8}$ "	1	Entire State
Sugar Maple	Fall or Spring	1.0	$\frac{1}{8}$ "	1	Entire State
Ash, White or Green	Oct. 15-Dec. 1	1.0	$\frac{1}{8}$ "	1	Entire State
Hackberry	Oct. 15-Dec. 1	3.0	$\frac{1}{8}$ "	1	Entire State
Black Cherry	Oct.-Nov.	2.0	$\frac{1}{8}$ "	1	Entire State
Yellow Poplar	Oct. 15-Dec. 1	6.0	Barely Cover	1	S. E. Missouri
American Elm	June 1	0.25	$\frac{1}{8}$ "	1	Entire State

Minimum requirements for the 4-H Club nursery project are as follows:

- (1) Seedbed 4 feet wide by 25 feet long.
- (2) Recommended amount of seed.

The first steps in planning the nursery project is to select one or more species to grow, obtain the necessary seed and locate the nursery site.

Selection of site is very important and upon this selection may rest the success or failure of the project. It is necessary that the soil be in cultivation, without sod and preferably free from weeds. A light, sandy loam, with well-drained subsoil and located near a supply of water is best but any soil type which will produce garden vegetables should be satisfactory. Good soil drainage is very important. Poorly drained, clay soils which are sticky and difficult to work in early spring, are not conducive to good root development. They stick to the roots so tightly when trees are being lifted that most of the lateral roots are broken off and remain in the soil. Locate the site, if possible, within one hundred feet south or southeast of buildings or windbreak, and protect it from all grazing livestock, poultry and rabbits.

The proper time for seeding the various tree species is shown in Table 2. The seedbed should then be broken up, either with a spade or plow, marked off with stakes and twine, and the surface smoothed up and crowned with a garden rake. A shallow trench along each side of the seedbed is necessary for proper drainage, as shown in Figure 4. Clean seed, such as pine, cedar, cypress, black locust or black cherry may be planted in shallow drills six inches apart. Hardwoods such as maple, ash, yellow poplar, catalpa and elm, the seed of which is attached to "wings" not easily removed, must be seeded by hand in drills, or hand broadcast. Drill seeding is recommended over broadcasting. It allows the use of a garden plow in summer cultivation and eliminates considerable hand weeding.

Tree seeds should be covered with fine soil or sand to a depth which is equal to the thickness of the seed. Do not cover too deep. Where seed is broadcast on the surface, the best method of covering is to sieve clean sand over the bed until the seeds are barely covered.

Germination takes place in from five days to three weeks, depending on weather conditions, tree species and condition of seed when sown. As the tiny seedlings often resemble weeds during the first few weeks of growth, it is best not to attempt weeding until the young trees can be easily distinguished. Seedbeds should be kept free of weeds until late summer, by which time the seedlings have shaded the ground sufficiently to keep down active weed competition. Watering of seedbeds is necessary during periods of prolonged summer drought and should always be done

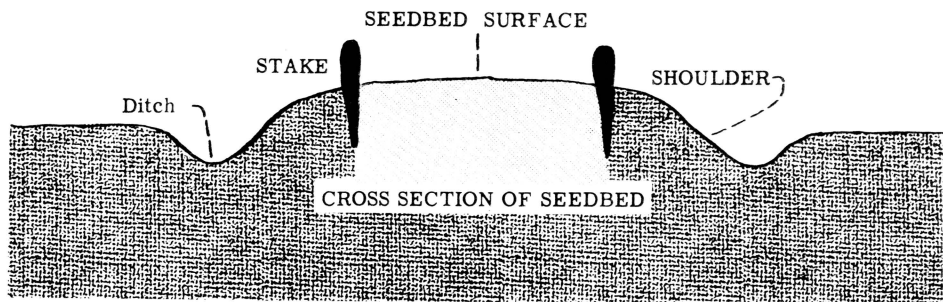
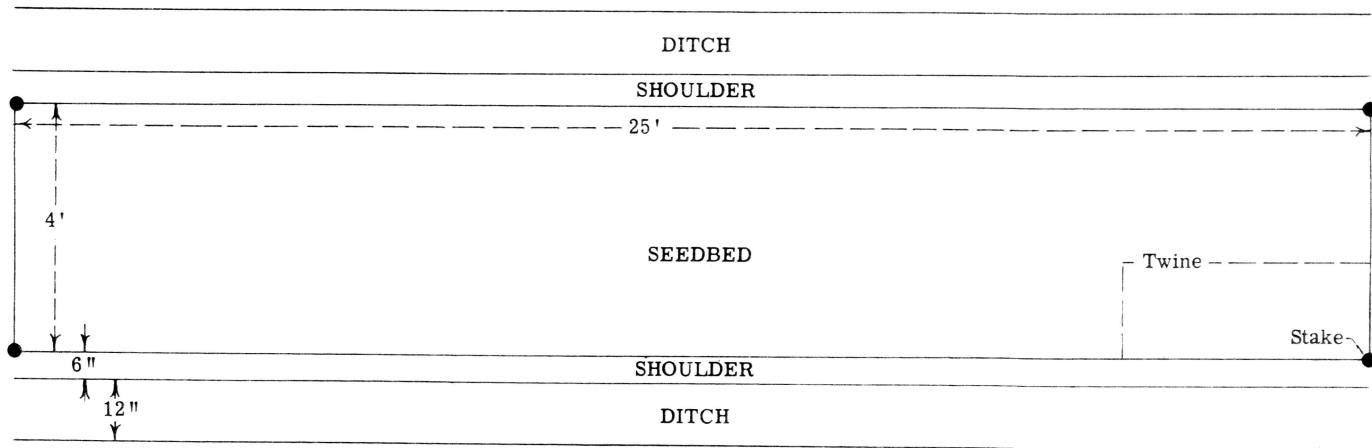


Fig. 4.—Detail and a cross section of standard 4-H club seed bed.

in the early evening, after sundown. To be effective, use enough water to moisten the top three inches of soil.

As a general rule, hardwood trees reach planting size in one year and are ready for transplanting to the field in March of the year following seeding. Shortleaf pine and southern cypress reach planting size in one year, but eastern red cedar and conifers not native to Missouri usually require two or more years in the seedbed. Conifers raised for windbreak planting should be transplanted at the end of two years and spaced two inches apart in rows six inches apart for at least one more year before they are finally planted as a permanent windbreak.

Young trees are hand lifted from the farm nursery bed by means of spade or spading fork. Care must be taken to keep the blade at least six inches away from the young trees and to dig enough to thoroughly loosen the trees and preserve the entire root system. Trees should be taken up immediately after loosening, counted, tied in bundles of 50 to 100 and immediately heeled-in a trench with the roots completely covered with moist soil as shown in Figure 6.

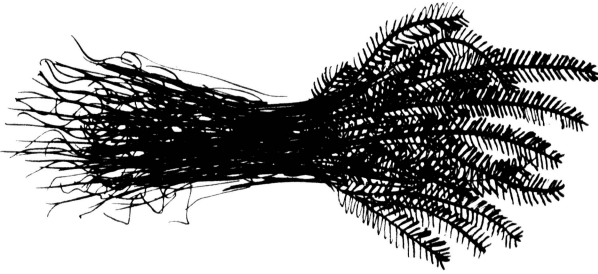


Fig. 5.—Bundle of 50 tree seedlings.

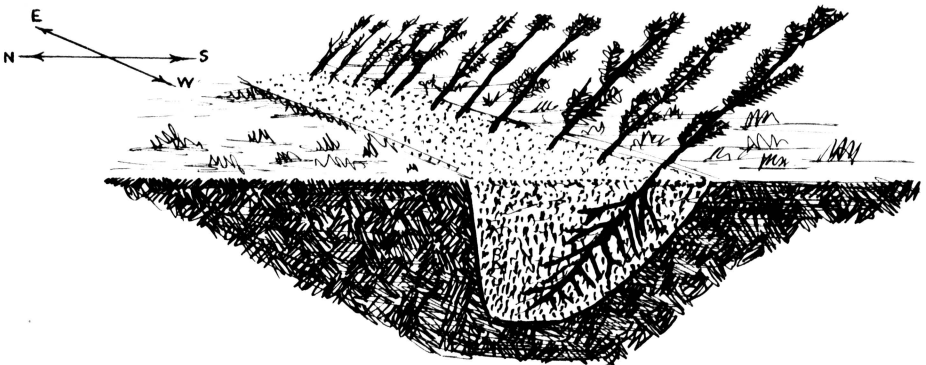


Fig. 6.—Trees properly heeled-in may be stored for several weeks.



If planting is to be done immediately, bundles of trees may be placed in tub or bucket containing enough water to completely cover the roots. Trees should never remain in water, however, for more than one day. The utmost care must be taken to prevent roots from dying out between lifting and transplanting and roots should never be exposed to the air for more than three minutes at any time.

### Direct Seeding

Trees recommended for direct seeding are those which produce a long tap root during the first year, and are therefore difficult to lift without severely damaging the roots. Such trees require much time and labor in digging holes deep enough to plant the entire root without crowding or doubling up. Into this class falls our most valuable hardwood tree—black walnut, together with white oak, bur oak, northern red oak, pecan and shagbark hickory. Other nut producing trees, such as butternut and the various species of hickory and oak may be established by direct seeding but their value is relatively low and they cannot be recommended for pure planting. They may, however, be mixed with the better trees if desired for special purposes. Members should select the species which they wish to plant, after first making sure they can obtain seed and that the soil of the planting site is suited to the trees to be planted.

Minimum requirements for the projects are as follows:

- (1) 2000 selected seeds.
- (2) One-half acre of idle land which can be completely protected against fire and grazing stock.

Planting should be done in the fall, soon after seed is collected, from October 15 to December 1, except where squirrels are too numerous and dig up the seed as soon as it is planted. To avoid this, plant about ten seed spots and observe them for at least ten days before completing the work. If the majority of nuts have been dug up by squirrels it is best to stratify the seed over winter and plant as soon as the frost leaves the ground in the spring.

Stratification prepares nuts for spring germination whereas nuts stored dry over winter often do not germinate until one full year after spring planting. A pit for stratifying, shown in Figure 7, should be located in a shady, sheltered spot, preferably on north side of building, where freezing and thawing is not too frequent. The soil should be light and well drained.

Do not store nuts where squirrels are present as they are almost certain to locate and destroy the nuts during the winter. Nuts may be stratified, hulled or unhulled, the only advantage in hulling being that they requires less than half as much space as unhulled nuts.

The most convenient tool for planting nuts is the grubbing hoe, al-

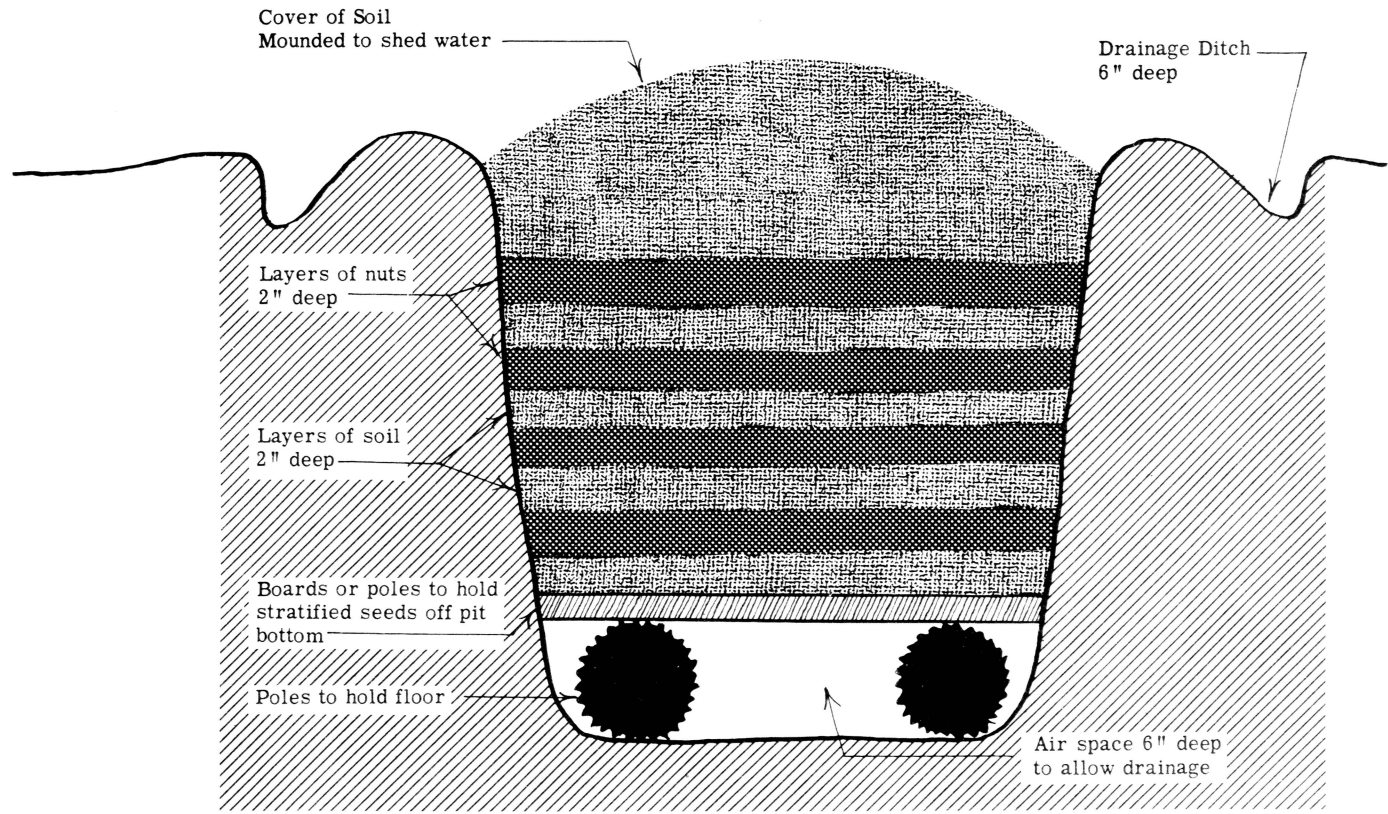


Fig. 7.—Cross-section of pit for stratifying nuts.

though a spade or shovel also may be used. Where sod is present it should be scalped away for a space about 18 inches square and the bare soil thoroughly loosened up. From three to five seeds should be planted per spot, spaced about 6 inches apart near the center of the scalped area, and not more than two inches deep. Careful, unhurried planting of a half acre will require about two days work for the average boy.

Table 3.--No. Trees Per Acre Required For Various Spacing.

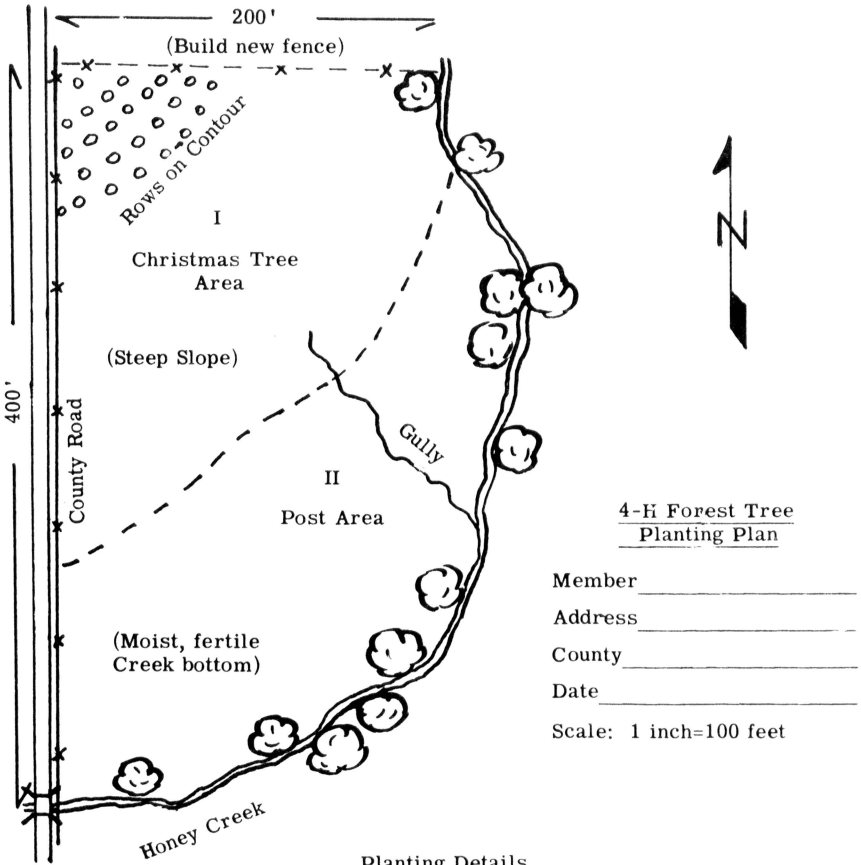
Spacing (in feet)	No. Trees Per Acre	Spacing (in feet)	No. Trees Per Acre
4 x 4	2722		
5 x 5	1742	6 x 8	908
5 x 6	1452	7 x 7	889
5 x 7	1245	7 x 8	778
6 x 6	1210	8 x 8	681
6 1/2 x 6 1/2	1031	8 x 10	545
6 x 7	1037	10 x 10	436

The recommended spacing for both direct seeding and forest planting projects is 6½ by 6½ feet which requires approximately 1000 seed spots or seedlings per acre as shown in Table 3.

Spacing as close as 5 x 6 feet, or as wide as 8 x 8 feet may be used if desired but the recommended distance of 6½ feet each way meets all requirements of growth, form and timber development as well as being simple to compute on a 1000 per acre basis. Spacing need not be exact but can be measured roughly by pacing. A light pole, 6½ feet in length, is convenient to use in checking the spacing. Although most trees are planted in straight lines and at regular intervals, curved lines and irregular spacing may present a more pleasing appearance for some types of plantations.

### Planting Tree Seedlings

As true in all other phases of farm management, the preparation of a good plan which is followed to the letter, results in better tree plantations. First of all decide what type of plantation is needed on the area you intend to plant. Then, select the proper tree species and sketch out the details of the area and the future location of the trees. Use your copy of Extension Circular number 563, "Planting and Care of Forest Trees," as a guide in selecting the species of trees which will grow on the kind of area you intend to plant and which will, at the same time, serve the purpose for which you are doing the planting. For example, do not try to grow pine on low, wet areas where you can see that cottonwood and bur oak are the species which appear "at home" under these conditions. The pine, on the other hand, will do much better than either of these bottom-land species when planted upon a dry south or west slope where the soil fertility is low.



4-H Forest Tree Planting Plan

Member \_\_\_\_\_  
 Address \_\_\_\_\_  
 County \_\_\_\_\_  
 Date \_\_\_\_\_  
 Scale: 1 inch=100 feet

Planting Details

- |   |   |
|---|---|
| <p><b>I Christmas Tree Area</b></p> <ol style="list-style-type: none"> <li>1. Size: 3/4 Acres</li> <li>*2. Number of Trees:<br/>           1,000 Jack Pine<br/>           1,000 Scotch Pine</li> <li>3. Site Preparation: Plowed<br/>           on contour in fall</li> <li>4. Spacing: 4 x 4 feet</li> </ol> <p>* To be planted at rate of<br/>     500 each year for next 4 years</p> | <p><b>II Post Area</b></p> <ol style="list-style-type: none"> <li>1. Size: 3/4 Acres</li> <li>2. Number of Trees:<br/>           375 Black Locust<br/>           375 Osage Orange</li> <li>3. Site Preparation: Hand<br/>           Scalp planting spots</li> <li>4. Spacing: 6 1/2 x 6 1/2 feet</li> </ol> |
|---|---|

Fig. 8.—Sample plan for a 4-H tree plantation.

Figure 8 is an illustration of a 4-H planting plan. Perhaps your plantation will serve as a windbreak to protect the farmstead or it may consist of wildlife area around the farm pond. Regardless of the type of planting you intend to make, you can vary such a plan and sketch to fit the situation on your planting area.

Here are some general suggestions which will help in your preliminary planning:

### **Windbreaks**

1. For winter protection around the farmstead, plant at least three rows of evergreens such as Jack, Scotch or Virginia Pine, or redcedar.
2. For the prevention of wind erosion in fields plant at least two rows of hardwoods such as black locust, catalpa or osage orange. Jack and Virginia pines can be used for this purpose, too.
3. Winter windbreaks are usually L shaped and are located on the north and west sides of the area to be protected.
4. Windbreaks around the farmstead should not be closer than 100-300 feet to nearest buildings.

### **Christmas Trees**

1. Use either Scotch or Jack pine or redcedar. Firs and spruces make good Christmas trees but do not grow well or rapidly in Missouri.
2. Use a spacing of 4 x 4 feet rather than the regular 6½ x 6½ foot spacing used in most forest plantations.

### **Pond Areas**

1. Plant a one or two-row evergreen windbreak around the north and west sides of the area enclosed by the pond fence, if the pond location will permit such planting.
2. Plant small clumps of trees of various species in suitable spots in the pond area. Try to make these clumps look as if they had grown naturally. They can consist of food and cover species for wildlife as well as trees which will provide shade and add to the attractiveness of the area. Do not plant trees on the pond dam or close to the water's edge. Pond or wildlife bundles which can be ordered from the Conservation Commission contain a variety of species which are suitable for such plantations.

### **Post Plantation**

1. Osage orange, black locust and catalpa are three excellent post species which require rich, moist soil for maximum growth. Redcedar is also an excellent post tree and will grow well on fair to poor soils. Be sure to choose a post species adapted to the area you intend to plant.
2. Osage orange and black locust can be planted in mixtures or can be used in pure stands. Catalpa and redcedar are ordinarily planted in pure stands.

### **For All Plantations**

1. Study your copy of Extension Circular 563, "Planting and Care of Forest Trees," until you are thoroughly familiar with the recommended

methods of preparing the planting site, receiving and handling planting stock and setting the trees properly.

2. Do the best possible job of site preparation, well in advance of the spring planting season.

3. Make plans and preparations for fencing to keep all livestock out of the plantation. Don't forget that mulitflora rose will make a good fence for the tree planting provided there is sufficient space between the trees and the roses.

### **Protection and Maintenance of Plantations**

Fire and livestock must be excluded from stands of young trees. Fire usually can be avoided by care on the part of the owner, but in sections where wood fires are common it may be advisable to plow a firebreak not less than six feet in width completely around the young plantation. Firebreaks should be disked several times during the growing season to keep down growth of vegetation. All forest plantations and windbreaks must be fenced either before or immediately after planting is done. Fencing is recommended for existing farm woodlands, as well as planted stands, for stock damage in many sections even exceeds damage by fire. Not only do animals browse on the leaves, twigs and buds of both hardwoods and conifers, but injure and ruin many more by trampling.

Cultivation of young stands during the first growing season is advised for all types of plantations when topography permits, and for two or more years in windbreaks. Where cultivation is not possible due to steep slope, rock outcrop, or other physical features, the young trees should be watched during the first growing season to make sure that they are not choked out by weeds. Shortleaf pine apparently survives better during the hot months if partially shaded by a light growth of grass, weeds or brush, but black locust and many of the other hardwoods suffer heavy loss through shading. By hand cutting small areas of weeds about trees which are heavily shaded, many seedlings can be brought through which might otherwise be shaded out. Weed competition after the first year is seldom serious enough to warrant cutting.

Borers or other injurious insects occasionally infest young stands of growing timber and cause considerable damage. This is true especially in overcrowded stands, in slow-growing stands situated on very thin soils, or after severe drought injury when trees are in weakened condition. When serious insect infestation occurs, ask the advice of your county agent, a trained forester or an entomologist before attempting control measures.

Aside from complete protection from fire and livestock, the planted forest stands require no labor expenditure for maintenance after the second year until trees begin to mature and are ready for harvest.

### SECTION III WOODLAND MANAGEMENT

More than one-third of the land in Missouri, or 15,500,000 acres, is covered with some form of tree growth. Farmers own approximately half of this large timbered area. Therefore, in these days when it is becoming more and more important to work toward the highest and best possible crop production from our land, we must learn to include and improve the management of the timber crop along with all of the other products which come from the farm.

The boys and girls of Missouri have a greater stake in the future timber supplies of the state and nation than do the present adult generations, because it takes many years to produce mature timber. Unless we begin now to prepare the way for future timber crops, shortages of vital wood products can and will become acute. The idea that our timber supply is inexhaustible is old-fashioned and ridiculous.

The production, protection, management and use of timber crops involves many practices, but on the whole these practices are no more mysterious or complex than the other farm practices which we consider as "everyday" in modern farm operation.

After reaching the stage in woodland management which involves harvesting forest products, the average 4-H member will have to call for adult assistance. However, in mapping, cruising and other phases of the management planning club members will discover some new and interesting practices which can be carried out by any one of them. Furthermore, a completed management plan for a management plot, or the entire woodland, will give both parents and club members a greater appreciation and considerably more knowledge of the home woodland.

#### Learning To Pace

Pacing is a common method of making rough measurements of distance across the end of a field or from one object to another. One pace is two steps. In other words, when you are pacing you count every other step. Foresters often use pacing in preparing rough maps, measuring the distance between sample plots and for various other measurements in the woods. Some people can pace distance almost as accurately as it can be measured with a steel tape.

Several of the activities which you will carry on in your woods will require measuring distances. Therefore, you should know how to pace and how to convert your pacing into feet of distance.

First measure off a practice course with a 50 to 100 foot tape. This course can be any distance you desire such as 660 feet (1/8 mile), 1320 feet (1/4 mile), or longer. Mark the ends of the course with stakes. The course should be on level ground if possible, and can be over some route which you use daily. For example: from the house to the mailbox or to the pasture gate.

When you are ready to start practicing on your course, here are the things you should remember:

1. Place your right foot at the starting stake.
2. Step out with your left foot and count each time your right foot strikes the ground.
3. Keep count of the paces. (Each two steps.)
4. Walk naturally. Don't try to step any particular distance.
5. Practice on your course until you have a good average of the number of paces you must take between your marking stakes.
6. Divide the number of feet in your course by the number of paces you took in covering the course. This will give you the number of feet in one of your paces. (Probably from 3 to 5 depending upon your age and height.)

Continue practicing by measuring the distance from the house to the barn; the length of the barn; and the length and width of the garden.

### **Learning To Use a Compass**

Every boy and girl should learn to use and rely upon a compass. Not only is a compass useful for helping keep directions straight when in strange country, but it is also a tool which is most valuable in making maps, locating section corners, running lines and for many other purposes. Part of your woodland management work will depend upon your being able to use a compass.

Compass dials vary considerably and it is not possible to cover all types in this publication. However, most pocket compasses will be suitable for use in mapping your woodland. Since very few of these small compasses have a sighting device it will probably be necessary for you to fasten a heavy black thread across the face of your compass to use in sighting the lines you intend to lay out. Perhaps you can tape the thread to the front and back of your compass with clear cellophane tape.

This thread should be put on carefully and stretched tightly across the N and S on the dial. Unless your compass is one of the so-called self-reading types, you will notice that when you sight it down a line the needle will swing into the NW quadrant when you actually have the compass pointed NE. This may seem confusing at first, but remember that the compass needle always points north regardless of how you turn the compass. Always orient your compass so that the N is under the point of the needle, then turn the compass slowly right or left until your thread "sight line" is laid exactly on the line you intend to run. You can then read the number of degrees your line varies from magnetic north or south.

Figures 9, 10 and 11 illustrate how you can use a compass, a school protractor and your pacing to make a map of your farm woodland.



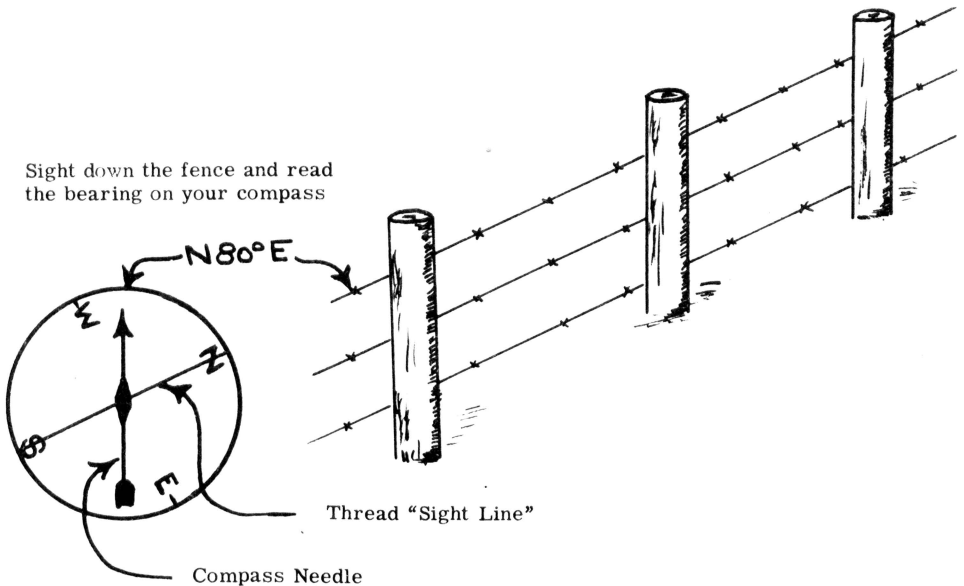


Fig. 9.—Taking a compass bearing.

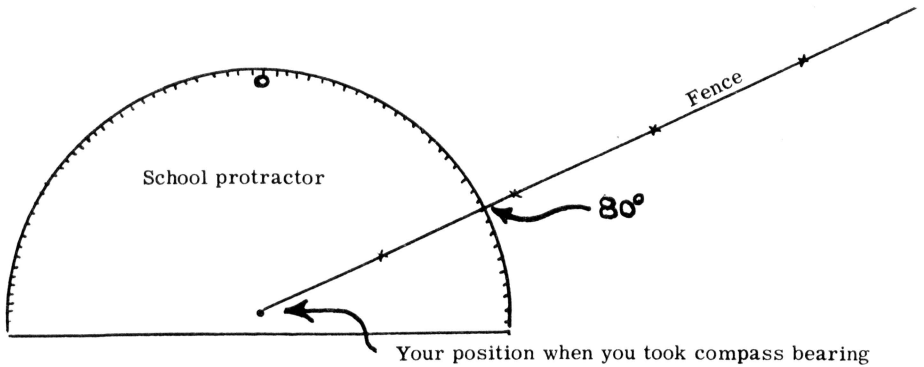
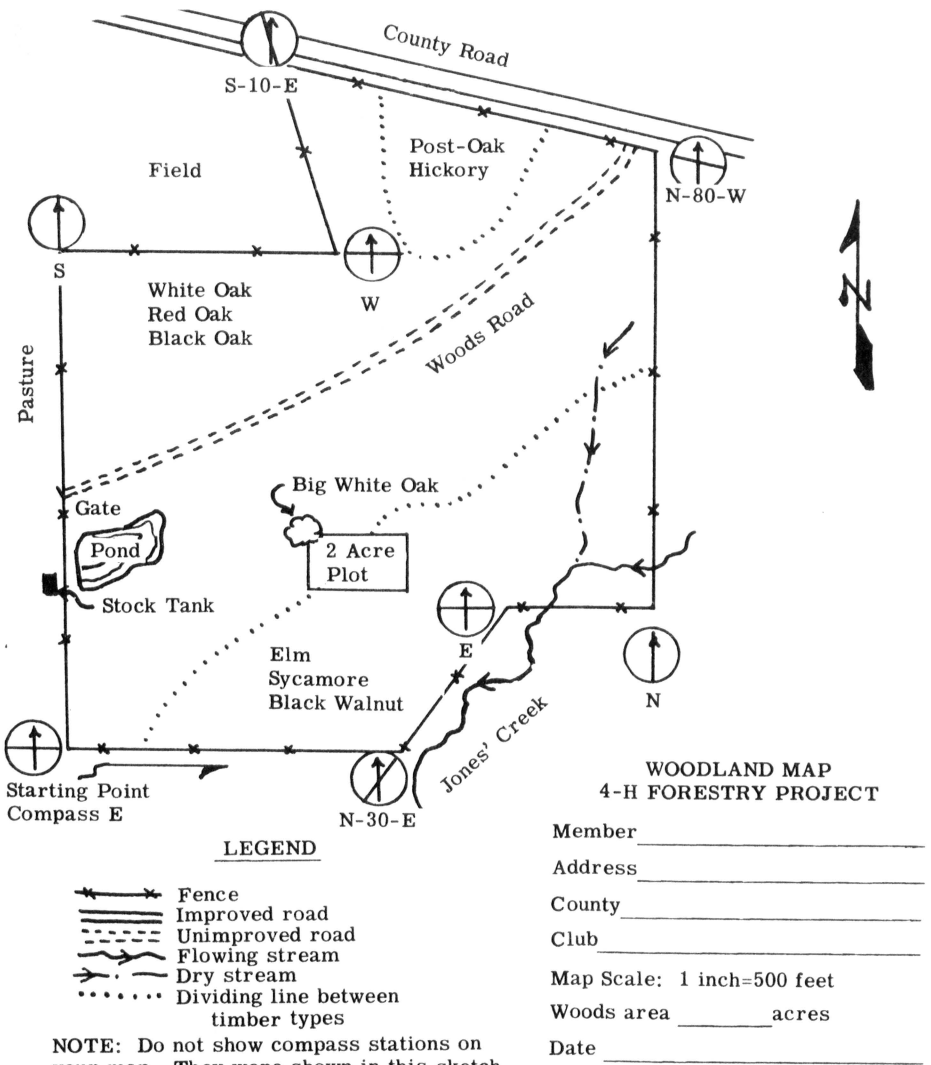


Fig. 10.—Plotting a compass bearing on a map.

### Staking Out a Woodland Management Plot

For practice in cruising and marking timber, a two acre plot should be selected and laid out in the home woodland. If you do not have a woodland on your farm, perhaps one of your neighbors will allow you to use a plot in his woods.

A square acre of land is approximately 208 feet (208.6) on each side. Select the area in which you want to lay out your plot then, through use of your compass and pacing, measure off two acres. Here your compass lines should run north and south or east and west. To run a compass line through woods, sight on a tree, stump or other object which is on your



**LEGEND**

- \*—\*— Fence
- ==== Improved road
- - - - Unimproved road
- ~~~~~ Flowing stream
- — — Dry stream
- ..... Dividing line between timber types

**NOTE:** Do not show compass stations on your map. They were shown in this sketch to illustrate sighting and reading compass bearings.

Fig. 11.—Running a compass traverse and making a map.

N-S or E-W line and which you can see clearly. Pace to the object. Take another sight with the same compass bearing and pace to the next object which is on your line. Do this until you have covered the required distance, then turn a square corner (90 degree angle) and run another side of your plot.

Mark each corner of your plot with a durable stake or paint a band around a tree which is close to each corner.

As you run the last line on your plot you should arrive back at your starting point. If the last sight over your compass misses the starting point by more than a few feet, your pacing and compass work have not been accurate and should be rechecked.

### Cruising Timber

At this time study pages 6 to 13 in Extension circular 576, "Farm Woodland Management." You will need to take only two one-fifth acre sample plots in your management tract and they can be located at the center of each acre. Therefore, you will not need an aerial photo, but you will have to use your compass and do some pacing to find the plot locations.

Prepare tally sheets such as shown on page 12 of circular 576. You will need a separate sheet for each species of tree which will be measured on your sample plots. Do not make sheets for such species as dogwood, persimmon, redbud and other trees or shrubs which have no commercial value.

From your study of circular 576 you learned that you will need to make two measurements on each tree you tally. The first is the diameter at breast height (4½ feet from the ground) and the second is the usable height of the tree.

You can use a tape, either cloth or steel, to measure the *circumference* (distance around) the trees and from Table 4 you can convert *circumference* to *diameter*.

Table 4.--Converting Circumference to Diameter

When Circumference Is: (Inches)	Approximate Diameter Is: (Inches)	When Circumference Is: (Inches)	Approximate Diameter Is: (Inches)
5-10	2	61-66	20
11-16	4	67-72	22
17-22	6	73-78	24
23-28	8	79-85	26
29-34	10	86-91	28
35-41	12	92-97	30
42-47	14	98-104	32
48-53	16	105-110	34
54-60	18	111-116	36

For measuring heights you should make a Tree Height Measuring Stick. For this stick you will need a smooth, clean strip of wood approximately ¼ inch thick, 1½ inches wide and 28 inches long. The stick should be marked off, with heavy pencil marks, into 6.9 inch sections beginning at the left end. (An exact measurement of a 6.9 inch section is shown in the margin of this page.) Then each 6.9 inch section is divided into halves with a lighter pencil mark as shown in Figure 12.



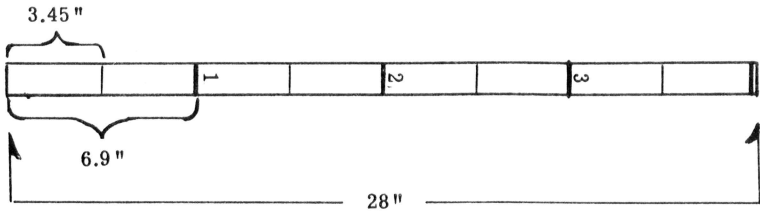


Fig. 12.—Making a tree-height measuring stick.

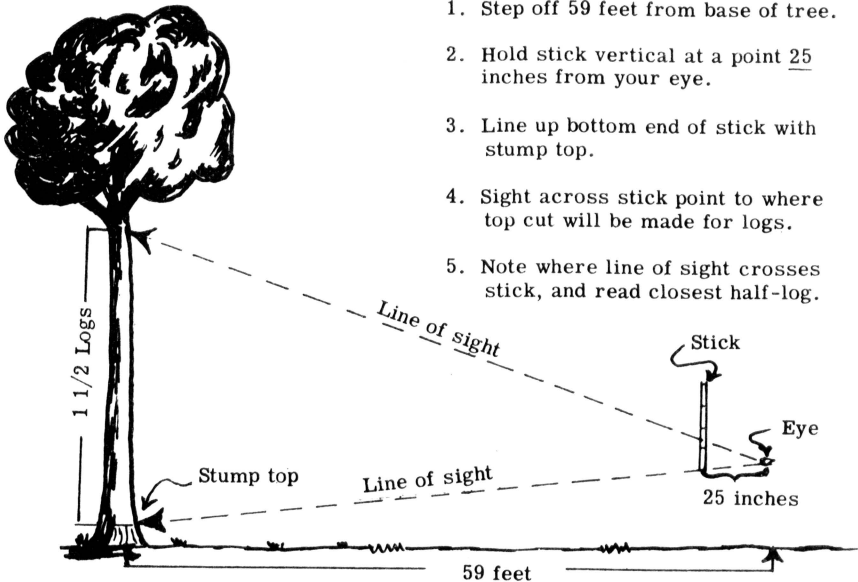


Fig. 13.—Using a tree-height measuring stick.

1. Step off 59 feet from base of tree.
2. Hold stick vertical at a point 25 inches from your eye.
3. Line up bottom end of stick with stump top.
4. Sight across stick point to where top cut will be made for logs.
5. Note where line of sight crosses stick, and read closest half-log.

Number the heavy lines on your stick 1, 2, 3, and 4 as shown in the illustration. When you are using the stick, the heavy lines will indicate 16 foot logs and the light lines will indicate half logs or 8 foot sections. (Refer to page 11 in circular 576.)

Figure 13 shows you how to use your tree height measuring stick. Also, see photograph on page 10 of circular 576, "Farm Woodland Management."

You recall from circular 576 that trees are classed as "good growing" or "poor growing." Before you can start measuring and tallying the trees on your sample plots, you should know the common defects which cause trees to be classed as poor growing. Figure 14 illustrates some of the most common defects which can be observed in standing timber.

Before you start cruising be sure to review the sections entitled "Obtaining Data on the Plot" and "Tallying" which are on pages 9 and 12 in your circular 576.

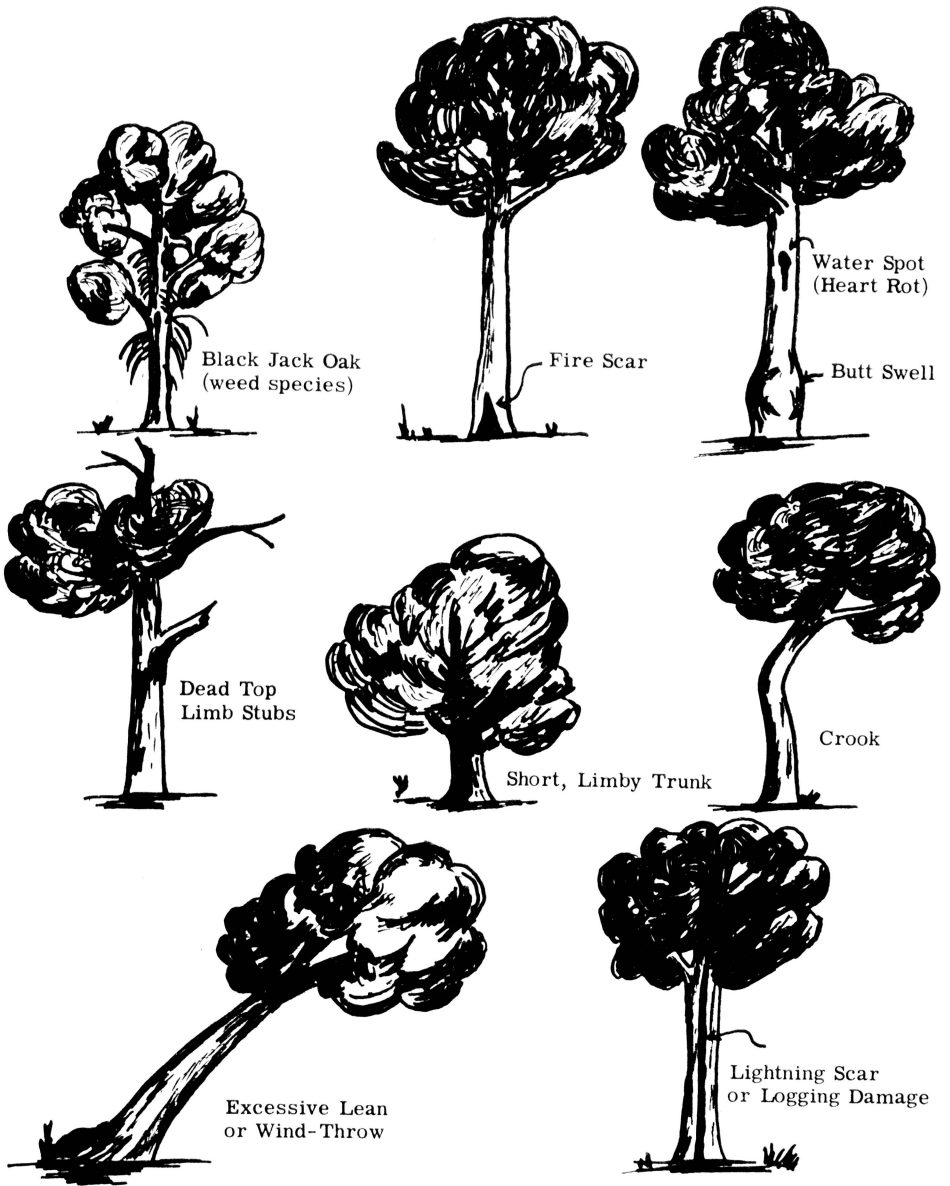


Fig. 14.—Some common defects in trees.

Label each of your tally sheets with the name of the tree species which will be tallied on that sheet. Tally the trees of both plots on the same sheets since there is no need for keeping the data separated by plots.

Remember that your circular plots should have a *radius* of 53 feet. If you are in doubt about including any tree which is close to the plot boundary be sure to pace from the plot center to the tree to verify whether it is in or out of the plot.

### Studying the Stand Per Acre

After you have finished measuring and tallying all of the trees on two one-fifth acre sample plots, you will have obtained some information which will show whether or not your woodland contains enough trees per acre to allow it to produce at the maximum rate.

Total up all of the trees (both good and poor and all species) in each 2-inch diameter class. In other words, add together all of the two-inch trees; then all of the four-inch trees; all of the six-inch and so on. Multiply each of the totals by 5 and the result will be the number of trees of each diameter class on your *entire two acre management tract*.

Now compare your totals with the table on page 6 in the woodland management circular. You should have twice as many trees in each diameter as is shown in the table because your totals were obtained from two acres and the table is for one. Very few woodlands have enough trees of all sizes to be classed as full stands.

As you compare your stand with the ideal woodland:

1. What size classes are too low or lacking in your woodland?
2. In what size classes are there more trees than indicated as desirable?
3. Can you determine some of the things such as overgrazing, fire, overcutting or other causes which have resulted in a poor balance of sizes in your woods?
4. A management plan includes recommendations which will help correct the stocking of a woods. It might include fencing to prevent grazing, planting or direct seeding to increase the number of small trees, or discontinuing cutting until the woods has had time to recuperate from over-cutting. List some of the things that need to be done in your woods.

### Computing Board Foot Volume

A board foot is a piece of lumber 1 inch thick and 12 inches square. The board foot is a common unit of measure for standing trees, logs and lumber just as the bushel is a common unit of measure for oats and corn.

You can compute the number of board feet in any of the trees above 10 inches in diameter which were tallied on your plots. For example; If you tallied an 18-inch tree which contained one and one-half 16-foot logs, you will find in the table on page 14 of your management circular that a tree of this size contains 175 board feet.

The next step in your timber cruise will consist of computing the volume of the trees 10 inches and above in diameter which were tallied on your plots. When computing volume keep the totals of each tree species separate and keep the volume in "poor" trees separate from that in "good" trees. After you have totaled up the "good" and "poor" volume on each of your tree species tally sheets, multiply each total by 5. This will give you the total amount of volume by species in "good" and "poor" trees for your entire 2 acre management tract. It might amount to as much as six or seven thousand board feet if your woods contains a good stand of trees above 10 inches in diameter. If it amounts to 2000 feet or less, you can be sure that your woodland needs better protection and management.

### **Marking Trees for an Improvement Cutting**

While you were measuring and tallying the trees on your sample plots you found that some of the trees had to be classed as poor crop trees because of their condition.

For example, if there were 4 such trees on the plots, then there will be approximately five times this number, or 20 trees, on your entire 2-acre management tract. At this time you should mark about half of these trees for cutting. In a few years you may want to return and mark the remainder of the "poor" trees. Why not cut all of the "poor" trees at one time? Study the section called "Improvement Cutting" on pages 15-16 of your management circular.

Mark the trees which should be removed from the management plot by painting a spot 3 or 4 inches in diameter on the trunk several feet above the ground. Paint another spot close to the ground so the stumps will show your mark after the trees are cut. Use a bright colored paint such as yellow, white, orange or light blue. Or, you can mix up left-over cans of paint to make a blend which suits you.

Put all marks on the same side of the trees. For example, if you mark the south sides of the trees, it is easy to see your marks as you walk north through the woods. This helps the cutters find the trees that are to be removed.

Some of the trees which were classed as "poor" may be completely hollow or, for some other reason, contain no sound or usable wood. Such trees are called culls. They should be marked with a large X to indicate that they contain no saw logs. Culls should be girdled or poisoned since they are taking up space which could be used by better trees. Some culls are den trees for squirrels and other wildlife, so it is best to leave one or two per acre when they are being used this way.

After you have completed marking the two-acre tract, perhaps your father will agree to cut the marked trees as he needs logs for rough lumber, fence posts, or fuelwood. The products from such cutting ordinarily

have a value which exceeds the cost of the labor and, as the cutting progresses, you can begin to see the results of your plan for managing your woodland as a farm crop.

### Scaling Logs

For planning purposes and for providing an estimate of the board foot contents of an entire woodland, the method which you used for determining the board feet in a standing tree is sufficiently accurate. However, the most accurate measure of board feet, cord feet and other units can be made after the trees are felled and cut into proper lengths. Measuring the contents of these (logs, bolts, etc.) is called scaling.

Assuming that some of the trees which you marked have now been cut into logs, you should scale and record the contents of each. This is particularly important if the logs are to be sold. Selling logs without scaling them is like selling steers without weighing them.

On page 20 of your woodland management circular you will find instructions for scaling logs. The necessary log rule is printed on the same page. To scale logs, take an ordinary yard stick and measure across the small ends, inside the bark. Then measure the lengths and look up the board foot contents in the table. For example: If you have a log which measures 14 inches at the small end which is 16 feet long, the table shows 135 board feet of lumber can be sawed from a log of this size.

Scale all of the logs which are cut from your woodland management plot and keep a record of them. This information will become an important part of the history of your woodland management project.

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