HOW TO CARE FOR YOUR SMALL FOREST

M. M. BRYAN

To care for your small forest, know first your goal.

A good small forest has needles, leaves, twigs, and small branches on the ground, a mat that absorbs water and keeps the soil from washing away. Under the litter is a layer of humus, usually dark-colored and rich looking.

A good woodland has no damaged and diseased trees. Poorly formed and overripe trees have been cut out, so that good ones have room to grow. Remaining are well-formed trees that are suited to the locality, the soil, and the climate, and that will make high-quality products.

The forest floor has little sunlight: If all trees are the same age, grass and young trees cannot grow under them because there is no sunlight; in a mixed-age forest, there will be little trees just sprouting, seedlings of various sizes, and large, mature, or nearly mature, trees. If your forest is in the West or South, it may be more open, and may even have some grass or plants under the trees.

The good forest has enough good trees, neither too many nor too few. If your goal is to grow Christmas trees, the ground will be covered. If you are a turpentine farmer, a few hundred trees per acre are right.

No matter what forest product is being grown, the crowns of the trees will be full and healthy; about a third of the total height of each tree will have branches and leaves. If the trees are all about the same age, the canopy will be closed in the form of a ceiling. If the trees are of all ages, there will be no continuous ceiling of foliage.

Trees close together usually grow tall and straight. They are trying to get light. Lack of sunlight on the lower branches causes them to die and break off. Thus, a healthy tree prunes itself and produces clean and straight logs, without too much difference in size between the butt and the top of the last log.

Wildfire and grazing animals have no place in a good forest. In some western and southern forests, a little grazing is possible. Hogs are kept out.

Several rules of good management will help you grow good trees.

1. Make improvement cuttings; remove the undesirable trees so that the better ones can grow faster. Usually several improvement cuttings are made before the final product is harvested.

Often the products removed will pay: Fuel wood can be cut from the poorer trees, railroad ties from short, forked trees, and even some sawlogs for home use. The good trees that are left are called the crop trees.

If each acre is adequately covered or fully stocked with the better hardwoods, the forest should grow from $\frac{1}{2}$ to 1 cord of wood a year on each acre. In the small forest of good pine, growth will average from 1 to 2 cords an acre a year—perhaps more in the South.

2. Thinnings should be made whenever the tops of the trees become crowded or when many dying branches appear—an indication that the trees want more room to grow. Often young seedlings become crowded; when they are thinned, firewood, pulpwood, bean and tobacco poles, and fence posts can be removed. In a few years another thinning can be made to yield mine timbers, small poles, pulpwood, railroad ties, more fence posts, and a few sawlogs.

Weed trees should be cut. Blackgum, chokecherry, scrub oak, or other less valuable trees may crowd out better trees.

Thinning also removes the excess of young trees; often the unwanted small trees can be cut about halfway down and the tops bent over. They continue to live and, by shading the ground,
make the better trees grow tall and straight.

*When to thin* is important. Usually thinning is needed:

(a) In young, fully stocked stands when about 15 to 20 years old;
(b) in the young stands that have stopped growing or become stagnated;
(c) when the crowns of young trees are crowded and many dead branches occur;
(d) when an interval of 5 to 10 years has passed between thinnings and the trees again crowd each other.

*How to thin* is sometimes more difficult than knowing when to thin.

A single thinning should not remove more than one-quarter of the volume in a stand.

Yellow-poplar, cottonwood, sweetgum, loblolly pine, slash pine, and any fast-growing trees can be thinned more heavily than trees such as white oak, basswood, and ash.

For southern pines and hardwoods the rule of thumb called D+6 is often used. For example, the diameter at breast height of one healthy tree is 10 inches and the diameter of the other healthy tree is 6 inches. Added together and divided by 2, the average diameter of the two crop trees is 8 inches; 8 inches considered as 8 feet, plus 6, equals 14 feet, the proper spacing between crop trees of this size.

In the West, the rule D+4 can be used for spacing crop trees of ponderosa pine. Other species may require different spacing and local advice may be needed in such cases.

Good sense is needed in thinning the small forest. Following a rule may result in thinning a clump of 6 to 10 good trees to only 2 or 3, when actually it might be better to cut only 2 or 3 trees, which will give the clump plenty of room to grow.

When a fast-growing young tree is directly under a mature tree that is soon to be cut, the young tree should be left for a future cutting.

Consider each tree individually and determine its chances of growing into good timber.

3. Liberation and salvage cuttings are part of the care. Wolf trees—large, branchy individuals with spreading crowns—often keep down the more desirable little trees that should be growing for the future. Forked, knotty, crooked, and other poorly formed trees also take up space needed by better seedlings and saplings. Diseased, rotting, as well as insect-infested trees will probably die before they can be cut into fuel wood or fence posts; they should be removed by poisoning or by girdling with an ax.

The undesirable hardwood trees and sprouts can be poisoned successfully with Ammate (the trade name for ammonium sulfamate). This poison can be applied close to the base of the tree. Chip out small cups in the tree trunk with an ax at 6-inch intervals around the tree. Place 2 level tablespoonfuls of Ammate crystals in each cup for trees 4 inches in diameter and over. For trees under 4 inches in diameter, 1 tablespoonful a cut is enough. Leave the trees to die; they should not be girdled or cut down because sprouting might occur. After a year, it is generally safe to cut the tree down if you want to. Use the poison in late summer or early fall. A 32.5-percent water solution of Ammate sprayed on green leaves will kill small trees and sprouts of undesirable species, such as blackjack oak.

Other poisons, obtainable from seed houses, are used for killing undesirable trees and shrubs like the persimmon, blackgum, and sweetgum.

Vines growing on trees kill them by shading or bending. Protect the crop trees by cutting the vines off at the ground.

Usually it is best to make a liberation cutting in early summer; sprouts from fresh stumps are less likely to appear then; and, it is easier to see which trees to cut.

Salvage cutting means removing the overripe trees that are growing too slowly to be profitable. Overripe trees are usually recognized by their light-colored bark, flattened crowns, and
How to Care for Your Small Forest

thin foliage. They should be cut and made into useful products before they are attacked by insects, disease, or are otherwise damaged. The thrifty, fast-growing trees that are damaged by fire, insects, disease, winds, or lightning should be salvaged while the wood is still usable.

4. **Pruning** the trees frequently increases their value.

In considering whether to prune, you should determine whether or not better prices will be received for the product to be harvested.

Local advice may be helpful and certainly is needed if any question arises as to the best time for pruning and how to go about it.

Prune only the vigorous and healthy crop trees.

Select about 200 to 225 such trees on each acre.

Prune trees the first time when they are from 4 to 6 inches in diameter. Cuts heal rapidly on these young trees and the knots will be small.

Prune in early spring just before the growing season begins.

Make clean cuts close to the trunk of the tree. A long stub may rot and later cause the tree to decay or be attacked by insects.

At any one pruning, remove no more than the lower third of the branches that make up the live crown of the tree.

Removal of too many live limbs will slow down the growth of the tree for several years.

After the trees have grown larger, another pruning up to 16 feet in height or for two clear logs may be desirable.

The best tool to use is a pruning saw with a 12- to 18-inch blade, 3½ to 5½ points to the inch. A ladder and hand saw can be used for the high branches. Some prefer a pruning saw fastened to a long pole. Do not use an ax.

Work safely; a falling limb is dangerous; ladders should be firmly placed against the tree.

**Harvest cuttings** are made to get cash from sales of products or to get material for home use. The way harvest cuttings are made determines whether the small forest is to provide continuous crops of trees, either annually or at intervals of 5, 10, 15 years or longer.

There are four types of harvest cuttings.

1. **Clear cutting** is the removal of everything of any value.

The small forest should not be cut in the way unless it is being cleared for pasture or crops. Many years will elapse before clear-cut land will provide cash returns or a crop of timber that can provide products for home needs. Sometimes undesirable trees seed in on the cleared land and the next crop of trees is less salable or has no value at all. Often the cleared woodland must be planted—usually a costly matter. Generally, the long-time cash income from woodland that has been clear-cut will be smaller than under any other method.

Some species of trees that grow in even-aged stands are best harvested by clear cutting. The area can then be replanted with the same type of trees that were cut and a new stand obtained.

Local advice should be sought before clear cutting a small forest of a particular species.

2. **The seed-tree method** is adaptable to certain even-aged small forests. By this method, at least 10 healthy, vigorous trees that average 10 to 12 inches in diameter at breast height should be left on each acre. The only advantage of seed-tree cutting over clear cutting is that the area may not need to be planted. If this method is used, it is usually best to leave the seed trees in groups. Often strips of trees are left standing to provide seed. Cutting in strips, however, is usually practiced in large forest areas.

3. **The diameter-limit method** is often used in the harvest cutting. All trees above a certain diameter at breast height, 10 to 12 inches in pine and 16 to 18 inches in hardwood, may be cut. This method has the fault that all the poorly formed, weak, diseased, and slow-growing trees under the desired
diameter limit are left in the woods to take up room. Also, all healthy, fast-growing trees above the diameter limit are cut at a time when they are producing the greatest amount of high-quality wood.

The method should be used only when the owner of the small forest has little time to spend in supervising the harvest of his forest.

These three methods—clear cutting, seed-tree cutting, and diameter-limit cutting—are of little use in the management of the small forest. They may be recommended for particular forests, but generally they will ruin the productive capacity of the small forest for many years.

4. **Selective cutting**, the best method of harvesting woodland products in a mixed-aged forest, is a combination of stand-improvement cutting and harvest cutting; it has many advantages also in even-aged stands.

Selective cutting should be made whenever there are trees that are ready for harvest. The following are guides to help the owner in the selection of trees for cutting:

(a) Cut the mature trees; they are ripe and have stopped growing.

(b) Select the less desirable species and any damaged, crooked, limby, or diseased trees; this gives the better trees more room to develop.

(c) If there are too many young, healthy trees in parts of the small forest, cut several of them so that the others can grow faster.

All trees selected for cutting should be marked: Paint is the best; it is easy to see; it can be removed in case of an error; it does not injure the tree. (An ax or hatchet blaze may cause blue stain or open the tree to insect attack.) An old paint brush on a long stick makes the marking easy. Medium-blue, yellow, and white paint show up well in the woods. Whitewash can also be used, but both whitewash and paint should be worked into the bark so that the mark will remain on the tree for the longest possible time. Often an old sock filled with lime will make a good mark if the cutting is to follow in a short time. If paint is used in a spray gun, it should be thinned with kerosene. It is often economical to use surplus paint that collects around the farm for marking timber.

Put at least two marks on each tree to be cut. One should be at breast height and the other just above the ground line; the mark on the stump is used to check the cutting after it has been completed. Put both marks on the same side of the tree and mark the trees on the side where the cutters or buyers usually enter the forest—it saves time that would be spent running around hunting the marked trees.

A defective or cull tree should be marked differently from the trees to be cut for salable products. An X mark or two dots or some other symbol will indicate that it is to be cut for fuel wood, just girdled, or poisoned and left there to die. The young, thrifty, straight, vigorous, full-crowned crop trees to be left for a future cut should have no marks at all on them.

An owner of a small woodland who is practicing selective cutting for the first time may find it difficult at first to mark the trees to be cut. A careful study of individual trees, advice or assistance from the local forester, and practice will make the job progressively easier.

**Perpetuation of the small forest** is usually taken care of by nature if the owner protects it from fire, grazing, and other damage.

If the trees are of mixed age, the older ones produce seed and the spaces opened up by selective cutting will be covered in a few years with small seedlings.

Trees that are all the same age and about the same size can be harvested in a series of three cuttings.

The first cutting will take out the larger trees, the ones that are mature and ready for harvest, and any others that need to be cut. Open spaces occur where the trees have been removed; the material on the forest floor rots
How to Care for Your Small Forest

faster and the mineral soil is sometimes exposed. The remaining crop trees, the larger ones, develop larger crowns and produce more seed.

The second cutting removes a few more trees during the winter and just after a heavy seed crop. The open spaces seed in with a heavy crop of seedlings, and the forest is on its way to adequate restocking.

Both of the cuttings should be light enough so that grass and weeds will not come in on the open spaces.

After the seedlings become established and can get along without the protection of the older trees, the last of the old trees can be cut.

This method of harvesting an even-aged small forest takes advantage of natural seeding and should result in a crop of young trees of the species desired.

There are particular kinds of trees in even-aged stands that can best be harvested by the seed-tree method. If yours is an even-aged forest, and a local forester advises clear cutting so that the species you have can again be grown in the area, 2 or 3 years can be saved by replanting the cut-over area with trees from the State nursery.

Often a small forest that has been heavily burned or pastured will reseed itself if livestock and fire are kept out after the young seedlings start growing. If the ground has been packed or is covered with a heavy sod, hogs may be turned in before the seeds fall. The hogs will root up the ground and prepare a seedbed. After the seeds fall or are blown in on the area, all grazing should be restricted until the young seedlings become well established.

The small forest can sometimes be perpetuated from sprouts from uninjured clean stumps that remain after cutting. Most of the hardwoods, except basswood, do not sprout satisfactorily after the tree has reached 60 years. Most of the cone-bearing trees do not sprout; exceptions are young shortleaf and pitch pines. Trees cut during winter or early in the spring usually produce the best sprouts, and there is less likelihood of any injury the following winter. Sprouts from trees that have been cut in the summer often are killed by the next winter's frost.

Where to Plant Trees is important. Planting is often desirable as a means for perpetuating small forests or of starting a new forest, and trees of a useful variety successfully started on the right land are almost sure to return a profit.

1. Plant trees on land that has little or no other use on the farm. Areas that are too small for growing crops are often used to grow a few trees that will be valuable for home use.

2. Understocked or sick forest areas that are not reseeding naturally can be planted.

3. Small forests that have been cut over and that are not reseeding satisfactorily should be planted.

4. If land has been cut up or ruined by erosion, the forest-tree seedlings will often hold it in place and produce a valuable crop in years to come.

5. If a small forest is filled with trees of no value, such as scrub oak or other worthless varieties, it can be torn up with land-clearing equipment and planted with trees that will have a future value.

6. Often the worn-out, rocky, or hilly land on a farm can be planted to trees, not only for the protection they afford the land, but to provide a home for wildlife, to beautify the farm, and to grow a few fence posts or timbers for home use.

It is well to remember that land that has been abandoned or considered useless will often grow a crop of trees.

What to Plant: Look around the community or general area where your land is located; see what kinds of trees are growing best and plant that type on your land. It is also good business to plant species of trees that grow fast and develop salable products in a few years; however, a fast-growing tree that will not produce a salable product should not be planted.
Hardwoods usually require better soils than conifers. Hardwoods need plenty of water and if the soil is of a type that absorbs water readily so the tree roots can get it without difficulty, a hardwood plantation is usually successful. Hardwoods grow best in a deep, loose, crumbly type of soil, where the roots have plenty of room to develop and where the subsoil is of the type that permits good root development.

Conifers often will grow in soils that are unsuitable for the hardwoods and where the available water is less than that required by hardwood seedlings. Generally they will grow even if not cultivated after planting. The roots are often shorter—another reason for better survival. For these reasons conifers are often the best species for worn-out, heavily gullied fields, abandoned pastures that are to be converted to woodland, the sandy areas, and areas where the soil is heavy or has a tendency to be cloddy or has a hardpan underneath.

Some general suggestions on the important species to plant if your land is in the South:

1. White pine at most elevations in the mountains.
2. Loblolly pine on most soils at lower elevations.
3. Shortleaf pine in the same areas as loblolly pine, except on drier soils.
4. Slash pine on the sandy loam soils with plenty of moisture. Longleaf pine grows best on dry, sandy soil, on sandy ridges, and on sandy loam soils.
5. Walnut on good soils and on rich bottoms. Other hardwoods, such as the locusts, that are planted for fence posts grew best if planted on the better soils.
6. Yellow-poplar on good soils. In parts of Virginia, North Carolina, and South Carolina, particularly the Piedmont area, Virginia pine is sometimes planted on the poorest soils. Loblolly pine, shortleaf pine, and redcedar are also desirable species to plant on poor to moderate soils.

In the Southern Appalachian Mountain region, these species can be planted:

1. Virginia pine, redcedar, short-
leaf pine, and pitch pine on poor soils.
2. White pine on moderate soils.
3. White ash, yellow-poplar, and the black locust on still better soils.

A number of different species should be considered if you live in the Central States:

1. Jack pine on the poorest soils. Shortleaf and pitch pine can also be planted on some of the worst locations. On medium soils, Norway spruce, red pine, white pine, red oak, cottonwood, and white ash will grow.
2. Black walnut and yellow-poplar on the best land, and black locust on land not quite so good.

If you land is in the Lake States or New England, the following species are often planted:

2. White spruce, Norway spruce, and white pine on fairly good soil.
3. Yellow-poplar, white ash, red and white oak are suitable for the best soils.

Seedlings generally are more satisfactory than seed for starting a plantation or in regenerating forest areas. Birds and rodents often cause a direct seeding of conifers to fail. Tree seeds do not germinate in extremely dry years. A few of the pines will grow from seed if they are planted within their natural ranges. Walnut, oak, hickory, and other nut trees are often started from seed. The nuts should be planted in holes and covered firmly with soil to a depth of about the width of the seed. Walnuts, hickory nuts, and acorns can be planted in the spring after the ground has become soft enough to work or after the frost has disappeared. Generally, it is better to plant these seeds in the fall, even though there is a danger that hogs or rodents will dig them up for food during the winter.

In small plantings it is unwise to broadcast tree seed. Instead, a number of seeds can be planted in a small spot that has been cleared of grass or other litter. Ten to fifteen seeds can be distributed over this small area and then
covered with about one-eighth inch of soil. The cleared patches for seeding can be 4 to 6 inches in size. If there is danger of erosion, a light mulch can be placed over the seeded spots, in which case the seeds do not need to be covered with soil. Seeds of pine should be sown in the fall for best results.

**In planting the seedlings,** these points may be helpful:

1. Seedlings planted in the fall before frost usually get a good start. If there is danger of frost-heaving, the seedlings may be planted in the spring just after the frost is out of the ground.

2. Seedlings should not be planted if they are still growing, that is, late in the spring or in summer.

3. Some State nurseries send out trees for planting that have been kept dormant in cold storage. If this practice has proved successful in your locality, you can plant seedlings at times when other work is not pressing.

4. Seedlings are planted, as a rule, with the spacing of 6 by 6 feet or 8 by 8 feet. Some seedlings that tolerate shade do best if planted close together. Others require more room. Approximately 1,000 trees to the acre is a satisfactory stocking once the plantation has become established.

5. Trees that grow rapidly can be spaced more widely than slow-growing species. If the soil is poor, more trees can be planted to allow for loss.

6. Sometimes the tree seedlings are planted in furrows to conserve moisture and prevent erosion.

The number of trees to the acre for specific spacings is: 5 by 5 feet, 1,742 trees; 6 by 6 feet, 1,210 trees; 6 by 8 feet, 908 trees; 8 by 8 feet, 680 trees.

Often it is desirable to plant several species in the same plantation to insure against damage by insects or disease, against failure of one species on the particular soil, and against the possibility that one species will grow into a crop of no value. Trees that stand much shade can be grown with those that require much sunlight.

It is not advisable to plant any fast-growing seedlings in a mixture that grows slowly.

Seedlings for planting on the farm and in the small forest can be obtained from the State forest-tree nurseries, which sell tree seedlings at cost or less; county agents and local foresters have the order blanks. Orders for the seedlings should be placed early.

Ordinarily it is not wise to plant tree seedlings that have been obtained from great distances.

Many seedlings die because they are improperly handled after they have been received from the nursery.

If the time, labor, and money invested in planting seedlings are not to be lost:

1. Keep the tree seedlings moist, particularly the roots.

2. Keep in the shade until planted.

3. A cool, well-ventilated place for storage is important.

4. Place the roots of the seedlings in moist soil or sand if planting is delayed for several days.

Of the several methods of planting, the one most suitable for the particular soil or area involved should be determined before the seedlings are taken from the heel-in bed or from their place of storage.

**Slit planting** means placing the seedling in the soil in a slit that has been made by a grub hoe, mattock, or spade. Planting bars, a special tool for making the slits, work well in light or medium soils where there is little debris or other trash on the land.

On rocky or trashy land, a hole can be dug and the tree seedling planted ¼ to ½ inch deeper than it grew in the nursery. Usually there is a mark on the stem that shows how deep it grew. The roots should be carefully placed so that they are not bent or crowded. If the hole is shallow and the seedling roots are doubled back or restricted in any way, the seedling might die. The soil should be firmly packed around the roots of the seedling—not too tightly but enough to remove the air pockets.
Where the soil is dry, watering often means the difference between success or failure of a planting.

Tree-planting machines are available in many States. In some localities they can be rented from the State forestry agencies or private owners; in other places they are available on loan from soil conservation districts, or other local organizations.

It is often profitable to cultivate tree seedlings, particularly for the first 2 or 3 years after planting.

Seeds and grass often kill hardwood seedlings and, in the Plain States (on the prairies), the shelterbelts or wind-breaks must be cultivated to insure their establishment. Some pines, notably slash and loblolly, however, react unfavorably to cultivation and are more subject to disease if cultivated.

The enemies of the small forest are many. Some of them can be highly destructive.

A wildfire, in a few minutes, can destroy the work of a lifetime in building up a stand of valuable timber; each year owners of small forests lose more than 15 million dollars because of fire. Most of these fires are man-made.

Get in touch with the nearest forester promptly if there is any indication that insects or disease are in your forest. Improvement cuttings, the removal of infested trees when a selective cutting is made, and the application of the best principles of forest management are enough in most cases to keep the small forest in a healthy condition and prevent serious damage, unless a general epidemic hits the locality.

About grazing the small-forest, the owner should remember:

1. High-quality timber should be grown on land maintained for that purpose.
2. Good cattle and good pasture go together. A fence between the forest land and the pasture land insures that neither the trees nor the cattle will suffer from interference by the other. Many well-managed small forests are damaged during a logging operation—the falling trees may be thrown against the crop trees or careless skidding may tear the bark from their trunks.

The skid trails should be carefully located. A skid trail or road running up and down hill in a small forest often develops into a large gully and pours water into fields below. With some species, a border of trees should be left around the small forest after a cutting operation to protect it from heavy winds.

Often crop trees are exposed to excessive breakage from ice and snow—a sign that cutting has been too heavy and that trees should be left in clumps until they become wind-firm or are removed.

An accurate measurement of the timber one has for sale must be made before a profitable sale can be made.

Knowing how much one has to sell from the small forest is just as important as knowing what to sell.

The owner should know the general specifications of the different timber products so that the returns from one product can be compared with the value of another.

Integrated use assures greater returns. Each tree should be carefully considered and cut into products that will bring the greatest return. A mature tree might yield two valuable sawlogs from the butt, several cross ties above that part cut for sawlogs, some pulpwood from the larger limbs, and firewood from the top. Nothing is wasted if this integrated utilization method is used in sizing up each tree before it is cut.

It may be more profitable for the owner to do his own cutting when integrated utilization is involved, because many timber operators do not handle more than one product at a single cutting.

Some advantages of integrated utilization are:

1. Care can be exercised so that each tree will be cut properly.
2. The owner or his employees can
How to Care for Your Small Forest

227

3. Each tree can be sized up before it is cut and the particular products can be determined.

4. The numerous products which result from integrated cutting will return greater profits. Pulpwood can be sold to pulpwood contractors, sawlogs to a local sawmill, and, in many localities, fuel wood brings a good price.

5. The owner can make several cuttings, taking out specific products each time. Poles and piling can be removed from the pine forest, after which sawlogs can be cut. The last cutting can consist of pulpwood from the tops and smaller trees that are marked. The same is true if hardwoods are being cut. Sawlogs or veneer bolts come first, cross ties next, and perhaps a sizable cutting of fuel wood from the tops.

If repeated cuttings are being made, care should be exercised or the small forest may be cut too heavily. Also, the high-quality products may be creamed off and the value of the forest for future harvests greatly reduced.

The various products cut from the small forest are measured differently.

Firewood is usually sold by the cord or rick.

Pulpwood is measured in cords, pens, or units.

Poles, piling, and mine timbers are measured by the running foot of length.

Fence posts, ties, and small poles are sold by the piece or unit.

Sawlogs are sold by board feet measure. A piece of lumber 1 inch thick, 12 inches wide, and 12 inches long is a board foot (a square foot of lumber 1 inch thick).

Measuring the board-foot content of a log is not difficult:

1. Secure a log-scale stick from your county agent or local forester. This stick has the board-foot contents of various sized logs marked upon it. By holding the stick at the small end of the log across the average diameter, the contents can be read direct.

If a log-scale stick is not available, three steps can be followed in measuring a log:

(a) Using a ruler or a yardstick, measure the average diameter of the log inside the bark at the small end. If the log is not round, measure the shortest and the longest diameter, add them together, and divide by two; this will give the average for the log being measured.

(b) Measure the length of the log to the nearest foot. Allow 2 or 3 inches for trimming off the battered ends at the time it is sawed into some product.

(c) From a log-scale table, determine the board feet in a log of the diameter and length that you have measured.

Three tables are in wide use for determining the scale of logs. The Doyle (which is used almost exclusively, particularly in the South), the International, and the Scribner decimal C. It is best to scale logs from the small forest according to whichever rule is legal in your State or has been generally accepted by buyer and seller.

If many small logs are to be sold, the International scale is considered the most accurate. The Doyle rule gives too low a measurement for logs under 28 inches in diameter. The Scribner decimal C rule is used in national forests and in many localities throughout the country.

If the logs have many defects, some deduction should be made from the scale. Common defects are rot, cat faces, ingrown bark, worm holes, check, shake, and pitch ring. Also, crooked or twisted logs resulting from spiral grain reduce the value of logs intended for high-quality lumber. First-grade logs have few or no defects; the number and kind of defects and the size of the log determine the other grades. An owner can learn a great deal by watching logs being sawed up at the mill. Certain defects or flaws soon become apparent. In scaling, then, he can estimate how much wood is wasted by the defect and deduct it from the board feet shown in the log table.

As yet there are no uniform log
grade rules; grading methods or systems are different throughout the country. Individual mills often have grading rules of their own. Prices, of course, depend on grades, and a top-grade sawlog always has a higher value than a lower-grade log.

Selling logs by grade is more profitable than selling them ungraded, but grading is so difficult for some products, particularly sawlogs, that advice of a forester is generally necessary if advantage is to be taken of this practice.

**Estimating Standing Timber** requires training and practice. It is easier to find the board feet in a sawlog than in a tree before it is cut. If the small-woodland owner is going to sell his trees on the stump or ask for bids for his standing timber, he must measure the trees to determine how much he has to sell.

The owner should also have a measurement of his trees for comparison with the measurement that a timber operator or timber buyer may have made at some different time. The chances of losing money on a timber sale are much less if the owner makes his own estimate of the amount and kind of products he has to sell.

Three steps to follow in measuring a tree are:

1. With home-made calipers, a carpenter’s square, or a yardstick, measure the diameter of the tree in inches at breast height—4½ feet above the ground.

2. Stand back from the tree and estimate how many usable 16-foot logs can be cut from it. A pole 17 feet high (having a 1-foot allowance for stump height) will be helpful in deciding the number of 16-foot logs.

3. Using the tree-scale tables, find the volume of the tree in board feet. If the tree is 18 inches in diameter and 2½ merchantable logs can be cut from it, there will be 206 board feet in the tree by the Doyle rule, or 292 board feet by the International rule. As in scaling logs, the Doyle rule gives a lower volume than the International.

These tables are made up from averages from the actual measurements of many trees. The local forester can advise the landowner on the proper table to use in his area and will have copies of it. (See also pages 851–853.)

Tree-measuring sticks may also be available from the county agent, the local forester, or the State extension forester. The tree-measurement stick will save time, and the volume of the tree in board feet according to the number of 16-foot usable logs can be read direct.

On the small forests of 50 to 100 acres, all the trees that are to be sold should be counted and marked. As the trees are marked and counted, the volume of every tenth tree should be measured. After all the trees have been counted, add the volume of all the trees that have been measured, multiply this total volume by 10, and you will have the estimated volume of your entire stand.

If the woodland is small, the best way to get a good estimate of the volume of the standing trees is to measure every tree. The sum of these measurements is the estimate of the number of board feet in that part of the stand that is to be cut, or in the entire forest if all of the trees are measured.

In the larger forests, one can estimate the volume of the entire stand by measuring only sample plots. It is important in making such an estimate to obtain a fair sampling, or the samples should represent the average in the best or worst part of the woodland. Usually samples of a quarter or a fifth of an acre in size are easier to work with. Sometimes 1-acre plots are used (1 acre is a 208-foot square). One-quarter of an acre is a 104-foot square, or 118 feet in diameter, if round. Round plots are easier to measure and to use in timber estimating than square plots.

Time will be saved if the trees are marked for cutting at the same time they are measured for board-feet content. Foresters sometimes recommend
How to Care for Your Small Forest

a timber cruise, which provides volume, growth data, and other information that is used in preparing a plan for the small forest.

Pulpwood is measured differently from sawlogs or standing trees. The local pulpwood buyer, county agent, or local forester will have specifications or know where to get them. Since different mills have different requirements as to length, it is always wise to get complete information before cutting begins or a sale is made.

PULPWOOD MAY BE SOLD from your small woodland in a number of ways:

1. Pulpwood trees can be sold on the stump and harvested by local contractors or agents of a company.

2. The owner can cut the pulpwood and sell it to the same individuals.

3. Pulpwood also can be cut by the owner, and hauled and loaded on the railroad car for shipment to the pulp mill. In this way, the pulpwood is measured on the car after it is delivered to the plant. Some owners cut and deliver pulpwood to the railroad siding, where it is measured while still on the truck or after it is piled.

The standard cord is the most common unit of measurement for pulpwood, but it is also measured in pens or units. A standard cord is a stack of pulpwood 4 feet high, 4 feet wide, and 8 feet long. It equals 128 cubic feet. It contains about 90 cubic feet of solid wood and bark, the remainder of the stack being air spaces. Freshly cut pulpwood is often piled 3 to 4 inches higher than the required 4 feet to allow for shrinkage when the wood dries.

Pens are hollow cribs of pulpwood about 6 feet high.

The unit is often called the long cord, and results from the practice of many mills wanting wood in lengths varying from 4½ feet up to 8 feet. A stack of pulpwood, in any of these lengths, 4 feet high and 8 feet across the front is called a unit. In any one unit the sticks should all be the same length. Since the units are made up of longer sticks than the 4-foot wood in a standard cord, the units contain a greater volume of solid wood. A standard cord of 4-foot pulpwood contains 90 cubic feet of solid wood; a unit of 5-foot pulpwood contains 113 cubic feet of solid wood. A unit of 6-foot pulpwood contains 136 cubic feet of solid wood.

You should be familiar with these various units of measure for pulpwood so that you do not by mistake sell a unit of wood for the price of a standard cord.

Often you will lose if you sell your pulpwood in pens, because the pens are usually built up with sticks of pulpwood of varying sizes. Buyers generally require five pens of wood for a standard cord or one unit. Five pens of pulpwood that have been cut 4 feet long and in which the sticks are all 6 inches in diameter will equal a standard cord, or approximately one unit of 5-foot wood. But five pens of pulpwood 12 inches in diameter equals 2 cords or 2 units. A woodland owner in this second case will lose a cord or a unit of wood if the buyer takes five pens.

Always measure pulpwood in cords or units, and sell it in the same way.

SOME OF THE OTHER PRODUCTS that the small-forest owner can sell are:

Railroad ties.—Because most ties are now treated with chemicals to prevent decay, practically all tree species in the small forest can be cut for ties.

Poles and piling are cut from southern pines, eastern white-cedar, Douglas-fir, and oak. Usually only the best trees will yield high-grade poles and piling. Specifications vary, and nothing should be cut until the owner knows what sizes he can sell and how to cut them. The local buyer or forester will have this information.

Veneer logs are used to make crates, boxes, and baskets, and the fancy veneer logs or bolts are used in making fine furniture. Black walnut, basswood, black cherry, the yellow birch, maple, yellow-poplar, the sycamore, sweetgum, blackgum, tupelo, beech, elm, and cot-
tonwood in the small forest often yield veneer logs. Specifications differ for the individual plants and no cutting should be done until the specifications are known. Valuable timber can be wasted and left in the woods by improper cutting of this product.

Mine timbers include props, lagging caps, sills, and ties. Specifications differ for each and it is best to see the buyer before cutting any type of mine timbers.

Bolts and billets are short lengths of logs used for making handles, spokes, cooperage, excelsior, woodenware, and many other small products. Ash, hickory, beech, birch, maple, and oak are used for ax, hammer, hoe, rake, and shovel handles. Aspen, cottonwood, basswood, willow, yellow-poplar, and southern pines are used for excelsior. Whiskey barrel staves are made from white oak bolts. Other barrels are made from staves of ash, beech, birch, maple, basswood, elm, and sweetgum. Each plant has its own specifications. The forest owner should find out what the plant will buy and how the product is measured—whether in cords, board measure, pieces, or the running foot.

Fuel wood has value for home use because a standard cord of longleaf pine, hickory, oak, beech, rock elm, hard maple, the black locust, or sweet birch, if dry, will give as much heat as 200 gallons of fuel oil or a ton of the best coal. The heavier woods will weigh about 2 tons a cord. Two cords of the lighter woods (the white pine, spruce, cedar, redwood, poplar, cypress, basswood) will give as much heat as a ton of hard coal. Heat value is increased if the fuel wood has been cut early and allowed to dry. Fuel wood can be cut from trees that are unsuitable for any other use and from limbs of trees that have been removed for other purposes.

Sell your forest products for a profit. That is the reward for good forest management.

Each time the management practices are improved on the small forest, each time a better method of selling is practiced, the owner receives more cash.

Four principles to help in making profitable sales are:

1. Sell only measured amounts of timber. Other products from farm and industry are sold by exact measurement: Bushels of corn, pounds of beef, tons of coal, and gallons of oil. When the forest owner sells his timber on the stump for a lump sum to the first buyer who comes along with an offer, the sale usually returns a large profit to the buyer.

Intelligent selling is based on knowing what one has to sell, both as to the amount and quality. It requires thought, care, and experience. Advice from a forester may be needed until the woodland owner is confident he can go it alone.

2. Harvest your own timber if it is possible.

If cutting and selling the converted products such as sawlogs, pulpwood, veneer logs, poles, and so forth, is a possibility, a little rough figuring will determine whether or not it will be profitable:

(a) Estimate the sale value of the timber on the stump.

(b) Determine harvesting costs—cutting, logging, hauling the product to market, and so on. The purchase of saws, tools, miscellaneous supplies, a truck, and other operating equipment, loss by depreciation, and the wages of hired help and labor all are harvesting costs.

(c) Estimate the sale value of the forest products you plan to cut.

(d) From the sale value, subtract the stumpage value and the harvesting costs.

(e) What remains is the owner’s wages and profit.

Generally there is a profit in harvesting one’s own timber. Also, greater care can be exercised in protecting the remaining crop trees from damage.

3. Find the most profitable market, both for sale of the trees on the stump and the converted products.
A little effort often uncovers numerous outlets for forest products:
(a) Ask your neighbors; they may have just made a sale.
(b) The county agent often will know.
(c) The local forester will have a list of markets and prices and often knows of markets elsewhere.
(d) Look for advertisements in your local paper or get a copy of a lumber trade journal.
(e) You may run an advertisement locally or in a metropolitan paper or trade journal.
(f) Write several of the wood-using industries. They furnish specifications and prices, and often their buyer will call if requested.

Fuel wood is needed by packing houses, bakeries, lime-kilns, brickmakers, and tobacco growers. Highway departments use piling, bridge timbers, and posts. Railroads need ties and heavy timbers. Mining companies and telegraph companies want poles. Paper companies buy pulpwood. Veneer logs, sawlogs, and bolts and billets can be sold to woodworking plants. Plants that make wine and whiskey barrels are ever on the lookout for high-grade white oak.

4. Marketing converted products brings the greatest profit.
Long, high-quality logs can be sold to mills that cut large timbers on special order. Lower-quality, short logs can be taken to a small mill that cuts lumber. Good white oak often will produce valuable stave bolts from the butt cuts, while the rest of the tree can be sold as sawlogs. Large, high-grade logs of other species such as sweetgum, yellow-poplar, walnut, and so on, can be sold separately as veneer logs for a high price. Tall, straight trees can be cut into poles or piling and sold at a premium.

Always before creaming-off the best trees in a small forest for the products that bring the highest prices, be sure you can sell for a fair price the less valuable trees that need to be cut. Often a small forest is high-graded and then no one will buy the lower-quality timber that remains.

The owner of a small forest who sells converted products must use skill and care in turning them out. All profit may be lost if many logs, poles, posts, timbers, or piling are rejected by the buyer.

If the owner does the cutting himself, greater care can be exercised. If a contractor is hired to do the work, the owner should personally supervise the cutting operation.

GETTING BIDS ON STANDING TIMBER or converted forest products is good business.

The points to tell the prospective bidder about your standing timber are:
The location and size of the woodland in acres.
The estimated amount for sale in board feet, cords, or other measurements.
The kinds of trees for sale.
The quality of the timber and its size range in diameter and height.
Whether logging will be hard or easy due to rough ground, hills, or deep ravines.
Accessibility to roads, railroads, and paved highways.
Whether the trees are old growth or second growth.
Whether the trees are forest grown or came in on old fields.
Prospective bidders on products you have cut will want to know:
Kind of product.
Amount for sale, such as number of cross ties, poles, posts, and so on.
Quality of the converted products.
Grade—if possible.
Lengths, and other sizes needed to explain the product.
Location of products.
Kinds of timber in the products:
Hickory, walnut, oak.

General items to include in all letters asking for bids, on stumpage or converted products, are:
Owner's name and address.
Conditions of sale as to payment, and so on.
When the timber or converted products may be examined.
The right to reject any and all bids.
Generally the highest bid is the one to accept, but if the market is distant and transportation costs high, a lower bid from a nearer market may be more profitable. Grading rules must be considered. Also, liberal scaling under a low-value rule may offset high prices under a precise rule. The reliability of the buyer must be considered.

SALES CONTRACTS are good insurance. A written agreement setting forth details of a sale of stumpage or converted products, signed by the buyer and the seller, will avoid misunderstanding.

In every agreement covering the sale of stumpage, either verbal or written, the following items should be specified precisely:
Description of the sale area.
Estimate of amount of timber to be cut.
Kind of trees and approximate sizes.
Sale price and provisions for payment before and during cutting.
Guarantee of title to timber.
What trees are to be cut—those marked with paint or blazed, the diameter limit, and so on.
Definition of merchantable trees.
Time limit sale is to run; when cutting and removal of timber will stop.
Place and method of measuring—log rule to use.
Protection of forest from fire and logging damage.
Right of entrance and exit to the forest.
Payment of taxes.
Method for settlement of any disagreements that may arise.
A performance bond, particularly in larger sales.

When converted products are sold, all agreements, written or oral, should state the method of measuring and grading, quantity to be delivered, merchantability limits, rate of delivery to a specified point such as a railroad siding, loaded on car, and so on, time limit for delivery or to fulfill contract, and the time and method of payment.

A timber-sale agreement takes little time and effort and will result in accord between buyer and seller.

Future sales are easier where past sales have been satisfactory to both parties.

M. M. BRYAN grew up in Pennsylvania, where his grandfather and his great-grandfather had been active in logging, lumbering, and sawmilling. He is a graduate in forestry of Pennsylvania State College. His work in the Forest Service has included timber-stand-improvement work, timber surveys on the national forests, land acquisition, assignments as ranger and forest supervisor, flood-control surveys, and State and private forestry. He now is chief of the Woodland Management Section in the Division of Cooperative Forest Management. Much of the information in this article is based on a bulletin, Managing the Small Forest, by Mr. Bryan and other men in the Department of Agriculture.

This diagram illustrates the felling of a tree. Two cuts are made on opposite sides of the tree; the undercut guides the direction of fall. (See page 241.)

The drawings on the following pages show some of the methods and tools used in forest operations.
How to Care for Your Small Forest

DIBLE PLANTING

1. Insert dibble and push forward to upright position.

2. Remove dibble and place seedling with root collar at ground level.

3. Insert dibble 2 inches from plant—pull back to firm soil at bottom of roots.

4. Push dibble forward to firm soil at top of roots.

5. Fill in last hole by scraping soil with shoe.

6. Pack soil firmly around seedling.

MATTOCK PLANTING

1. Insert mattock—lift handle and pull back.

2. Place seedling at correct depth, packing roots with moist soil.

3. Fill in around seedling by scraping soil with shoe.

4. Pack soil firmly around seedling.
HOW THINNING UNDESIRABLE TREES IMPROVES THE FOREST

Bark spud
Draw shave
Spud from old shovel
Auto spring

Prune southern pine to about two-thirds of total length
Cut close
GRAVITY-LOADING METHODS

YARDING SLED

LOG CART

SKIDDING PAN

CROSS-HAUL LOADING

CROTCH GRAB

GRAPPLE HOOK

TIP-UP JAMMER

Loading Position

Moving Position