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**WHAT ABOUT QUICK-ENERGY FOODS?**

Young athletes often ask about foods high in fat and sugar, such as candy, pop, and desserts. These foods are often called “empty-calorie” foods because they are usually high in calories but contain few nutrients. Keep consumption of these foods to a minimum. Get your energy from foods that supply ample protein, vitamins and minerals, as well as calories. Many athletes mistakenly believe that high-sugar foods will give them quick energy before a game or an event. *High-sugar foods such as candy or honey should be avoided before a game or event.* Sweets can cause rapid swings in blood sugar, make you feel tired, and decrease performance.

**WHAT ABOUT CARBOHYDRATE LOADING?**

Should young athletes follow strict carbohydrate loading routines often used by adult athletes who are involved in endurance events such as marathon running or bicycling? *Definitely not.* True carbohydrate loading is a very rigid exercise and diet plan that adult athletes follow for the week right before the big event. During the first half of the week, glycogen stores are drained by exhaustive exercise and by eating a very low-starch diet. The athlete then gets a rebound effect during the second half of the week by eating a very high-starch diet and no exercise at all. Such strict routines drastically increase glycogen reserves that are needed only for marathon-type activities. These very high levels of glycogen are not needed for high school sporting events.

True carbohydrate loading can severely stress the body and cause heart and kidney problems. A high school athlete should eat plenty of starch everyday and not make these drastic dietary swings from low to high levels of starch.

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The Illinois Cooperative Extension Service provides equal opportunities in programs and employment.
FARM YOUR FOREST

Theodore W. Curtin

Circular 1291
University of Illinois at Urbana-Champaign
College of Agriculture
Cooperative Extension Service
Cover: A wooded area in Illinois. Forestland accounts for 4.3 million acres or 12 percent of the land area of this state.

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Eighty-four percent of the timberland in Illinois is owned by Illinois farmers and other private landowners.

The basic unit of agriculture is the farm, but all too often, farmers do not include their woodland or marginal land areas as part of their total farm operation. Managing the forested areas of a farm should be equally important and integral to its operation as is the management of other crops.

Unfortunately, wooded areas are often not managed, and landowners overlook important sources of income and much enjoyment. Besides providing basic information about the harvesting and marketing of timber products, this circular helps landowners begin developing a plan for managing or farming their forest. Like farmers of other crops, those who farm a forest need a management plan to develop their forest to its greatest potential. An outline of a forest management plan suggested by the Illinois Department of Conservation is provided in Appendix A.

Left unattended, a forest may revert to a jungle of weeds, brush, and trees of little value. It could become overgrown or understocked with trees that mature more slowly; the wildlife habitat of such a forest could degenerate; and its recreational values could decrease. It could also become more susceptible to disease, insects, fire, and other hazards.

To be profitable, tree farming, like the farming of other crops, may require special crop varieties, fertilizers, or improved harvesting techniques. The condition of a stand* or continuous group of trees should dictate the allocation of time and resources. Tree planting may enhance an existing stand. Thinning and tree removal may be necessary to provide additional room for the remaining trees to grow and develop. Most important for the vigor, productivity, and profitability of a forest is cutting or harvesting at the

*Terms in boldface appear in the glossary.
appropriate time to prevent the waste of this valuable resource. These cultural practices are all part of good forest management.

A degree of stewardship accompanies all land ownership. Nearly three-quarters of all commercial forestland in the United States is privately owned. These forests provide the fiber for our morning paper and our cereal box as well as the wood for our furniture and homes. Because of this constant demand for forest products, a managed tract can afford an annual income or a growing bank account for emergencies. In addition to supplying traditional forest products, well-managed forests make woodlands more attractive and healthy, increasing their recreational potential and their wildlife. Nature lovers, hikers, skiers, hunters, and others receive enjoyment from such forests. Because a well-managed forest enhances this enjoyment, it increases the value of property and makes an estate more valuable for family and heirs.

Preoccupied with annual crops, some owners of forestland in Illinois have ignored the benefits of a good forest management plan. This lack of concern has greatly affected the productivity of their forestland and degraded scenery, recreation, and wildlife.

Often the result of decades of past abuse, most forests today have developed without such a plan. In Illinois, tree growth has been only one-half to one-third of its potential. This wasted potential growth is a significant economic loss for owners of forestland.

Understanding the many opportunities for profit and pleasure in Illinois forestry, however, should encourage those who own a forest in this state to develop a good forest management plan. District foresters in the Division of Forest Resources of the Illinois Department of Conservation and private consulting foresters can help develop one. Offices located throughout the state are listed in Appendix B.

This 35-year-old white oak plantation in Piatt County is part of Illinois's hardwood stand, which represents 98 percent or 4.7 billion cubic feet of the total growing-stock volume in Illinois.
Why does one own a forest? One frequent answer to this question is that the forest came with the farm. Whether bought or inherited, however, this resource need not be wasted if the owner of a forest first establishes goals to guide its comprehensive management. One basic consideration is the owner’s need for immediate versus long-term income. Others include the time and resources that the owner has for management activities; the owner’s interests in complementary benefits, such as hunting, wildlife, recreation, and soil conservation; and opportunities for diversified farm income with alternative forest-related crops, such as Christmas trees, shiitake mushrooms, fuelwood, or biomass, a short-rotation, energy-producing crop. These considerations will limit and structure the management plan.
Developing a Management Plan

Determining the Property Boundaries

The first step in developing a management plan is to know its location and size. Obtaining this information is generally not a significant problem for Illinois landowners because most of the state is laid out in a grid system known as a rectangular survey. Its divisions are townships and sections. Townships are 6 miles square and have 36 sections, with each section containing about 640 acres. (However, incomplete townships also exist.)

Aerial photographs and county plat books with accurately scaled diagrams showing boundaries and subdivisions are available at some libraries and many county agricultural offices and provide quick references for locating land areas and boundaries. Land forms, old fences, and corners can often be identified with these references. In the absence of these identifiable features, it is sometimes necessary to hire a registered land surveyor to reconstruct them, particularly for determining boundary lines. Determining specific features of interior areas may not require the services of a surveyor.

Getting a Visual Impression

In addition to helping determine property boundaries, aerial photographs are useful for understanding the topography and other characteristics of a forest. Both ridge tops and wet areas should be easy to determine on aerial photographs as well as drainage patterns and the resulting erosion. The locations of new or existing roads are also more apparent on them. Past and current aerial photographs help appraise existing conditions because they also reveal a forest’s harvest and fire history. A good set of aerial photographs, therefore, is indispensable.

A ground reconnaissance, however, is also necessary. The presence of charred tree trunks discovered in a preliminary survey of a forest may substantiate its fire history. Decay and root rot could indicate heavy grazing. The absence of a particular size of tree in a forest may also indicate a period of grazing.

Knowing the history of a forest should help determine how past years have influenced the number of wildlife and consequently how to plan in order to maintain or increase it. For example, oak, a mast-producing tree, needs

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Figure 1. An aerial photograph (left) and a plat map (right) of an area complement each other. They should be compared for a maximum understanding of a site. (This map is reproduced with the permission of Rockford Map Publishers, Inc.)
Taking an Inventory

The next important step in developing a management plan is taking a forest inventory, commonly referred to by foresters as "cruising." A cruise determines the species present, the number of trees by diameter and height classes, their vigor and condition, and the volume of wood present.

Primary forest products are most often measured in terms of cords, tons, or board feet. Understanding these concepts will be helpful in taking the inventory.

Cords. A cord is a volume measure of stacked wood. Rough forest products are cut and stacked to create a standard cord, which is 4 by 4 by 8 feet or 128 cubic feet of space. Because of the space between the pieces of stacked wood, a cord contains about 90 cubic feet of wood. Variations of this unit are "face cords," which contain individual pieces less than 4 feet wide, usually 16 or 24 inches. Another variation is the "long cord," which contains pieces as long as 5 feet or longer. A long cord is 4 by 5 by 8 feet and represents 160 cubic feet. Firewood and pulpwood are usually sold in standard cords.

Tons. Unstacked wood and chips are sometimes sold by weight. On the domestic market, the 2,000-pound ton is the common unit.

Board feet. The board foot is the normal quantity designation for sawlogs and veneer logs—logs suitable for lumber and veneer. The specific log rule used will affect the estimate of the volume of wood present. The log rule is refined for application to tree or log measurements. When used to measure trees, the rule is called a tree scale, and the diameter measurement is at breast height (diameter breast height, dbh). The log rule is used to measure logs, the diameter in this case being from the small end and inside the bark (diameter inside bark, dib). A handy slide rule with both tree scales and log rules is available from the Illinois Division of Forest Resources and Natural Heritage, 600 North Grand Avenue, West, Northwest Office Plaza, Suite 2, Springfield, Illinois 62706. Illinois Department of Conservation foresters use the International 1/4-Inch Rule, which is regarded as the most accurate; however, many Illinois timber buyers employ the Doyle

This dead tree and the edge effect on the border of this forest offer food and shelter for numerous species of wildlife.

large openings with full sunlight to reproduce. A selective harvest that was not followed up by a Timber Stand Improvement (TSI) Program to hasten and improve tree growth could explain the condition of an undesirable wildlife habitat containing only a few oak seedlings and few large trees. A ground reconnaissance of this forest would reveal that TSI practices are needed.

Little diversity of species and age class in a woodlands—also undesirable from the standpoint of wildlife—could be the result of an even-aged or a clear-cut system of forest management. This type of management can produce a pole stand by age 25. However, oak, a species that is difficult to regenerate in the understory, would have greater chance of reestablishing itself with this type of management. From a prior ground reconnaissance, it might be known that at an earlier age, this forest was dominated by briars, young trees, and other herbaceous plants, which provided an abundant food source and cover for wildlife. The edge effect created by even-aged management, nevertheless, would be very beneficial to wildlife because habitat diversity increases in the area between a forest and an open area.
Rule (Figure 2), which underestimates smaller logs. Although the merchantable height is usually measured to a 10-inch top, forks, large branches, or other tree forms often limit this height (Figure 3).

These inventory data are critical for developing a forest management plan. The volume of wood in a forest may indicate whether or not a harvest should be conducted. The condition class and species list, which indicates the quality of the growing stock as good, medium, or poor, may be used to evaluate the need for thinning, pruning, brush removal, or other TSI practice.

The procedures for taking and evaluating a forest inventory may seem complicated and confusing to those unfamiliar with them. Identifying the species present in a forest may also be a problem. As with many other professional chores, help is available. Consulting foresters work for a fee. State foresters, whose fees are paid by your taxes, are also available, but their resources are often overcommitted. These foresters may work for you, with you, or just guide you through any complicated sampling, measurement, tree identification, or interpretation of data. When you are determining the sampling procedure needed for your forest, they should be consulted to indicate the species to group, height classes, and diameter-breast-height classes. These data are important for determining the total volume and annual growth of a stand. In addition, foresters can make recommendations for suitable stocking levels and for properly scheduling TSI activities and harvesting.

They can provide information about the possible beneficial effects of a harvest on soil conservation, wildlife, and the recreational use of woodlands. For instance, both erosion and the siltation of streams can be reduced with proper harvesting techniques; and wildlife benefit, as noted earlier, when edge effects are formed by the creation of large openings near woodlands and when a number of den and mast-producing trees are left. Foresters can also tell owners of forests how the skid trails and roads created by harvesting can have recreational value when converted to hiking and ski trails and how harvesting permits more access to a forest for hunting and picnicking.
Harvesting and Marketing

Landowners frequently ask, “Why should I harvest my trees?” Trees naturally grow old and die, and the wasted resource can never be recovered. If you do not harvest your crop of trees, Mother Nature will probably “harvest” it for you through disease, storms, fire, and the effects of aging. This loss can be significant economically and unmeasurable in terms of the many other benefits of a forest.
When and How To Harvest

When should trees be harvested? The size and age of trees should be considered here. Large trees in a forest are not necessarily the oldest. Larger trees are usually genetically superior and develop faster. The forest manager should learn to recognize the growing conditions of trees and remove trees that grow slowly, favoring those that mature faster. Biologically, many central hardwoods mature at about 20 inches diameter breast height and should be harvested then unless market conditions dictate otherwise. There are also instances when early unplanned harvests are proper, such as salvage operations following a severe windstorm, fire, or an attack by a disease or insects.

An intermediate cut is a harvest that thins a stand to encourage the establishment of advanced reproduction and to increase the growth of a stagnated stand. Usually done with a selective harvest, an intermediate cut may have better results with even-aged management according to current studies.

Even-aged management is gaining in popularity over other silvicultural systems because it allows light to enter a stand and thus encourages the development of generally less tolerant trees, such as ash and oak. Not freed from the competition of other overshadowing trees, many Illinois hardwood stands will eventually be dominated by sugar maple, and other less desirable species.

(Tree diameters are measured at 4 1/2 feet above the ground with a tape graduated for reading the diameter directly.

(Logging roads offer access for recreation, fire suppression, and subsequent additional harvesting.

(The natural establishment of oak, however, needs assistance; therefore, the chemical control of vegetation that competes with oak is often necessary during the early years of development).

Other methods for establishing even-aged management, such as the shelterwood and seed tree systems, may require added expense and excessive time, and the forest could actually be replanted with the money received from the harvest of residual trees.

A possible disadvantage of even-aged management in Illinois, however, is that it encourages agricultural development because it is a temptation to plant crops other than trees on the cut-over land.

Regardless of the silvicultural system chosen, harvesting can have significant environmental consequences if not properly planned and executed. Skid trails left by logging operations should be perpendicular to the slope. Log roads should be graded to channel the runoff from precipitation to relatively flat areas. Dams should be erected wherever necessary to control erosion. Rubber-tired skidders used for bunching logs are preferred because they cause less damage to the site than tread or track machines. Skilled operators can also reduce the damage caused by logging. Remember, however, that the effects of a logging job are seldom worse than Mother Nature's method of harvesting.)
Identifying Timber Products

It is a good business practice to be familiar with the timber market just as with other agricultural markets. In addition to recognizing forest products, you should know the current markets and specifications for the products as well as how to harvest the timber to avoid waste.

Sawlogs are the most common primary forest product. Improper preparation of a sawlog may lower its grade or make it a cull. Excessive crook may be avoided by proper cutting. The minimum length for a sawlog usually is 8 feet, but logs are actually cut about 2 inches longer to allow for end trimming. The required trim allowance may vary among mills. The minimum diameter is about 10 inches inside bark. However, this small log may be uneconomical and, in many instances, might be better diverted to another product. A 16-inch diameter tree with two 16-foot logs will scale or yield almost 5 times more and have a better quality than a 10-inch, one-log tree.

The rule of thumb for estimating the volume of a tree is that the volume doubles from one 2-inch increment to another in the 8- to 16-inch class. This phenomenon occurs primarily because of the loss associated with slabs and edgings in logs with small diameters.

A stumpage sale, or sale of standing trees, is the most common of all timber sales. Because it usually occurs once in a lifetime, there is little chance of benefiting from previous experience. Professional help is strongly advised.

Veneer logs are sliced or rotary cut to obtain thin sheets of wood called veneer. Perhaps the most valuable primary forest product, veneer logs should never be harvested without a knowledge of the specific requirements for the selected market: walnuts, oaks, or other fine hardwoods. Specifications for veneer logs are very strict, so an unskilled logger could lose considerable value by miscutting these logs. Defect-free logs from about 16 inches in diameter are required for "face veneer." Minimum lengths for veneer logs may be less than minimum lengths for sawlogs; defects in a veneer tree, therefore, can sometimes be cut out. Because specifications vary between mills, it is wise to contact a local buyer before cutting the logs. It is also important to know the type of mill where veneer logs will be sold because requirements for a rotary mill are stricter than those for a slicer mill.

Other valuable forest products are barrels and casks. Shortboled white oaks that may not make a veneer or sawlog because their trunks are not long enough can sometimes be used by the cooperage (cask and barrel) industry. Bolts or blocks of wood for making staves and heads, the sides and endpieces of barrels, are also very valuable. The unit of measure for these bolts is the stave foot, the distance across the end section measured where the sap and heartwood meet. The stave bolt is 39 inches in length; shorter pieces are acceptable for head bolts. Although the 39-inch stave cut is somewhat shorter than that required by the veneer industry, both markets desire clear, unblemished material. Cooperage stock generally commands a respectable price. The primary barrel stave industry in Illinois is for tight cooperage, in which liquids are stored. The barrels in which bourbon is aged, for instance, require tight cooperage.
A pile is a heavy, usually round timber that is driven into the ground for support of a foundation. This use mandates that piles be straight. Most piles are from coniferous species. This very special product commands a high price, but specifications are stringent; therefore, it is wise to be aware of the buyer's particular specifications and needs before cutting piles. Much of the pile market has been captured by the cement and steel industry. The Illinois piling market is not large, but it is very lucrative.

Wood used for fuel has become somewhat more valuable than wood used for paper, fiberboard, and other pulp products in Illinois since the energy crisis of the late 1970s. Most fuelwood is produced by independent operators who seek out free wood and sell it for a reasonable return on their labor. Very little is paid for the standing timber. Most of the charge for fuelwood and pulpwood—some of the least valuable forest products—is from the labor involved in the preparation of these materials. This opportunity to remove undesirable trees from a stand, however, is good for TSI. Pulpwood specifications by species and size of bolts vary among mills, so delivery contracts are usually necessary. To sell fuelwood and pulpwood, check with your buyers before developing the material. These materials do not have a lucrative market. Most mills for pulpwood are scattered around the periphery of the state along the rivers.

With the wide range of products from a timber sale, forest owners must ask questions and do their homework to find the exact specifications for the ones they want to sell. It would be wasteful and uneconomical to cut a load of 10- and 12-foot logs only to have them scaled back 2 feet because no trim allowance was left on them. Before cutting, forest owners should also check to be sure of the current market and price for the materials to be harvested. Sometimes mills accumulate an inventory that restricts further purchases.

Timber Sales

A good forest management plan may include a sale of timber every 10 years. On small tracts of 20 acres or less, sawtimber is harvested less frequently.

Sawtimber is commonly sold on a marked-tree or lump-sum basis to the most competitive bidder. In the first case, the owner or the owner's agent designates trees for sale by applying paint marks on the tree near the ground line and about 6 feet off the ground. The owner then advertises the trees for sale, indicating the species, number, sizes, and perhaps the estimated volume. Competitive bids should always be sought. Prospective buyers will usually check the timber to obtain estimates of their value and quality. After the sale and harvest, the owner has the marked stumps to check for compliance.

In the case of the lump-sum sale, the owner generally advertises that all trees of a specific species above a certain diameter may be cut. The bidding is then done after prospective buyers estimate the volume of the unmarked trees of specific sizes. This method of marketing sawtimber is often not as satisfactory as the marked-tree method because it allows buyers to "take the cream of the crop" by harvesting only the good, highly valuable species and leaving the rest for the landowner to manage.

Selling timber on a sealed-bid basis is highly advisable because it pays. When bids are solicited early, some offers are commonly doubled or tripled. If five or six sealed bids are received, it is not uncommon for the top bid to be twice or three times that of the low bid.

Sellers should know the bidders, their loggers, and how the loggers work. Sellers should find out, for instance, whether or not the loggers are skillful loggers who do the least possible damage to the residual stand and cause a minimal amount of erosion. This latter question is especially important if the sold timber is scaled as it leaves the woods because the buyer then would not have to pay for their mistakes, which are left in the woods.
Because timber sales commonly reach into the thousands of dollars, it is wise to use a signed written contract, with the buyer stating all the terms of the agreement, especially the dollar amount and the method of payment. Other items commonly in written timber sale contracts include: the length of time allowed for removal of the product; the liability for damage done to roads, drainages, fences, utility wires, and open gates; and penalties for cutting unmarked trees or leaving broken equipment in the woods. Sample contracts for guidance are available from the Cooperative Extension Service, but it is beneficial to hire legal counsel. A sample contract is included in Appendix C.

Taxation

Taxation, another area for professional assistance, should be considered when drawing up a contract for a timber sale. Illinois does have a 4 percent timber harvest fee, which funds the cost-share program of the Illinois Forestry Development Act of 1983. This program reimburses forestland owners for much of the cost of carrying out a forest management plan approved by the Illinois Department of Conservation. Another tax consideration is that capital gains apply to this long-term crop. The laws are constantly changing; therefore, legal advice in this case is especially important. Electing to have the settlement for the timber paid in two different taxable years may help those receiving substantial amounts from the sale of their timber.

Forestation and Reforestation

Forestation and reforestation, the practices of developing a new or existing forest, are other ways to begin a tree farm program. Direct seeding is an important and acceptable method of reforestation in certain areas of the West and South where the cost of custom planting would be excessive, but in Illinois, it is not generally recommended because the topography is quite suitable for machine planting and because the newly sprouted seedlings encounter severe competition from native vegetation. Tree planting with seedling and transplant stock usually offers the maximum potential for successful tree establishment. The use of cuttings and tubelings or containerized seedlings for special situations may warrant consideration. For instance, cuttings are an economical method of reproducing cottonwood, and are necessary if a clone is to be copied. Produced in a greenhouse, tubelings are available earlier than nursery stock from frozen beds and are thought to encounter less transplant shock than bare root materials.

Understanding the Site

It is particularly important to understand the soil, exposure, and drainage of the planting site. A planting site whose soil has been greatly disturbed or altered can be quite risky. It may be droughty or poorly drained, but these features may be difficult to recognize in disturbed soil. More fertile soils with relatively more organic material are preferred. Heavier

Young trees lodge because they cannot resist strong winds when their roots are in tight soggy soils.
agricultural soils offer better initial tree establishment if competitive plants are controlled. Soil depth is very important in long-term tree development because many species will survive and live on a shallow soil but will never grow and develop into desirable products. Walnut is a prime example: when the walnut taproot contacts a hardpan, the tree will stop growing and exist without further development.

The exposure of a plantation to the sun and wind will affect its initial survival and long-term development. Sites with southern and western exposure are warmer and drier than those facing the north and east. Exposure to winds from the south and west is also detrimental because they are more drying to the soil. The damage from wind exposure may vary, however, because existing trees and shrubs may offer some degree of protection. Besides its drying effect, wind may cause trees to develop one-sided crowns or to lodge when soil conditions are very wet.

The drainage of a planting site will have an effect on the long-term development of many species. In addition to wind lodging, soils with poor internal drainage cause root rot and are generally poor planting sites. Red pine is a classic example of a species that grows well in the beginning but after about 15 years will not survive under poor internal drainage conditions.

Preparing the Site

In nearly all cases, some type of site preparation is advisable before tree planting. Mechanical actions, such as cutting brush and weed trees, are only temporary. For instance, scalping or scraping the site with a bulldozer may only provide one year of control. The most satisfactory treatments are chemical treatments that eliminate both the tops and roots of brush and weed trees and prevent regrowth for several years. Good preemergence and postemergence herbicides that provide excellent weed control are now available. New products are constantly being introduced into the site-preparation market.

Species Adaptation and Planting Stock

As with many plants, trees are adapted to specific climatic conditions. In Illinois, many species bridge the gap between southern and northern climates. Of these, white pine, cottonwood, silver maple, walnut, white ash, and white and red oaks are commonly planted. Although red pine is native to the Lake States and has been planted extensively in northern Illinois, it should be restricted to sandy soils for best development. Loblolly pine generally does well in southern Illinois, but it is susceptible to ice and snow damage, and its total net growth is no better than that of white pine. Shortleaf pine, an old standard, is highly susceptible to tip moth and has not been planted extensively in recent years. Bald cypress, a native to the southern counties of Illinois, is a good choice on tight soils. Yellow poplar, another native, does well on the better southern sites; sweet gum is not as site specific in the southern region.

The tree planter should be knowledgeable about the requirements for good survival because of the abundance of small, bargain stock and ungraded materials sold at some nurseries. In general, the tops of good conifer seedlings are 4 to 10 inches tall, whereas those of hardwood seedlings are 8 to 24 inches tall. The northern conifers are planted usually as 2- or 3-year-old seedlings or 3- or 4-four-year-old transplants, depending on the site and competition.

White pine, a northern species that performs as well as loblolly pine, has adapted to a wide variety of soils and is not subject to winter injury.
The height-caliper or height-to-diameter ratio is a better measure of stock quality than height alone. Five to 10-inch conifers should have a caliper of 1/10 to 2/10 inch. Trees with the minimum caliper should be at the lower end of the height range. Hardwoods over 8 to 10 inches tall should have a correspondingly greater diameter.

Tree Spacing

After selecting the planting stock, the grower must determine the spacing of seedlings in the field. There is little justification for spacings closer than 6 by 6 feet. Wider spacings may be both more economical and practical. Because of the need to control early competing herbaceous materials, often the width of the owner’s mowing equipment is a major factor in determining row width.

Once the spacing is determined, the required number of trees can easily be calculated. For example, a spacing of 6 feet within the row and 8 feet between rows requires 48 square feet (6 by 8 feet) per tree. Given that there are 43,560 square feet in an acre, 908 trees could be planted per acre (43,560 divided by 48 equals 908). Common tree spacings for different species are below.

<table>
<thead>
<tr>
<th>Spacing</th>
<th>6 x 6</th>
<th>8 x 8</th>
<th>10 x 10</th>
<th>12 x 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of trees</td>
<td>1,210</td>
<td>680</td>
<td>436</td>
<td>302</td>
</tr>
</tbody>
</table>

Storing and Caring for Planting Stock

The success of a plantation may be influenced by the care given the trees before they are planted, so proper storage and care of planting stock between the time the landowner receives it and the time it is planted are especially critical. The roots must never be allowed to dry, even for a few moments. If kept cool and moist, planting stock shipped in crates, boxes, and open-ended containers may be kept safely in those containers for 7 to 10 days. Plastic-coated bags, which recently have come into use, do not store stock as well. Weather conditions and personal commitments may delay planting beyond the safe storage limits. In this case, to prevent damage to the stock, it should be removed from the shipping carton and heeled-in a shallow trench in a protected area.

Machine Versus Hand Planting

Tree planting, especially in heavy soil, is hard work; therefore, most planting jobs in excess of 1,000 to 1,500 trees require machinery. Tree planting by hand is better, but planters can become careless as they tire. This factor generally makes machine work superior, but the adjustments on the tree planter should be checked periodically to make sure it is functioning properly.

Figure 4. Heeling-in. First cut: Dig a trench with a shovel or spade. Place trees against the back side of the trench. Second cut: Place the earth from the second cut on the roots of the first row of trees. Pack the soil with foot. Third cut: Place the second row of trees in the second cut and pack the soil from the third cut on the roots.


Controlling Unwanted Pests

Trees in a new plantation urgently need freedom from competition for light, nutrients, and water. Grass, broadleaf weeds, and herbaceous plants compete with young trees for survival in new plantations and should be controlled. The old system of scalping and planting in a furrow has given way to modern chemical control.

Chemical weed control is very complex, and detailed recommendations for it change yearly. Which chemical to apply is one variable. A preemergence or postemergence herbicide can be used in most situations. Some chemicals, however, may be toxic to the desired plant material and must be directed away from it. The proper season to apply herbicides for successful weed control is still another variable. Different soils often require different application rates. The skill of the operator as well as the calibration and condition of the spray equipment can also vary. Either could decrease the effectiveness of the weed control program. All of these factors, coupled with constantly changing recommendations, make it necessary to consult with an experienced forester before herbicides are applied.

Plantation establishment may also involve the control of insects and rodents. For instance, mice can be troublesome when they are numerous. A clean, weed-free plantation is a safeguard against these and other pests.

Mechanical or chemical control of grass and weeds will also minimize damage from ground fires. Kept clean, fire lanes may prevent a neighbor’s or your careless fire from spreading into the plantation.

Oak wilt, a common and sometimes serious disease of red and black oaks. Bur and white oak are seldom affected.

Cultural Practices and Protection

Plantations and natural stands benefit from many cultural practices and protective measures. If given the chance, an untended forest may develop like an untended garden or lawn. The natural stands that were present when this country was settled developed very slowly over centuries. We cannot afford to wait so long for our next crop of trees.

Weeding and cleaning, two TSI practices, involve the removal of inferior species, poor specimens of desirable species, and diseased and insect-laden trees and vines. A weed has frequently been defined as a plant out of place, so the objectives of the manager must be defined before weeding. A box elder, for example, is generally thought of as a weed tree, but in pulpwod production, it is perfectly acceptable and may be left. Another example is the removal of a black walnut in a white pine stand because it hindered the development of nearby white pines.

When weeding has been delayed too long and the undesirable trees have begun to overtop desired trees, the cultural practice needed for TSI is a release. Unwanted trees may be killed chemically and left standing, or cut, and the stumps treated to prevent sprouting. This practice may be performed every 5 to 10 years, depending on the need, and can be especially important for the development of desired trees.

Trees, like other plants, are affected by crowding and respond to thinning. Early in the life of a plantation or natural stand, crop trees should be identified and marked—usually with a band of paint. Crop trees are the best-formed, most rapidly growing, and well-spaced trees. Thinning favors these
designated trees. Crop trees usually should be 25 to 40 feet apart, and at least 25 but not more than 75 trees should be left per acre.

Crop trees designated for final-rotation harvest of the highest value products should be pruned to a height of 17 feet: 16 feet of log and one foot of stump. Pruning to 26 feet—1 1/2 logs plus trim allowance—may be economical with highly valuable species. Limbs allowed to persist will lower the quality of the log by allowing the annual diameter growth to surround the limb and cause knots. Trees not designated for the final harvest and not warranting the expense of pruning can be removed in precommercial cuts and thinnings yielding lower-quality products.

Disease can destroy entire tracts by killing susceptible trees and may cause serious problems for the remaining trees when their environment changes suddenly. The seriousness of the disease depends on the method of infection and the value of the trees affected.

Tree diseases are classified as infectious and noninfectious. Infectious diseases, such as oak wilt, are caused by a pathogen; whereas noninfectious diseases, such as sunscald, are the result of environmental or man-made conditions.

Professional help is usually required in diagnosing a disease and prescribing control measures. Often, laboratory examinations of infected plant material will be necessary to verify the pathogen. Suitable control measures can then be applied at the appropriate time.

Trees can be weakened by fire, floods, drought, and many other causes, and then killed by a secondary problem. Fire scars allow insects and decay fungi to enter trees. Insects harm trees directly by consuming them and indirectly as vectors or carriers of diseases. Borers, for instance, are insects that often attack a weakened tree. All parts of the tree are subject to insect attack. The effects of an attack on parts that are above the ground are readily diagnosed, whereas the symptoms of underground damage or internal damage may often escape the notice of an untrained eye. As with diseases, professional help is often needed to diagnose and prescribe treatment for insect-related problems.

The potential for wildfire in a stand will vary according to its condition and the local environment. Forest owners should be concerned about long spells of dry weather, weed and brush accumulation, and local burning customs. A well-maintained firebreak and
cooperative neighbors will help minimize fire problems. The times for greatest concern are early in the spring before rains cause vegetation to green up and the fall after frost has killed the weeds and grass.

Damage from both wild and domestic animals can be severe. Birds, such as grosbeak, which eat the buds, and blackbirds, which roost on the new growth, can seriously damage pine trees. Deer both browse and rub trees, and mice and gophers feed on their roots. Beavers are a problem in some areas of Illinois. Livestock should not be tolerated in a woods because they can trample small seedlings, compact the soil, and bruise young trees. Rooting habits of pigs can be added to the problems created by livestock.

Trees can also be lost through theft. The potential for tree theft is most serious when highly valued products are present. Commonly stolen are individual walnut trees or any number of ordinary sawlog trees along a boundary where the adjacent timber is being harvested. The usual excuse is mistaking the position of the property boundary line. Valuable Christmas trees are sometimes stolen by the truckload because they are easily cut and handled. Illinois’s law requiring haulers of forest products to prove ownership does help control the problem.

Wildlife Enhancement

Landowners are often reluctant to cut trees because they believe that any form of forest management reduces the potential for wildlife. They also commonly believe that any disturbance is detrimental and that large trees are necessary to attract most wildlife. These beliefs are completely false.

Wildlife species survive on three basics: food, water, and cover, all of which can best be provided in a managed woods. Food and cover seem to be the most critical.

The correct food for energy and growth, coupled with adequate cover for nesting and protection, will attract and keep wildlife. The fruit from nut trees, wild grapes, and berries, and the seeds from herbaceous plants, supplemented by spilled grain in agricultural fields, provide excellent food.

The cover provided by hollow trees called snags, the dense canopy of young saplings, and the herbaceous materials in openings and edges help provide nesting and resting areas. A mixture of plant species and diversity of cover available in a managed forest seem to satisfy most wildlife. Landowners, therefore, may wish to leave a few snags in their forests.

The next step is up to you.
Conclusion

andowners manage their forests for sawtimber, recreation, wildlife, water conservation, or a combination of these objectives and profit from their forests in many ways. If you desire more profit or enjoyment from your woodlands, you must begin now. Remember that your taxes on them must continue to be paid whether you manage them or not. Furthermore, any natural improvements in them will come much more slowly than they would with proper management. Natural deterioration rather than improvement is a real possibility. The demand for wood products is expected to double in the next 40 years. The time to start growing trees for that market is now.

Glossary

advanced reproduction: young woody plants present before the harvest of a timber crop.
age: the number of growing seasons elapsed in the lifespan of a tree.
biomass: the total of all components of trees and shrubs—roots, stems, branches, and leaves—measured in terms of weight.
bunching: skidding logs together to form a load for hauling by other equipment.
condition class and species list: a list of trees by species along with their stage of development, for example, “red oak, mature” or “red oak, medium growing stock.”
cooperage: containers consisting of two round heads and a body, composed of staves, held together with hoops. The requirements for the materials and manufacture of slack cooperage, used for holding nonliquid products, are less stringent than the requirements for those of tight cooperage, used for storing liquids.
crook: a curve in a log.
cull: poor material that cannot be sold.
edge effect: zone of transition between a forest and an open area.
even-aged management: system of forest management in which all trees are treated as if they were of the same age, usually within 10 to 20 years.
fuelwood: wood—usually of low quality and value—that is to be burned for the production of heat and other forms of energy.
forestation: the natural or artificial establishment of a forest in an area where there is no forest.
ground reconnaissance: a review of conditions or developments in a given area made while walking through the area.
head bolt: material prepared for remanufacture into the top or endpieces of a barrel.
heel-in: to place young trees in a trench and cover their roots with soil for storage before planting.
intermediate cut: a harvest later than a pre-commercial thinning but before the final harvest of a crop of trees.
lodging: the permanent displacement of a tree from the perpendicular usually caused by a combination of soggy soils and strong winds.
log rules: tables showing estimates of the amount of lumber that can be sawn from logs of specific dimensions. In Illinois, the Doyle Log Rule and the International 1/4-Inch Log Rule are the most common.

mast: collectively the flowers, fruits, and seeds produced by trees and consumed for food by wildlife and domestic livestock.

pulpwood: wood cut or prepared primarily for manufacture into pulp for subsequent manufacture into paper and allied products.

reforestation: the natural or artificial restocking of an area with forest trees.

release: to free trees from competing vegetation by chemical or mechanical methods.

sawlogs: logs that are to be manufactured into lumber, as opposed to veneer logs, cabin logs, and other types of logs.

sawtimber: trees that are managed for the production of lumber logs.

scale: to measure trees or logs in order to estimate their yield of forest products.

scalping: to remove competing vegetation, usually in preparation for tree planting.

seed tree system: a system of harvesting that in one operation removes all the mature trees except a few seed-producing trees to furnish seed for reestablishing a cut-over area.

selective harvest: method of harvesting in which individual trees or small groups of trees are cut at periodic intervals. Selection for this type of harvest is based on the physical condition or degree of maturity of the trees and results in an uneven-aged stand.

shelterwood system: a system of harvesting in which all the trees in an area are removed in two or more cuttings. This procedure allows for the establishment of new seedlings under the protection of the older trees.

short-boled: trees whose merchantable length is shorter than normal for a particular species or woodland.

stand: a group of trees that is distinguishable from other groups in a given area. A stand is usually of uniform size and condition and is called pure if 80 percent are of the same species.

stave bolt: a piece of wood from which the sides of a barrel are manufactured.

stumpage: standing trees.

Timber Stand Improvement Program (TSI): a program of removing less desirable trees, vines, and shrubs to improve the stock and quality of a residual forest stand.

trim allowance: the additional 2 inches beyond the required length of a log that permits manufactured boards to be cut square and to exact even lengths.

tubelings: young trees grown individually in a controlled environment within small tubes to accelerate their growth before the trees are planted in a field.

veneer logs: high-quality, defect-free logs from which veneer is made.
Appendix A
Outline of a Suggested Forest Plan

Landowner's Name:

Acreage:

Permanent Index Number (if used in county):*

Location (Quarter, Section, Township, and County):

I am the owner of the property for which this plan has been prepared. The plan meets my requirements and has been prepared in accordance with Public Act 83-446. I will follow the recommendations to the best of my ability. If any changes in ownership or conditions of the forest are made, I will notify the Division of Forest Resources and Natural Heritage in the Department of Conservation within 30 days.

Please do / / do not / / forward this information to the Illinois Department of Revenue for land assessment purposes.

---

Landowner

Address

Date

This plan is approved by:

District Forester

Date

*Required only when the approved management plan certification is to be forwarded to the Illinois Department of Revenue.

(Source: Amended at 9 Ill. Reg. 14278, effective September 5, 1985)
1a. Owner

2a. Address

3. Property
   a. Location (legal description)
   b. Area (acres)
   c. Tax Code # (if used in county)

4. Description of Land
   Include topography, soils, species growing or planted, history and map of the property for:
   a. Open Land (cropland, pasture, land without forest trees growing on it)
   b. Forestland (at least 10 percent stocked)

5. Specific Information, Recommendations
   a. Open Land (afforestation, reforestation) if applicable
      (1) preplanting recommendations (planting stock, site preparation)
      (2) spacing
      (3) species and numbers required
      (4) postplanting recommendations (care of the planted stock)
   b. Forestland (established forest) if applicable
      (1) volume/acre
      (2) basal area/acre
      (3) stocking/acre
      (4) growth/acre
      (5) harvest schedule
      (6) cultural practices to meet forest need: planting, regeneration, species selection, and stocking

6. Soil and Water Conservation Goals — A statement of landowner’s goals and practices to maintain or reduce soil erosion for meeting or exceeding the tolerable level established by the Department of Agriculture.

7. Wildlife Habitat Enhancement — Install compatible practices that will enhance potential wildlife habitat and meet the owner’s objectives.

8. Protection Measures — Procedures to deal with insect, disease, and environmental problems. Where fire is a danger, firebreaks must be installed and maintained.

9. Financial Considerations — Discussion of specific costs involved in implementing open land and forest recommendations.

10. Other Considerations
# Appendix B

## Sources of Assistance for Illinois Forest Owners

Extension Forester  
110 Mumford Hall  
1301 West Gregory Drive  
University of Illinois  
Urbana, IL 61801  
(217) 333-2777

State Forester  
524 South Second Street  
Springfield, IL 62706  
(217) 782-2361

Illinois Consulting Foresters, Inc.  
Current address and phone can be obtained from the offices listed above.

Forest Resources Districts in Illinois. These districts are shown on the map on page 22. District foresters can be contacted at the following addresses and telephone numbers:

<table>
<thead>
<tr>
<th>No.</th>
<th>Box</th>
<th>City</th>
<th>Address</th>
<th>Phone 1</th>
<th>Phone 2</th>
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<tbody>
<tr>
<td>1</td>
<td>P.O. Box 6</td>
<td>Mt. Carroll</td>
<td>61053 IL</td>
<td>(815) 244-3655</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Castle Rock</td>
<td>State Park, R.R. 2</td>
<td>Oregon, IL 61061</td>
<td>(815) 732-6184</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>P.O. Box 126</td>
<td>Cambridge</td>
<td>61238 IL</td>
<td>(309) 937-2122</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Randy Timmons</td>
<td>IVCC East Campus</td>
<td>Building 11</td>
<td>2578 East 350th Road</td>
<td>Oglesby, IL 61348</td>
</tr>
<tr>
<td>5</td>
<td>P.O. Box 335</td>
<td>Macomb</td>
<td>61455 IL</td>
<td>(309) 837-1124</td>
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<tr>
<td>6</td>
<td>P.O. Box 795</td>
<td>Pekin</td>
<td>61554 IL</td>
<td>(309) 347-5119</td>
<td></td>
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<tr>
<td>7</td>
<td>P.O. Box 472</td>
<td>Lisle</td>
<td>60532 IL</td>
<td>(312) 964-8081</td>
<td></td>
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<tr>
<td>8</td>
<td>First National Bank Plaza</td>
<td>17th and Halsted</td>
<td>Suite 205</td>
<td>Chicago Heights, IL 60411</td>
<td>(312) 754-0945</td>
</tr>
<tr>
<td>9</td>
<td>P.O. Box 148</td>
<td>Shelbyville</td>
<td>62565 IL</td>
<td>(217) 644-2411</td>
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<tr>
<td>10</td>
<td>P.O. Box 129</td>
<td>Charleston</td>
<td>61920 IL</td>
<td>(217) 345-2420</td>
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<tr>
<td>11</td>
<td>P.O. Box 477</td>
<td>Pittsfield</td>
<td>62363 IL</td>
<td>(217) 285-2221</td>
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</tr>
<tr>
<td>12</td>
<td>P.O. Box 401</td>
<td>Havana</td>
<td>62644 IL</td>
<td>(309) 543-3401</td>
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<tr>
<td>13</td>
<td>P.O. Box 170</td>
<td>Carrollton</td>
<td>62016 IL</td>
<td>(217) 942-3816</td>
<td></td>
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<tr>
<td>14</td>
<td>P.O. Box 603</td>
<td>Hillsboro</td>
<td>62049 IL</td>
<td>(217) 532-3562</td>
<td></td>
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<tr>
<td>15</td>
<td>P.O. Box 149</td>
<td>Carlyle</td>
<td>62231 IL</td>
<td>(618) 594-4475</td>
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<tr>
<td>16</td>
<td>P.O. Box 21</td>
<td>Sparta</td>
<td>62286 IL</td>
<td>(618) 443-2925</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Stephen A. Forbes S.P.</td>
<td>R.R. 1, Kinmundy</td>
<td>62854 IL</td>
<td>(618) 547-3477</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>P.O. Box 313</td>
<td>Olney</td>
<td>62450 IL</td>
<td>(618) 393-6732</td>
<td></td>
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<tr>
<td>19</td>
<td>P.O. Box 206</td>
<td>Fairfield</td>
<td>62837 IL</td>
<td>(618) 847-3781</td>
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<tr>
<td>20</td>
<td>P.O. Box 188</td>
<td>Murphysboro</td>
<td>62966 IL</td>
<td>(618) 687-2522</td>
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<tr>
<td>21</td>
<td>Dixon Springs</td>
<td>State Park, R.R. 2</td>
<td>Golconda, IL 62938</td>
<td>(618) 949-3394</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>P.O. Box 67</td>
<td>Goreville</td>
<td>62939 IL</td>
<td>(618) 995-2568</td>
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</table>
Appendix C

An Example of a Timber Sale Contract

A contract is “an agreement, upon sufficient consideration, to do or not to do a particular thing.” Contractual obligations are applicable only to the parties agreeing to them. These obligations are created by words or sometimes by conduct that demonstrates an intention of the parties involved to exchange certain rights with a concurrent exchange of duties.

Certain elements are necessary for a valid contract: legally competent parties, proper subject matter, an offer, an acceptance, and consideration. If anyone of these elements is absent, there is no contract.

Most contracts that a farmer makes need not be in writing to be enforceable, but there are three important exceptions: transfers of real estate and farm leases; a contract not to be performed until one or more years after it is made; a contract to sell goods valued at $500 or more. (Krausz, N.G.P., and H.W. Hannah, Law and Court Decisions on Agriculture, Champaign: Stipes Publishing Company, 1973, pages 14-18.)

The following document offers excellent guidelines when preparing a timber sale contract. Separate articles may be added to suit specific circumstances. It is advised that the Seller and Purchaser employ legal counsel to review the contract prior to its endorsement.

TIMBER SALE CONTRACT

CONTRACT entered into this _____ day of ______________________, 19____, by and between ________________________________, of ____________________________, Illinois, hereinafter called the Seller, and ________________________________, of ____________________________, (city), ____________________________, (state), Illinois Timber Buyer License Number ________________________, hereinafter called the Purchaser, WITNESSETH:

1. The Seller agrees to sell and the Purchaser agrees to buy for the total sum of ________________________________ dollars ($____________) under the conditions set forth in this contract all of the live standing timber marked or designated for cutting and all of the dead or down timber marked or designated upon an area of approximately _______________________ acres, situated in the ______________ of Section ____________, Twp. ____________, R. ____________, __________________________ County, Illinois, on land owned and recorded in the name of _________________________________.

The Purchaser further agrees to pay to the Seller as an initial payment under this contract the sum of ________________________________ dollars ($____________), receipt of which is hereby acknowledged, and a final payment in the sum of ________________________________ dollars ($____________), prior to any cutting or removal of timber under this contract.
2. The Seller further agrees to mark and dispose of the timber conveyed in this contract in strict accordance with the following conditions:

   a. All trees to be included in this sale will be marked with a distinctive mark on the bole and stump.
   b. No trees under _____ inches in diameter at a point 4 1/2 feet from the ground will be marked for cutting.
   c. No concurrent contract involving the area or period covered in this contract has been or will be entered into by the Seller without the written consent of the Purchaser.
   d. The Purchaser and his employees shall have access to the area at all reasonable times and seasons for the purpose of carrying out the terms of this contract.
   e. Unless otherwise specified, all material contained in the marked or designated trees is included in this sale.
   f. 

   g.

3. The Purchaser further agrees to cut and remove all of the timber conveyed in this contract in strict accordance with the following conditions:

   a. Unless an extension of time is agreed upon in writing between the Seller and Purchaser, all timber shall be paid for, cut, and removed on or before and none after the ______ day of __________________, 19_____, and any material not so removed shall revert to the Seller.

   b. Unmarked trees and young timber shall be protected against unnecessary injury from felling and logging operations. If, however, unmarked trees are cut, damages shall be paid the Seller at the rate of $1 per tree plus $_______ per M bd. ft. for ___________ and $________ per M bd. ft. for all other species, and in the event that any such trees are cut, said trees shall remain upon the premises and shall be the property of the Seller.

   c. Necessary logging roads shall be cleared by the Purchaser only after their locations have been definitely agreed upon with the Seller or his representative, and any trees to be removed in the clearing operations shall first be marked by the Seller.

   d. During the life of this contract and on the area covered, care shall be exercised by the Purchaser and his employees against the starting and spread of fire, and they shall do all in their power to prevent and control fires.

   e. Any liability for damage, destruction, or restoration of private or public improvements or personal damages occasioned by or in the exercise of this contract shall be the sole responsibility of the Purchaser, and the Purchaser shall save harmless the Seller on account of such damages.

   f. The risk of loss or damage to the trees herein purchased, from any and all causes whatever, shall be borne by purchasers from the date hereof.

   g. The Purchaser will not assign this agreement without the written consent of the Seller.

   h.

   i.
4. The Seller and Purchaser mutually agree as follows:

   a. All modifications of the contract will be reduced to writing, dated, signed, and witnessed and attached to this contract.

   b. Any need for reassignment of interest of either party may be changed within 10 days following written consent by both parties. All terms of this contract legally bind the named representatives to execute this document as written.

   c. The total number of trees conveyed is _______ (having a volume of approximately _______ bd. ft.) composed as follows:

   white oak, _______, red and black oak, _______.

   d. In case of dispute over the terms of this contract, final decision shall rest with a reputable person to be mutually agreed upon by the parties to this contract. If the parties hereto do not agree upon a third party within 10 days following the initiation of the dispute, or in the case of further disagreement, then within 15 days from the initiation of the dispute, it shall be submitted to a Board of Arbitration of three persons, one to be selected by each party to this contract and the third to be selected by the other two. The Board shall decide the dispute within 5 days after the matter is referred to it.

   In the event that damages are awarded to the Seller by the Board of Arbitration and are not paid on the date that the award is made, then all operations of the Purchaser shall immediately cease, and if the award is not paid or satisfied within 30 days after the date of award, the Seller may take immediate possession of the premises upon which the timber is located, shall retain as liquidated damages all money paid by the Purchaser, and the title to all timber shall revert to and become the property of the Seller.

In witness whereof, the parties hereto have set their hands and seals this ______ day of ________, 19__.

WITNESSES:

(For the Purchaser) (Purchaser)

(For the Seller) (Seller)

Adapted from a timber sale contract prepared by Michael F. Bolin, June 1988.