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THE UNIVERSITY OF TENNESSEE
AGRICULTURAL EXTENSION SERVICE

PB1523

Forest Practice Guidelines for Tennessee

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Cover photo by George M. Hopper

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Tennessee has been blessed with a beautiful bounty of forest resources. We trust these “Guidelines” will improve forest practices in Tennessee and enhance the quality of life for all Tennesseans.

George M. Hopper
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Forest Practice Guidelines for Tennessee

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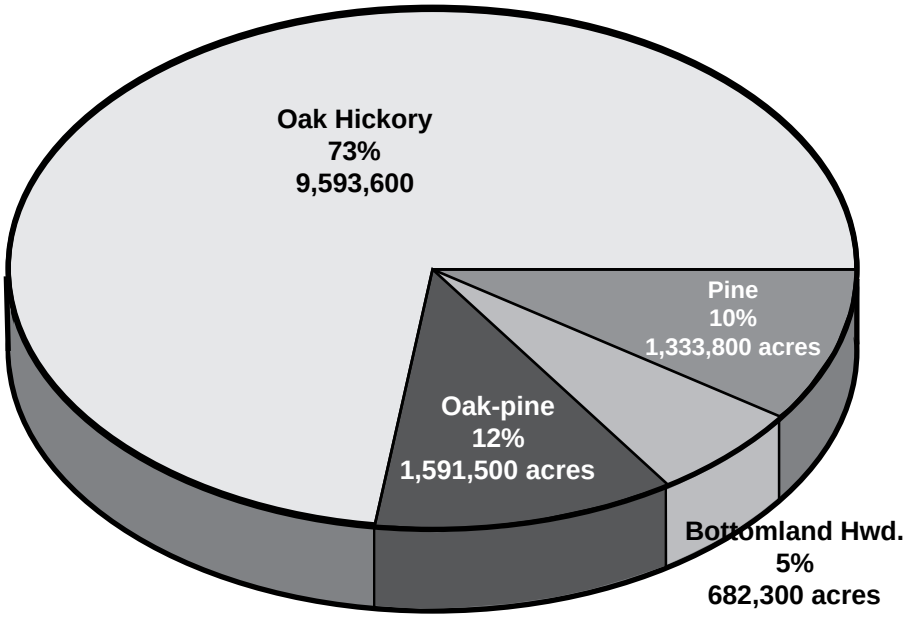
Purpose

Those involved in managing Tennessee forests have felt the need for a concise statement about forest practices in Tennessee. Although several sources provide information about Tennessee's forests and appropriate forest practices, searching for information takes considerable time, and in some instances the sources are not readily available. These guidelines provide a ready, authoritative reference. This publication identifies appropriate forest management practices and informs the Tennessee forest landowner about making wise policy decisions and establishing long-range goals.

However, many land management decisions are complex and can not be explained here. In most cases, forest management requires the services of a professional forester. A professional forester has received at a minimum a four-year college degree in forest management from an accredited forestry program, and keeps current about the latest forest management practices.

Forest Types in Tennessee



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Forests of Tennessee

Forests are an integral part of the Tennessee environment. When the first European settlers reached the territory that was to become Tennessee, forests covered more than 85 percent of the land area. With these settlers came logging, land clearing and frequent fires. Historical records indicate native American people burned the forests routinely to create improved grazing for wildlife. Some accounts suggest that there were savannah-like conditions in many areas of the state.

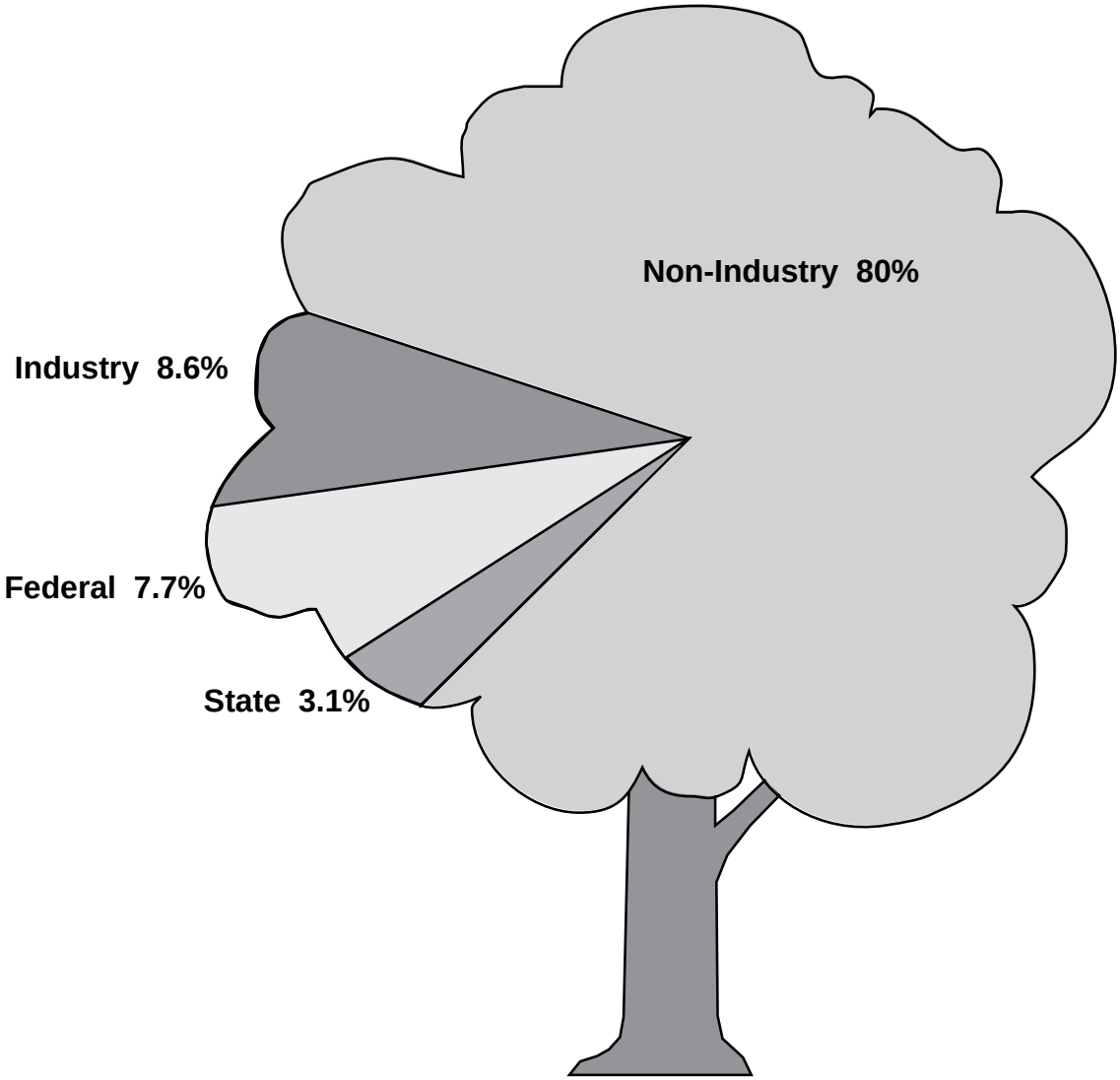
The most recent statistics from 1989 Tennessee forest survey show 13,265,000 acres, or 50 percent of the total land area, is still in forest cover.

Private forest landowners, the vast majority non-industrial, decide the fate and management on 11,756,400 acres of the state's forest land. This represents 88 percent of the total forest resource (Table 1).

Differences in climate, soils and physiography make the forests of Tennessee as complex as any found in the temperate regions of the world. More than 200 species of trees grow in Tennessee, 60 of which have commercial value.

Table 1.
Distribution of Forest Ownership in Tennessee
(from Forest Statistics for Tennessee Counties-1989 USDA-FS SD-148)

FOREST LAND		
Owner	**Acre**	**% of Total**
Private		
Industrial	1,143,900	8.62
Non-industrial	10,612,500	80.00
Public		
Federal	1,027,400	7.74
State	422,200	3.18
City/County	59,400	0.44
Total forest land	13,265,400	—


Non-Industry 80%
Industry 8.6%
Federal 7.7%
State 3.1%

Unlike most of its neighbors to the south, Tennessee's forests are mostly hardwoods, with oaks dominating significant portions of the forest landscape. This publication will discuss five major forest types in Tennessee: oak-hickory, oak-pine, bottomland hardwoods, cove hardwoods and pine.

Forest stands composed of various oaks and hickories cover 73 percent of the commercial forest areas (9.6 million acres). The oak-hickory forest type includes a mixture of species, ranging from very valuable black walnut, yellow-poplar and high-grade red and white oaks, to the economically low-value post and blackjack oaks. Pine and oak-pine types occur on 22 percent of the commercial forest area, and typically develop on relatively dry upland sites.

The east and plateau regions of Tennessee contain pine, oak-pine and oak-hickory forest types. Upland hardwood sites generally are concentrated in the central and west-central regions. Bottomland hardwood sites are primarily located in the west region.

Mismanagement and uncontrolled fires have caused serious damage to forest resources of Tennessee. For many years, logging operations that cut only the best trees, a practice referred to as "high-grading," has reduced forest productivity. High-grading results in a forest of defective and commercially undesirable trees left to occupy and regenerate the forest. Although the practice of high-grading continues, significant improvements have been made in forest protection, e.g., wildfire suppression. Also, reforestation programs have established more than a million acres of trees on eroded fields.

Although analyses of forest conditions in Tennessee show that the quality of our hardwoods is declining, timber growth is increasing. Statistics from 1950 to 1989 show that the sawtimber volumes increased from 16.2 to 53.6 million board feet. Moreover, desirable commercial species now cover a higher proportion of our forest land, but there is still much to be done to improve and protect the forest. The Tennessee Division of Forestry, The University of Tennessee Agricultural Extension Service, the Tennessee Valley Authority, the U.S. Forest Service, the Tennessee Forestry Association, concerned individual landowners and forest industries are contributing to this improvement.

Forest Values

Tennessee's forests are one of our state's most valuable natural resources. Forests furnish a variety of products and benefits to the state's economy and its citizens. The timber industry probably predates the state itself, yielding raw materials for construction of homes and buildings and many other basic products such as furniture, crossties and paper. Additionally, trees yield chemicals used in hundreds of products produced in plastics and chemical manufacturing.

Wood-using industries in Tennessee manufactured products which had a shipment value of $4 billion in 1992. Forest-related industries in Tennessee employ more than 50,000 workers and pay $1 of every $8 of manufacturing-based wages. Tennessee is the nation's leading producer of log homes and hardwood flooring, and annually ranks among the top three states in hardwood lumber production.

Tennessee's forest lands also create habitat for forest wildlife, providing food and shelter for many game and non-game species. Hunting, fishing and other outdoor activities contribute greatly to the quality of life in Tennessee. The success of Tennessee's outdoor recreation and tourism industry is due in no small part to the beauty of the state's forest-covered landscape. Protection from soil erosion and reduction of noise and air pollution are among the many environmental benefits forests provide.

Forest Practices and Silviculture

Silviculture

Silviculture is the art and science of tending a forest. Silviculture includes the establishment, improvement and harvest of a forest to meet the owner's objectives. Silviculture is based on an understanding of natural resource processes, such as disturbance, succession, competition, nutrient cycles, hydrology, tree biology, soils and associated ecological phenomena. Manipulation and control of the natural processes using scientifically based silvicultural techniques can create forests suited to the goal of ownership in less time than would occur naturally.

Partial Harvests Versus Regeneration Harvests

Forest management generally includes harvesting trees. Trees that are harvested and processed into products continue to benefit people by providing useful wood products.

Silviculture is the art and science of tending a forest.

When a forest owner decides to harvest trees, the decision is often based on personal economics. However, a timber harvest results in a long-term impact on the forest environment. Because of this, the landowner should have a plan before the harvest that addresses long-term goals.

What does it mean to regenerate? To a forester, regeneration means to produce a new, vigorous, healthy, well-stocked stand of trees; it refers to starting the stand of trees over (as opposed to converting forest land to some other land use). However, not every stand is in need of a regeneration cut; rather, some require only a partial cut.

Forest rotation is the time required to grow a timber crop to economic or natural maturity. One way to think about rotation is "the beginning and the end." A corn crop begins with a clearcut, followed by planting, weed control and final harvest. For corn, rotation may be six months. For oak, rotation may be 30 years or 150 years depending on the site, desired product and landowner objectives. A forest manager can shorten the rotation length by controlling stand density and matching species with appropriate sites. Whatever the time period, the final harvest completes the rotation.

At the end of rotation, trees are harvested and the forest is regenerated. Forest regeneration systems are effective when properly applied. Artificial regeneration involves planting seeds or seedlings. Advantages of this method are better control of species composition and genetic improvement. Natural regeneration methods include seed tree, shelterwood, clearcut, group selection and single tree selection. Each of these methods produces a new forest and is designed for use in specific forest types.

Whatever regeneration method used, the final harvest, at the end of rotation, should produce a new, young, healthy forest.

Partial cuts

Cultural treatments that occur during the rotation affect yield, rate of growth and quality of timber. Silvicultural partial cuts during stand development are generally referred to as thinning. Some people see a thinning as a selection for regeneration. However, in a managed forest, thinning reduces stand density to benefit the crop trees left. Crop trees are chosen, released and grown to the end of the rotation. By thinning the stand, the crop trees grow faster and reach a larger size sooner.

In his text on Silvicultural Practices, D.M. Smith had this to say about thinning: "The essential generalities about thinning have been buried in the flood of qualifications that must inevitably enter into any discussion. The most important fact to be noted is that the total cubic volume of wood, which can be produced by a stand in a given length of time, tends to be fixed and immutable. However, by skillful control of the growing stock the forester can marshal production to capture the highest net return possible under the economic circumstances."

"The trees that are cut represent a salvageable surplus not needed to ensure full utilization of the growing space; they are, therefore, available for harvest. In the act of removing them, it becomes possible to build more crown surface on selected individuals so they will attain larger diameter, become more valuable and be less vulnerable to damage."

"The positive action of choosing the kind and number of trees to remain for future growth should be emphasized much more than the selection of trees to cut for immediate use."

Silvicultural Systems and Regeneration Methods

In the life of every timber stand the time eventually arrives when it is mature. Once mature, some or all the trees can be harvested and the stand regenerated through artificial or natural regeneration. The method chosen for harvest and regeneration depends on forest conditions and landowner's goals. There are two types of silvicultural systems a forest landowner may develop with various harvesting plans: 1) even-age systems (see page 9) or 2) uneven-age systems (see page 10). Foresters use both management systems successfully in Tennessee. Remember, each system attempts to carry out a specific purpose and is based on tree biology (silvics). The manager of the forest must consider the unique silvicultural characteristics of each species.

An important biological principle of tree growth is that of "tolerance." Tolerance in forest trees refers to a species' ability to compete. The ability to perform in competition with other trees and to tolerate shade determines a species' tolerance level. For example, beech regenerates very well in shade and is considered a shade-tolerant species. On the other hand, black cherry needs full sun to regenerate and to grow. Therefore, cherry is an intolerant species. Table 2 gives shade tolerance levels for several important species.

Tolerance in forest trees refers to a species ability to compete. The ability to per form in competition with other trees and to tolerate shade determines a species tolerance level.

TABLE 2:
Tolerance of trees to shade is important in choosing a silviculture system for natural regeneration. The listing below shows the relative shade tolerance for several

commercial species.

INTOLERANT OF SHADE	INTERMEDIATE IN TOLERANCE TO SHADE	TOLERANT OF SHADE
Northern Red Oak	White oak spp.	Red Maple
Black Walnut	Persimmon	Sugar Maple
Black Cherry	Baldcypress	Hornbeam
Sassafras	Black Gum	Beech
Ash	Hickory	Magnolia
Locust		Mulberry
Yellow-Poplar		Dogwood
Sweetgum		Eastern White Pine
Cherrybark Oak		Hemlock
Hackberry		
Cottonwood		
Willow		
Birch		
Loblolly Pine		
Virginia Pine		
Shortleaf Pine		

Silvicultural systems are based on age, either even-age (less than two distinct age classes) or uneven-age (three or more distinct age classes). Tree diameters and heights in a stand can characterize the age distribution.

The five major methods to regulate the age structure of the forest for even-age systems: 1) the clearcut method, 2) the shelterwood method, or 3) the seed tree method; and for uneven-age systems: 4) the single tree selection method, and 5) the group selection method.

Caution: The popular practice of selecting trees based solely on diameter or quality is "high-grading," a practice that leaves a high proportion of culls and less desirable species to occupy the forest. Diameter-limit cutting is not a recommended silvicultural practice. The harvesting of only the best trees continues to cause considerable damage to Tennessee's forests.

Tree planting has been used to restore a forest and to improve competition, stocking and desired genetics.

A common mistake in forest regeneration is to plant trees on poor, cut-over sites, with inappropriate species and without control of competing brush and weeds. Selecting suitable sites, getting good planting stock of improved genetic quality and controlling competition are critical factors that determine plantation success.

Hardwoods have not been planted as widely as pine. Hardwoods usually demand better sites and are not well-suited for many marginal old fields. However, research continues on how to plant hardwoods for timber and wildlife, especially in wetland reclamation. Of particular importance in planting hardwoods are site selection, seedling quality, improved genetic sources and competition control, during the early years.

Caution: The popular practice of selecting trees based solely on diameter or quality is "high-grading," a practice that leaves a high proportion of culls and less desirable species to occupy the forest. Diameter-limit cutting is not a recommended silvicultural practice. The harvesting of only the best trees continues to cause considerable damage to Tennessee's forests.

Even-Age Systems

A stand is even-age if the age difference between the youngest and oldest trees is less than 20 percent of the length of the rotation. For example, an even-age stand managed on a 50-year rotation can have no trees more than 10 years younger than the oldest trees. The upper canopy of the forest is continuous in even-age stands, since trees are mostly of similar heights. Tree diameters will differ within the stand, since competition among trees affects diameter. However, diameter distribution of these stands has a normal bell shape curve (Figure 1), with many trees close to average diameter, and few trees of larger or smaller diameters. Existing forest stands may exhibit even-age conditions from their diameter distribution and pattern of the forest canopy.

Methods used to produce even-age forest stands include clearcuts, shelterwood cuts and seed tree cuts.

Clearcuts — All trees 1-inch diameter at breast height (DBH) and greater are cut or deadened. This method is useful to regenerate intolerant species (Table 2). Regeneration from clearcuts normally depends on stump sprouts, seeds in place or planted seedlings. Regeneration harvest provides specifically for the production of new trees, either through natural regeneration, from sprouts or germination of seeds or planting seedlings. Sprouts (called coppice) grow faster than seedlings. The existing root systems of sprouts use the site better than seedlings by providing more water and nutrients to the plant. Although sprout origin stands grow faster, they generally decline after several successive harvests. This decline in a coppice forest is due to decreasing vigor of the aged root system. Estimates show 60-70 percent of Tennessee's current hardwood forests are of sprout or coppice origin. Regeneration densities as high as 30,000 seedlings per acre have been produced in hardwood clearcuts designed for natural hardwood regeneration.

Clearcuts may range greatly in size. Preferably, clearcuts should be no larger than 50 acres, and of irregular shape, depending on terrain, age of adjacent stands and nearness to streams.

Regeneration densities as high as 30,000 seedlings per acre have been produced in hardwood clearcuts designed for natural hardwood regeneration.

Shelterwood cuts — are designed to provide shelter for the regeneration. In the shelterwood method, all but 20 to 50 trees per acre in the initial harvest are removed. The number of trees left depends on advance regeneration already present, species desired and size of trees left as the shelter.

A shelterwood cut requires a second harvest after the new stand has been established. The second harvest removes shelter trees and releases the newly established stand, creating an even-age stand. Species that regenerate well in a shelterwood generally are intermediate in shade tolerance (Table 2).

Seed tree cuts — Regeneration with a seed tree cut requires the manager to leave six to 15 evenly-spaced trees per acre. These "seed trees" produce seed and regenerate the new stand. After establishment of the new stand, the seed trees must be removed or deadened. This method is useful to regenerate light-seeded species that are intolerant to shade, such as yellow poplar and pine.

Uneven-Age Systems

Uneven-age silvicultural systems, sometimes referred to as selection systems, originally developed in Switzerland as a way to rehabilitate hardwood stands that had been harvested too heavily. Similarly, many hardwood forests in the Eastern United States have been heavily cut. Although many of Tennessee's forests have been cut on a diameter or "size-selection" limit where only the largest and best trees are removed, diameter-limit cuts are not an approved forest management practices. Diameter-limit cuts usually are destructive, and should be avoided in hardwood forests. "High-graded" stands must be either brought back into the manageable units slowly with uneven-age silviculture, or completely regenerated with even-age silviculture.

An uneven-age forest is a forest of high diversity. An uneven-age forest managed under selection silviculture will eventually have trees of many ages, species and sizes. An uneven-age forest is relatively stable, with small likelihood of forest stress and disease eliminating the entire stand. Uneven-age forests produce an upper canopy that is irregular, with trees of significant height differences (Figure 1). Tree diameters also will differ greatly, so the stand will contain many trees of very small diameters and fewer trees of the larger diameters. The diameter distribution for uneven-age stands illustrated in Figure 1 is a guideline for creating and maintaining a forest of all age classes.

Conceptually, uneven-age silviculture is a highly desirable method of forest management, as it could provide a sustained yield of wood from a small forest tract. However, the intense recordkeeping and periodic harvests required to maintain the desired diameter distribution make the method difficult to administer and practice.

There are two uneven-age silviculture methods used to regulate a forest, 1) single tree selection and 2) group selection.

Single tree selection removes trees from all diameter classes. Single tree selection silviculture produces a stand with many small trees and a decreasing number of trees in each larger diameter class. This process requires periodic harvests and requires detailed recordkeeping and patience. Most hardwood species can be managed under this method, but those trees tolerant to shade will tend to be regenerated in the understory (Table 2).

Group selection produces a forest of many small stands. Group selection develops a matrix of even-age groups scattered throughout the forest. In group selection, harvested areas of groups of trees create 0.1- to 1.5-acre openings. The diameters of individual openings should not be more than two to three times the heights of adjoining trees. These openings, or groups, regenerate to intolerant species, producing a forest of many different-age stands. Group selection relies on maintaining an uneven-age forest by creating many small even-age stands.

There are pros and cons to uneven-age selection silviculture. Table 3 lists the advantages and disadvantages of producing an uneven-age forest.

TABLE 3:
Selection silviculture for uneven-age management has advantages and disadvantages. Listed below are a few items to consider.

Item	Advantages	Disadvantages
Structure	Crowns of all sized trees, of many ages produce a layered canopy good for wildlife.	Shade prevents regeneration of intolerant species such as oak, ash, cherry, walnut, and poplar.
Regeneration	Maintains high level of young trees at all times.	Prevents growth and regeneration of hardwoods that are more valuable for lumber.
Volume	Spreads wood production to trees of all sizes.	Must be regulated on a volume basis alone.
Size of tract	Suited for small hardwood woodlot management less than 50 acres.	Difficult to regulate on hardwood tracts greater than 50 acres.
Quality of timber	Produces greater variety	Reduces annual production of high quality saw-timber, increases volume of small trees that may not be salable.
Sustained harvest	Allows owners to select trees for harvest more frequently.	Requires detailed inventory of all trees more than 2 inches in diameter.
Record keeping	Accurate records for appraisal and future decision making always available.	Requires detailed inventory of all trees more than 2 inches in diameter.
Composition	Produces communities desirable for a wide variety of wildlife species.	Leads to eventual change in forest composition to tolerant trees that are less commercially valuable in terms of timber.
Age distribution	Develops stands with trees of many ages.	Difficult to judge annual growth rates and production of many ages.
Diversity	Selection produces stands with more species, ages, tree sizes and canopy levels.	Produces stands that are more complex, and so more difficult to harvest and maintain.
Economics	Spreads cash income on a more continuous cycle.	Not considered economical for hardwood management because of difficulty in record keeping and significant losses in high value sawtimber volumes.

Importance of Forest Site

A forest site includes the soil and the landscape it occupies, the vegetation it supports and the atmosphere. The success of any forestry activity is heavily dependent on site conditions.

Forest soils of Tennessee range from very productive to problem soils incapable of producing commercial timber. Consequently, every forest activity planned for a given area must be geared to the capability of the site. This is essential in making wise management decisions.

Forest soils provide trees with nutrients, oxygen (for root growth), water and physical support. The capability of a soil to produce a commercially valuable forest diminishes when one or more of these items becomes limiting. Soil series refers to various types of soils. It is helpful to know in which series a soil belongs. However, forest productivity by tree species often varies within a series. Your local Soil Conservation Service officer or your county Extension agent can help identify the particular soil series for a given area. An "ideal" soil for growing trees in Tennessee might be:

Deep - At least 4 feet to bedrock

Fertile - Contains ample quantities of organic matter, nitrogen, phosphorus, potassium, calcium and other essential elements

Well-drained - Not having a water table within the root zone at any time during the growing season and never for more than a few days during the dormant season.

Friable - Nearly equal portions of sand, silt and clay in loose aggregations with good tilth.

Most soils in Tennessee have some qualities of an "ideal" soil. There are many tree species that thrive in Tennessee soils, with each species having its own special soil requirements. Variable soil types also result in different mixtures of hardwoods occurring on a ridge versus those found in bottomlands.

However, soil is only one ingredient of a forest site. When making management decisions such as choice of species, method of regeneration, use of herbicides or site preparation, each characteristic of the site should be considered. Some other important characteristics are:

Aspect - The direction a slope faces affects soil moisture and temperature. Aspect plays a key role in site productivity.

Slope position - Slope position affects the degree of exposure to the sun and the quality of the soil. Steeper slopes are more prone to erode and require special care during road building and harvesting. Soil moisture concentrates at lower slope positions.

Elevation - Tree species sometimes grow within a range of elevations. Some species will not grow above certain elevations, while other species may thrive there.

Climate - This is the result of geographic location and helps to determine the natural range of a species. It is usually not wise to plant a species too far out of its natural range.

In addition to the soil and the above-ground environment, a study of the past land use plays an important part in forest site evaluations. If the area was once in agriculture, then one might consider the effects of farming on the site. The erosion of many abandoned old fields may have partially depleted the nutrients in the soil. Planted trees, especially most hardwoods, often grow poorly under such conditions. Recently abandoned fields may support a heavy sod cover that can prevent the rapid development of planted trees.

Yet, past land use also can be helpful for forestry. For example, terraces, cover crops, fertilizer and liming residues improve a poor soil, increasing site capability for growing high-quality trees.

Timber Harvesting Guidelines

Careful planning of timber harvesting operations can help assure timber regeneration and growth, enhance wildlife habitat, protect the soil from erosion, preserve visual values and reduce management costs. When possible, enlist the help of a professional forester who is experienced in forest management and conducting timber sales. Consider the following factors before conducting a timber sale:

Assure timber regeneration and growth: When regeneration of timber is necessary, choose a harvesting system that will create conditions necessary for regenerating desired species. A preharvest assessment is necessary to design a regeneration method that will adequately reforest the site and meet landowner management objectives.

With proper planning, timber harvests can create excellent "new" wildlife habitat. Distribution of cuts may also reduce the visual impact of harvesting operations. Trees can be harvested and regenerated from some areas, while leaving some of the forest land area undisturbed.

Enhance wildlife habitat: Manipulation of forest vegetation is a key to regulating and enhancing forest wildlife habitat. The basic components of wildlife habitat - food, cover, water and space - must be made available if favored species are to flourish, and must be provided

during every season. Habitat diversity can be achieved by creating stands of several age classes, ranging from seedlings and sprouts to mature trees. Therefore, unproductive woodlands can be transformed into productive wildlife habitat by conducting timber harvesting at regular intervals.

Openings created by regeneration cuttings furnish browse, forage and breeding areas for deer, while nesting areas, seed-producing plants, soft mast and insects are provided for turkey, quail, small mammals, many songbirds and other non-game species.

Small groups of trees may be left uncut in opened areas to provide cover and food for wildlife which use the area. Snags and live trees may also be left standing as perches for hawks and for use by cavity-nesting birds. Leaving large woody debris at some locations provides additional habitat for both large and small fauna. Pole-size timber affords escape and protective cover, as well as nesting habitat for many bird species.

Mature timber not only provides cover for forest wildlife and songbirds, but also produces most of the high-energy foods found in the forest. These include acorns, hickory nuts, walnuts and other hard mast that feed deer, turkey, squirrels and many other animals during the winter.

Water holes or ponds should be provided every one-quarter mile for use by wildlife if water is not already available in streams, ponds or lakes.

BMPs

Prevent soil erosion and water pollution: If improperly conducted, logging operations may degrade forest sites through erosion and cause sedimentation of streams and lakes. However, just cutting trees does not cause erosion in the forest. Most erosion is caused by activities associated with removing timber from the woods. These include such activities as construction and use of access roads, skid trails and log landings. Such activities remove the protective organic litter layer from the surface and loosen soil, making it vulnerable to erosion.

Best management practices (BMPs) were developed to reduce or prevent erosion caused by forestry operations. Conscientious use of forestry BMPs can prevent most erosion and nonpoint source pollution of streams and lakes caused by forestry activities in the woods. BMPs, for protection of water quality, should be incorporated in timber sale contracts and implemented during and after harvest operations.

Preserve visual values: Many landowners avoid managing their forest land because they fear the results will “look bad.” In many cases, forestry operations sometimes do look bad due to poor planning or thoughtless timber harvesting. Although cutting even one tree looks “bad” to some people, there are many actions that can be taken to reduce the visual impact of cutting trees and still achieve landowners’ timber, wildlife and other forest management objectives.

Tennessee’s predominantly hardwood forests have a surprisingly natural ability to regenerate themselves rapidly. Areas completely cleared of trees in spring will be covered with green plants by fall. In five years, the same area will be blanketed with trees 10-20 feet tall. Therefore, although recently-harvested, wooded areas are changed in appearance, rapid regrowth begins softening and improving the visual quality of such areas almost immediately. Such areas will produce a beautiful and vigorous new forest within the space of a few years.

Preservation of visual values, like every other aspect of forest management, requires careful planning. The following examples of visual management can be employed to ensure that landowners preserve the beauty of their wooded acres, while practicing sound timber and wildlife management.

Examples inclide:

- limit and vary the size of timber harvest areas,
- shape harvest areas to conform to natural landform,
- disperse harvest areas throughout the forest area,
- leave a 1/10 to one-acre patch of trees in open areas for wildlife cover and food and to soften the appearance of harvest areas,
- establish visual buffer zones 50-100 feet wide between harvest

areas and roads or field edges, selectively harvest mature individual trees within visual buffer zones,

- when thinning stands visible from roads or field edges, fell trees away from visible areas, or cut up visible logging debris to reduce visibility and speed-up decomposition.

Forest Health and Protection

Overall forest health is largely dependent upon the type of management and protection applied. Forest vigor can be maintained by good planning and timely application of management practices. Overall forest protection is most economically achieved through prevention of poor forest practices.

Forest health: When considering which trees to grow, select species which are well suited for growth on available sites. Otherwise, the lack or abundance of water, nutrients and other factors may result in unacceptable growth and development, premature decline and increased vulnerability to insect and disease attack.

As trees grow, their crowns expand and additional food is manufactured. Thus, to maintain vigor and prevent stagnation and decline, overstocked stands should be thinned. Thinning will remove slow-growing, poorly-formed trees to provide adequate growing space for well-formed trees of desirable species.

As do all organisms, trees grow to maturity and then decline in growth and vigor before dying. Some species, such as black locust and Virginia pine, reach maturity at a relatively early age, usually less than 100 years. White oak, bald cypress and beech, on the other hand, are relatively long-lived species and may live for up to three or four centuries. The death of older trees usually occurs as a result of increased vulnerability to such factors as competition from other trees, insect or disease attack, or ice and wind storms. Therefore, when income from timber production is the goal, trees should be harvested when they reach financial maturity, but before they begin to decline and die from natural causes.

Growing trees on suitable sites, maintaining the growth and vigor of stands and harvesting timber when it matures are the basic management principles that contribute to overall forest health. These principles are always implied in recommendations contained in a forest management plan. In addition, periodic inspections of woodlands should be conducted to detect pest infestations, storm and fire damage and any abnormal condition of stands, as well as instances of boundary and timber trespass.

Forest protection: Managed forests require protection from uncontrolled fire, destructive insects,

Thus, to maintain vigor and prevent stagnation and decline, overstocked stands should be thinned. Thinning will remove slow-growing, poorly-formed trees to provide adequate growing space for well-formed trees of desirable species.

diseases, animal pests and the potential effects of the weather.

When managing southern pines, fire may be used as an effective and economical tool for reducing the hazard of dangerous wildfires, clearing land for reforestation and improving wildlife habitat. When managing hardwoods and white pine, however, fire cannot be used as a management tool. Due to the thin bark of these species, fire causes damage and degrade to standing trees through stains, rots and insect pests.

The Tennessee Division of Forestry furnishes effective wildfire detection and control throughout the state. However, forest landowners should assess the potential hazards for wildfire on their property and take steps to prevent them. Such measures may include building fire lanes next to roads and railroads, maintaining favorable relations with neighbors and exercising care when burning trash and brush.

Other measures landowners should take to protect woodlands from damage and prevent timber loss include:

- inspecting woodlands at least once a year for evidence of damage by insects, diseases, animals, wildfire or storms
- salvaging damaged or infested timber promptly to reduce losses and prevent infestation or spread of disease or insect pests
- taking prompt action to control destructive animals, such as beavers, to prevent additional damage to trees by girdling and flooding.
- thinning stands to reduce the risk of insect and disease infestation and damage caused by ice, snow or wind storms.

Best Management Practices (BMPs) for Forestry Activities in Tennessee

Practice: Forest Access Roads

1. Locate roads as high above and away from streams and lakes as possible. When possible, locate roads near the crests of ridges on the side slopes to assure proper drainage.
2. Establish streamside management zones at least 25 feet wide between roads and water courses, to protect stream banks and to trap sediment and other materials that may enter streams.
3. Avoid stream crossings. When necessary, cross at right angles to minimize disturbance to stream banks and channels.
4. Construct roads on gradients ranging from 3-10 percent.
5. Drain water off roads as soon as possible, using outsloping, crowning, ditching, water bars, rolling dips and culverts as may be appropriate and practical.
6. Avoid or minimize use of roads during wet weather.
7. Revegetate cuts, fills and road surfaces as soon as practical to stabilize disturbed areas.
8. When logging activity has ceased, retire roads by reshaping and restoring all drainage structures. Revegetate disturbed areas. Close roads to traffic, especially during wet weather.

Practice: Forest Products Harvesting

1. Locate log landings on level ground well away from streams or major drains.
2. Skid trail gradients should not exceed 10 percent except for short distances.
3. Never use drains or stream courses as skid trails.
4. Establish streamside management zones at least 25 feet wide next to streams and major drains. Do not allow skidders and other equipment to operate inside streamside management zones.
5. Construct water bars on skid trails, and revegetate disturbed areas as soon as possible after logging operations cease.

Practice: Mechanical Site Preparation for Reforestation

1. Choose a site preparation method that will expose and disturb as little bare soil as possible.
2. Establish streamside management zones between site prepared areas and stream courses to prevent disturbance of stream banks and to prevent sediment and organic debris from reaching streams.
3. Operate site preparation equipment along the contour of the land to reduce soil movement.
4. Locate windrows well away from drains and along the contour of the land.

Practice: Pesticide Use

1. Choose pesticides suitable for use on target species and registered for intended use.
2. Before using a chemical, be sure that atmospheric conditions allow a maximum amount of chemical to reach the target species.
3. Never apply pesticides directly to water.
4. Maintain buffer strips to avoid drift or accidental application of chemicals.

Practice: Livestock Exclusion

1. Exclude livestock from woodlands to prevent erosion and to protect site productivity and timber growth.
2. Fence off small areas of shade along the woodland for animals to use as shelter. Plant groves of trees for livestock shelter on flat or gently sloping land.

Silvicultural Practices for Major Forest Types in Tennessee

OAK - HICKORY

Type description

Every physiographic region and nearly every county in the state has oak-hickory type forests. Nearly three-fourths of Tennessee's forests consist of oak-hickory stands. Therefore, management of this forest type is a matter of concern to a large number of the state's 250,000 landowners.

Some species of oak, particularly white, northern red and black, are prevalent throughout the state. These species become predominant and attain peak development on moist sites. Such areas include the lower mountain slopes and coves in the east and the bottoms and river terraces in the middle and western portions of the state. In the mountainous eastern areas, chestnut and scarlet oaks are more common in mixtures with those mentioned above. They are the principal species on poorer sites—dry upper slopes, ridge tops and dry upland flats. In the west, post, blackjack and southern red oaks are more likely to occupy the poorer sites.

Hickories are a consistent part of the oak-hickory type, although not to the same extent as oaks. Principal species are shagbark, pignut, mockernut and bitternut. Depending upon site quality, topography and climate, one may also find ash, blackgum, yellow-poplar, elm and various maples scattered throughout these stands. Sassafras, black cherry, black locust, black walnut, persimmon and a variety of other hardwoods grow here as well.

Oak-hickory forests are present today primarily because of past land use practices, the incidence of chestnut blight and fire protection. From the 1850s to the early 1900s, heavy logging, grazing and wild fires significantly disturbed Tennessee's forests. These practices promoted a forest understory of vigorous sprouting species. In the 1930s, the chestnut blight eliminated the American chestnut from the Tennessee forests. This tragic event allowed for oaks and hickories to further develop. Oaks and hickories have somewhat thicker bark and were able to survive some of the ravages of the wild fires. When intensive fire control programs began in the 1950s, the surviving oaks and hickories thrived. These species were able to mature and grow into our current forests.

Harvesting, Regeneration and Cultural Methods

Factors that contributed to the prominence of the oak-hickory forest (wildfire, grazing, heavy logging) have been reduced in modern times. This reduction, plus a successional process that favors more shade-tolerant species, have left the forest manager with a difficult challenge in regenerating oaks and hickories.

Harvesting in an oak-hickory forest and consequent regeneration are inseparably linked. There are certain species characteristics and site requirements that must be met before such a stand successfully regenerates and perpetuates itself as an oak-hickory type.

Most commercially valuable species that generally occur in the oak-hickory forest are intolerant or moderately tolerant of shade. These species require nearly full sunlight for successful regeneration and survival necessary to establish a new stand. On the other hand, less valuable species such as maple, blackgum, elm, beech, hickory, dogwood, hornbeam and sourwood; as well as many shrubs, are much more tolerant of shade. These species not only reproduce readily under shade, either from seed or seedling sprouts, but will exist for long periods under a relatively dense canopy. When released, they grow rapidly and may occupy a considerable proportion of the new stand. These commercially less desirable species must be controlled before the stand can be successfully regenerated to desirable species. This may be very expensive. Control methods available include the use of prescribed fire, mechanical girdling or complete stem removal. Chemical control via stem injection or ground spot treatments is also an effective method.

Oaks and hickories are sporadic seed producers. Unless conditions are ideal, very few oak seedlings will become established under a dense forest canopy. Inadequate light and moisture conditions retard the growth of new seedlings. Following overstory removal, seedlings that do survive have difficulty competing with less desirable but more rapidly growing seedlings and sprouts of other species. Oak-hickory seedlings must stay in a dominant position in the understory if they are to survive. Recent studies have shown that by eliminating the midstory, some oaks—especially white oaks—will become established and achieve a dominant position in the understory, thus preparing themselves as advanced regeneration.

Disturbances in the forest, such as fire, drought and harvesting, create opportunities for oak regeneration to advance. Such disturbances may kill or reduce other competing vegetation and allow more light into

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the understory. These disturbances are usually not fatal to oaks, but top dieback followed by resprouting of the seedlings may occur.

Stump sprouts survive in greater numbers than do seedlings. A mature root system from a former tree nurtures the young succulent sprout. This makes the sprout a hearty competitor and places it in a much better position to become a dominant member of the new forest. Stump sprouts generally are more vigorous than seedlings. Through the sprouting process, reproduction of these desirable species gradually increases in number and size, even under moderate canopies. Advance reproduction should be at least 4 feet tall and 1/2-inch in diameter at the root collar at the time of overstory harvest. This enables it, or sprouts starting from it, to compete successfully with other regeneration. Thus, oak-hickory stands begin the regeneration process before, not after, the final harvest cut. Efforts to harvest and regenerate such stands without adequate advance regeneration should not be attempted.

In much of the area occupied by oak-hickory forests, shade-tolerant hardwoods are climax types. Site quality, location, other species present and the response of these species to conditions created by cultural operations all affect the rapidity with which tolerant species replace the oaks and hickories. If the management goal is to perpetuate the oak-hickory forest, these species best reproduce and grow as even-age groups or stands.

Single-tree selection has not been used successfully as a silvicultural system for maintaining oaks. Some oak regeneration will become established and persist for long periods under selection cutting. However, it will not develop satisfactorily under a uniform canopy, even at a one-third stocking level. The result will be the change of the oak-hickory stand into one dominated by shade-tolerant and usually less commercially valuable species, such as beech and maple.

Group selection is a satisfactory method of cutting for the propagation of light-demanding and moderately tolerant species such as oak. The small, well-dispersed openings thus created leave the forest with the general appearance of having a full canopy. The size of the group cutting has little effect on either the density or composition of the regeneration. Resulting seedlings or sprouts will grow more slowly toward the edges of the opening as a result of competition from the adjoining canopy. Diameter of openings should be no more than two to three times the heights of adjoining trees. The disadvantage of this harvesting method is largely administrative and economic. The creation of many small stands of varying age classes makes them difficult to identify and treat in later cultural and harvesting operations.

When making a regeneration opening in the forest, attention should be given to the amount and type of vegetation left standing. Remove or kill all non-merchantable overstory trees and undesirable understory plants greater than 2 inches in diameter. Undesirable untreated plants will impede regeneration growth and could occupy a main part of the new forest.

Where sufficient advance reproduction of oaks is absent, clearcutting precludes oaks and hickories from the stand. On medium to poor sites, sprouts from the stumps of cut trees may provide an oak component in the new stand. Clearcutting on good sites without adequate advance oak regeneration may result in the conversion of the stand to more shade- intolerant species such as yellow-poplar, sweetgum or black cherry. This may be desirable if is consistent with long-term goals and the soil is sufficiently fertile.

If advanced oak and hickory regeneration is lacking, delay the final harvest cut. Manipulate the stand through light cutting to promote new growth. Control of the mid-story allows the oak reproduction an opportunity to become established. Once this growth has reached sufficient size and numbers, harvest the tract.

Shelterwood cuttings may be useful in encouraging advanced oak reproduction. Conduct at least two

cuttings over a five to 10-year interval to establish a new stand of oak. A good seed production year and proper balance of light is important in establishing advanced oak reproduction under the shelterwood method. Control of tolerant midstory canopies insures proper oak-hickory regeneration and growth. A good method of control is treatment with herbicides. The shelterwood system may have utility where aesthetics are of prime importance, but it has no advantage over clearcutting when adequate oak regeneration exists prior to harvest.

The seed-tree cutting method has little value in regenerating oak stands. The heavy seeds are poorly distributed, and the slow-growing seedlings are rapidly over-topped by other vegetation. Additionally, oaks have very sporadic acorn production. Seed trees might reduce the aesthetic impact of heavy cuttings and provide some mast for wildlife. To better achieve these goals, restrict the size and alter the shape of clearcut areas, and retain stands of mast-producing species along the borders of adjacent stands.

Regardless of the harvesting method used, and the time between the regeneration of a stand and its later harvest, periodic intermediate cuts should be made. Intermediate harvests depend upon the age and condition of the stand. Utilize the cultural practices of weeding, cleaning, release, salvage, thinning and timber stand improvement. These practices allow reduction of competition, improved stand vigor, improved composition, control of tree spacing and maintenance or improvement of growth rate. Thinning throughout the rotation also increases crown diameter, which may result in greater mast production for wildlife food.

Insects and diseases have little effect upon the choice of silvicultural systems for use in the oak-hickory forest. No practical control measures exist for either defoliating insects or oak fungal pathogens. However, because healthy, vigorous stands are less susceptible to infestation, you can lessen insect and disease outbreaks through judiciously applied improvement cuttings and salvage of infested material.

Cattle and hardwood forests are not compatible. Cattle eat, trample and otherwise destroy advance regeneration that is essential to the propagation of oak-hickory forests. Soils become compacted. If cattle need forest stands for shelter, a small area should be fenced off for their use.

OAK - PINE

Type Description

The oak-pine forest is the second most extensive forest type in Tennessee. It is largely a mountain type, mostly found from the Cumberland Plateau eastward.

These forests are transitional in nature, falling somewhere between the pioneer southern pine types and the climax upland-hardwoods or oak-hickory type on the successional scale. More than half of the trees in the oak-pine forests are hardwoods, principally upland oaks, with various upland yellow pines—loblolly, shortleaf and Virginia—accounting for between 25 and 49 percent of the total number of stems. The principal oaks are white, northern red, scarlet, black, chestnut and southern red, depending upon location and site. Associated hardwoods might be hickory, yellow-poplar, sweet or black gum, maples and ashes, combined with such understory species as dogwood, redbud and sourwood.

Harvesting, Regeneration and Cultural Methods

The silvicultural system and harvesting method used in the management of oak-pine forests depend largely upon site quality and ownership desires within the limits of site capability. These forests, due to their transitory nature, are seldom managed to perpetuate the type. Rather, they are usually managed either to hasten their transition into a climax hardwood forest, or to reverse normal trends and re-establish pines as the dominant species.

On moderate-to-poor sites, generally ridge tops, upland flats with shallow soils, and south and west slopes, the objective of management in oak-pine stand is generally to increase pine at the expense of the hardwood component. Pine is usually favored over hardwood here because it generally produces greater yields and faster rates of growth. Pine will grow satisfactorily and will produce profitable volumes even on shallow or eroded soils.

Most upland yellow pines are shade intolerant, and therefore require an even-age management system for successful regeneration. Also, more valuable hardwoods in the oak-pine type, such as yellow-poplar and northern red oak, are relatively intolerant, and regenerate best under silvicultural systems that produce even-age stands. To obtain maximum stocking of commercially valuable species in future stands, harvest cuttings must be followed by vigorous methods of species control, such as prescribed fire, use of herbicides or mechanical site preparation.

Most even-age systems of regeneration—clear cutting, shelterwood and seed tree—have been used successfully. However, the most effective method of re-establishing pine has been clear cutting with intensive hardwood control, and site preparation followed by planting or direct seeding of the desired species. This method allows the landowner to control both species composition and density. It also provides the opportunity of replacing a species with a more desirable one in particular problem areas, e.g., the replacement of natural shortleaf pine with loblolly pine in areas of disease susceptibility, or the substitution of shortleaf pine with loblolly pine in the northern sectors of the range where ice and snow damage is prevalent. Clearcutting and planting will probably become more economically feasible as genetically-improved strains of pine and hardwoods, with greater growth potential and more resistance to insects and disease, become more readily available.

Natural pine regeneration may sometimes be obtained under even-age management without planting or seeding. These techniques will generally result in the regeneration of another oak-pine stand, which may or may not be in

harmony with ownership goals and optimum land use. Natural pine regeneration will depend largely upon the number of seed-producing stems in the existing stand, the timing of the cut, site preparation and hardwood control. If the cut can be timed to coincide with a good seed crop, and adequate site preparation is carried out, sufficient natural regeneration may be obtained to maintain the existing pine/hardwood ratio, or even increase the pine component. How much of this regeneration will survive and establish itself in the new stand is directly related to the amount of hardwood competition control exercised early in stand development. Without this control on good soil, new pine seedlings will be rapidly overtopped by fast-growing hardwood seedlings and sprouts. On poor ridge tops, loblolly will outgrow hardwood seedling/sprouts without any treatment.

An oak-pine stand, if undisturbed, naturally develops into an oak-hickory, upland hardwood or cove hardwood stand. Losses of pines due to storms, insects, diseases or fire will create openings in the forest canopy. These openings are quickly occupied by oaks and other hardwoods already present in the understory. This natural process may be accelerated by applying silvicultural techniques which discriminate against the pines and favor hardwoods. This is particularly desirable on the better sites—bottomlands, coves and moist slopes with a north and east exposure—where site quality permits rapid growth of higher value hardwood species.

The method of accomplishing this transition is simple. By cutting mature pines heavily and hardwoods lightly, and exercising little or no hardwood control, the stand will be transformed into an all-hardwood stand on good sites. The advance regeneration present in the stand prior to the cut will determine, to a large extent, the species composition of emerging stands.

Before converting an oak-pine stand to pine, even on the poorest site, the landowner should consider the effects such a step will have on surrounding areas and wildlife. If the landowner is largely interested in maintaining or increasing wildlife populations versus commercial timber production, existing oak-pine stands may prove more valuable for wildlife habitat than would pure pine stands.

It is recommended, however, that many upland drainages and streamside management zones not be cleared and planted to pine, but be either lightly cut or left undisturbed. These “natural” areas will add diversity to the site and create numerous edges or transition zones, enhancing wildlife habitat.

BOTTOMLAND HARDWOODS

Bottomland hardwood forests are wetlands. These sites require the most sensitive silvicultural treatments. Because of the high productivity of these lands, forest management in bottomland hardwood offers a wide array of options to the forest land owner.

Type Description

Bottomland hardwood types occur on alluvial soils which are often subject to flooding and overflow. Over the years, flood-prone areas continue to change soil texture and land elevation due to siltation and soil deposition from flooding.

Bottomland hardwood tracts support some of the best wildlife habitat and produce some of the most valuable veneer and sawlogs in Tennessee. The major river bottoms of the state contain the largest and more productive bottomland tracts.

Pioneer bottomland hardwood types are cottonwood and black willow, and both occur in pure, even-age stands. Cottonwood usually seeds in on the higher areas of bar and island formations, usually the upstream and streamfront areas with lighter, coarser-textured soils. Willow tends to regenerate on the back side and downstream toe of islands and bars.

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Cottonwood stands will reduce stocking naturally in the early years without stagnation. In mixed stands, cottonwood usually dominates in eight or 10 years. Cottonwood matures in about 45 years, while willow stands begin to decline after 35 or 40 years.

Cottonwood is usually succeeded by a mixture of sycamore, sweetgum, sweet pecan, hackberry, elm and other riverfront hardwood species. Intolerant species like sweetgum occur in large openings. Willow breaks which are higher and better drained eventually give way to a combination of hackberry, soft elm, green ash, Nuttall oak, silver maple, honeylocust and river birch. On wide open sites, sweetgum and pin oak often take over as the secondary type. As soils build, age and become more acid, sweetgum and the red oaks such as water, willow, Shumard and cherrybark will predominate. The older types of the bottomland forest usually include various red and white oaks with sweet pecan and hickories.

Old river channels, which do not completely fill with sediment, will seed with bald cypress or tupelo gum. Establishment of these channels takes a long time because seed and water conditions must be just right for seeding to occur.

Harvesting, Regeneration and Cultural Methods

Bottomland hardwood management and regeneration depend upon the timber types, age and state of succession, past cutting practices, size and type of ownership and the owner's goals. One of the major considerations in managing bottomland hardwoods is to avoid disruption of the natural water flow pattern. Fortunately, forestry practices best suited in maintaining hydrologic cycles also produce abundant wildlife habitat.

One of the major consider-ations in managing bottomland hardwoods is to avoid dis-ruption of the natural water flow pattern.

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Adequate hardwood regeneration usually will not occur where soil water tables have been altered and where soil degradation has occurred. Water tables raised by catch basins, hydrologic dams and blocked or altered stream channels are usually associated with road construction, beaver dams or careless logging. Lowered water tables caused by stream channelization may also affect species composition, regeneration and growth. Altered water tables can cause reversion of a bottomland site to a less desirable timber type or to a nontimber vegetation.

Stand conditions downstream from major water impoundments generally show decline, butt rot of mature timber and wind throw. Uniform stream flow and prolonged flooding which maintain a high water table may result in decline of the stand. This situation differs from the natural ebb and flow of water from streams without impeded drainage patterns.

Managing mixed hardwood forests is complicated. Before choosing a harvesting plan, landowners should perform a comprehensive survey of the site conditions and stand composition. Research and experience have shown that bottomland hardwood stands with less than 20, 40 and 60 square feet per acre of basal area of wood, at ages 20, 30 and 40 years respectively, are potential candidates for a regeneration-type harvest. The information needed for regeneration for each stand includes: 1) condition and size - distribution of the overstory trees for each species, 2) quantity of all understory tree species, 3) amount and type of competing vegetation, and 4) seed crop and seed bed conditions.

Silviculture of mixed bottomland hardwoods favors certain species over others for sawlog production because of form, quality, value and rate of growth. Preferred species for sawlog production include: cottonwood, sycamore, sweetgum, sweet pecan, green ash, cherrybark oak, Nuttall oak, willow oak, white oak, cow oak, black walnut, yellow-poplar and bald cypress.

The landowner should consider the existing competition prior to harvest of a bottomland hardwood forest. A jungle of undesirable tree species, vines, briars and annuals often results after the harvest of a bottomland forest. However, in judging the success of a regeneration cut, one must show patience. After 10 to 15 years, intolerant species begin to express dominance. In alluvial bottoms these intolerant species include green ash, cherrybark oak, yellow-poplar, sycamore, river birch and eastern cottonwood. For muck swamps, the preferred species include swamp black gum, tupelo gum, bald cypress and green ash.

Growth in many existing unmanaged natural bottomland stands may only be 40 board feet per acre or more per year. Managed hardwood stands should develop and maintain a base volume of 4000 board feet per acre. A 7 to 8 percent annual growth (280 board feet per acre per year) is possible in well-stocked, managed stands.

Research shows large responses in growth in bottomland hardwoods when stocking levels are adjusted early in stand development.

Releasing a young stand should be adequate to allow tree crowns enough room to develop during the cutting cycle. On good sites, stands should be cut back to about 80 square feet of basal area per acre.

Scarification caused by normal logging operations in openings is usually helpful in bottomland hardwood regeneration. As seedlings develop in the openings, they must be released by removing trees in other areas.

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This publication considers well-stocked and well-managed stands. However, throughout many Tennessee river bottoms, woodlands have been exploited and mismanaged, becoming fully stocked with saplings and poles of undesirable species. Many bottomlands are literally a jungle of weeds and vines, with a scattered overstory of overmature cull trees. If there are adequate numbers of saplings or small poles of preferred species in the stand to produce future crop trees (30-40 per acre), then removal of undesirable trees should be the first corrective step. If crop trees are sparse, later selection cuts may be delayed or widely spaced in time. If adequate numbers of potential crop trees are not present, and timber production is the primary goal of ownership, then clearcutting may be necessary. Remove all trees greater than 2 inches in diameter. If a seed tree of a preferred species is available in the area and seeded conditions can be created by exposure of mineral soil, an excellent stand may be obtained. However, newly established regeneration obtained must compete with vines and weeds, and therefore is often slow to emerge as a visible stand.

Trapping is the best way to control beaver populations.

Landowners may reforest bottomland hardwood sites successfully by artificial regeneration. Both planting seedlings and direct seeding are options for reforestation work.

One key to planting hardwoods is matching the species to the site. Landowners should evaluate the drainage patterns, flood hazards and soil types before planting a hardwood species.

Cattle and hog grazing are not compatible with growth and regeneration of mixed hardwoods. Landowners should also prevent livestock grazing from damaging hardwood timberlands. Bottomland sites are not conducive to excessive soil erosion. However, extensive areas of hardwood forest have sustained damage and heavy mortality from blocked drainages and silt deposits from upland sites.

Landowners should take precautions to prevent blockages in the natural drains of bottomland soils. Keep clearings for log loading sites as small as possible. Where plantations are established on river banks, maintain uncut strips of timber on the river bank. Leave filter strips along sloughs and bayous when clearing for plantations. Keep permanent riverbank log-loading sites in ground cover when not in use. Remove temporary fills for haul roads across dry drains and sloughs when no longer in use. Culverts and bridges should be used in water-filled sloughs and bayous to prevent blocked drainage. Drains and sloughs blocked by natural siltation during overflow should be kept open, if possible, to prevent water-killed timber. Ditching may require government permits to dispose of dredged material.

Control beaver populations where they cause or contribute to flooding and timber mortality. Trapping is the best way to control beaver populations. Continuous trapping may be necessary to control populations.

Wildlife managers rate bottomland forests as prime habitat. Bottomland hardwoods have a higher deer-carrying capacity than any other forest type in the South and perhaps in the nation. Research has shown carrying capacity of one deer per 10-12 acres in many bottomlands. This compares with one deer per 18-20 acres in upland mixed hardwoods, and one deer per 25-30 acres in the oak-pine type. Similarly, turkey, squirrel and rabbit habitat in bottomland hardwoods is equal to or superior to other forest types in Tennessee.

Finally, bottomlands make a great contribution to the welfare of waterfowl, especially mallards and wood ducks. Both species are acorn feeders, and thus find the frequently

flooded bottomlands with abundant oak species perfectly suited to their needs. In these environs, waterfowl also feed on invertebrates found on the underside of dead leaves for needed protein. The importance of bottomland woodlands to the overall waterfowl picture is clear from study of both the Atlantic and Mississippi flyways. In both flyways the mallard and wood duck rank first and second, respectively, in the total duck harvest.

Other less tangible benefits are the aesthetic, recreational and ecological roles that bottomland forests play. Forests along the drainages slow and hold water in time of flooding, acting as a giant funnel releasing water slowly when needed. Also, the forest has a profound effect on the ground water supply by modifying and slowing any abrupt changes. Still unknown is the complete role of the bottomland forest in affecting local rainfall, humidity and related weather patterns.

These intrinsic and ecological values of the forested wetlands of Tennessee affect and improve the quality of life for all Tennesseans.

COVE HARDWOODS

Type Description

Cove hardwoods occur most frequently in the Plateau and Eastern regions of Tennessee between elevations of 500 and 4,000 feet. They are typically found on northerly and easterly aspects, lower and middle slopes, coves and ravines, and valley floors. Stands are characterized by a large number of dominant and sub-dominant trees and by a great diversity of species. Species present in the stand and their proportions vary considerably due to past treatment, natural stand disturbances and sites of different quality, aspect, elevation and latitude.

Cove hardwoods are highly productive and typically occupy good-to-excellent sites. Soils are fairly deep, medium-textured and well-drained. Annual precipitation is well distributed and ample, ranging from 40 to 55 or more inches. On these rich sites, major species are long lived and attain very large sizes.

A single species, such as northern red oak or yellow poplar, occasionally dominate a stand, but typically 25 or more species will be present. Important components are yellow-poplar, northern red and white oak, sugar and red maple, American beech, white ash, American basswood, black cherry, cucumbertree, sweet and yellow birches, hickories, yellow buckeye and black locust. Other species occur occasionally, including a few conifers such as eastern white pine and eastern hemlock. On good sites at higher elevations, the type merges in many places with northern hardwood-black cherry mixtures. On drier situations with shallow soils, the type gives way to oak-hickory.

Harvesting, Regeneration and Cultural Methods

Stand condition is probably the most significant consideration in determining silvicultural needs, and stands should be classified as a first management step. These classifications should reflect factors of damage, quality, density and age. The following are offered as examples of condition classes: damaged poletimber, damaged sawtimber, sparse poletimber, sparse sawtimber, low quality pole-timber, low-quality sawtimber, mature poletimber, mature sawtimber, immature poletimber, immature sawtimber, and seedlings and saplings.

Stand management in cove hardwoods is complicated by the wide range of conditions present. The many species associated with this type range from intolerant to moderately shade tolerant. There also may be wide variations in site index.

Recommended management activities for cove hardwoods will generally fall into one of two categories: intermediate cutting or thinning, and harvest cuts for regeneration.

Cove hardwoods generally require intermediate cuts to produce large, high-quality trees. These cuts will usually consist of either a cleaning or commercial thinning operation. Cleaning takes place in seedling and sapling stands less than 20 years old during the period of rapid growth when crown class differentiation is occurring and mortality is high. Cleaning should include the following considerations:

1. The goal is to select preferred species, improve stem quality, shorten the rotation and enhance wildlife habitat.

2. Timing is critical for success. If done too early, cleaning will encourage sprouting, which may overtop selected trees. If cleaning is delayed, the opportunity for exerting a lasting influence on the stand may be lost. Depending on site, existing conditions and objectives, the proper time for cleaning is when the stand is about 10 years old.

3. The intensity will vary with conditions, but should follow the rule of doing as little as possible to meet the desired goal. Attention should be focused on selected crop trees and removing their competition. Overtopped stems should be ignored.

4. A well-spaced stand of 100 crop trees per acre, free-to-grow, is generally accepted as a desirable goal.

The principal cove hardwood species respond favorably to thinning, although response varies with species, sites, residual density, tree size, vigor and age.

Yellow-poplar is among the fastest growing species in cove stands, but others such as northern red oak and black oak do comparably well. Intermediate in rate of growth are red maple, basswood and ash. White oak, chestnut oak, sweet birch and the hickories are among the slow-growing species.

If the landowner's objectives include maximum production of sawtimber, management should stress diameter and board foot growth of individual trees rather than total cubic foot growth within the stand. Cubic-foot growth, unlike diameter growth, increases with the number of trees per acre. Thinning to encourage growth of individual stems may reduce to some extent this cubic-foot volume growth, but diameters of individual crop trees and board foot volume growth of the stand will be enhanced. Most unmanaged stands in Tennessee are overstocked for optimum diameter growth of individual stems and board-foot growth of the stand.

Thinning eliminates poor-quality trees and less desirable species, thus concentrating growth on crop trees. There is, however, a potential danger of epicormic sprout-

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ing, a natural reaction of many trees exposed to increased sunlight on their boles, typically occurring following logging where the remaining trees are exposed to increased sunlight. Many small branches develop below the crown, reducing the ability of the tree to produce grade lumber. In cove hardwood stands, susceptibility to epicormic sprouting varies with species, but is most prevalent on trees under stress and low vigor. The amount of sprouting also depends on intensity of thinning, and is related to individual tree genetic characteristics. The risk of epicormic sprouting is greater on poor sites and most commonly occurs on the southerly faces of exposed tree boles.

The timing of intermediate cuts can be quite flexible, and for this reason, economic considerations often influence scheduling. Because cove hardwoods are commonly composed of many species with varying growth potentials and different age classes, cove hardwoods do not stagnate. Depending on the situation, the option exists for either light-but-frequent thinnings, or relatively heavy thinnings at longer intervals.

Cove hardwoods are so complex that no one silvicultural system can be considered best for all conditions. All hardwoods sprout vigorously when small, and seeds of some species such as ash, yellow-poplar and black cherry are produced in abundance annually and remain viable in the forest liter or duff for several years. Natural hardwood reproduction usually occurs following any type of harvest cutting.

The silvicultural system and its associated harvest cutting method greatly influence species composition, due to the wide variety of species and their varying degrees of tolerance to shade.

Uneven-age management with selection cutting causes the least disturbance in the forest canopy. It tends to encourage shade-tolerant species such as sugar maple, beech and hemlock. Thus, this system favors the economically less valuable, slower-growing tolerant species and discriminates against more light-demanding species.

Group selection or patch cutting of small areas, one-half to one acre in size, permits the establishment of light-demanding species such as yellow-poplar and black cherry. But management costs are high and there is a loss of quality in border trees around the openings due to epicormic sprouting. As stated earlier, this system does not lend itself to intensive forestry when timber production may be the principal objective.

Shelterwood cuttings appear to be a promising method for regenerating species with intermediate shade tolerance. When advance regeneration is lacking, this method has some advantage in establishing oaks, hickories and other mid-tolerant species. However, it also favors those that are more tolerant. The shelterwood method may have its best utilization where aesthetics are important.

The seed-tree method is of little value in the regeneration of cove hardwoods. The heavy seeds of cove hardwoods, such as oak, are poorly distributed, while the light seeds of yellow poplar, ash and black cherry and certain other species are usually already sufficiently available in the forest floor.

Clearcutting is a highly useful tool for the regeneration of fast-growing intolerant species such as yellow poplar and black cherry. Where adequate advance reproduction is present, it also encourages development of oaks, hickories and other mid-tolerant species. Clearcutting may well be the most economical and preferable method when wood production is the primary objective. However, in scenically sensitive locations, aesthetic objections may limit clearcuts to small areas.

Although it is important to follow Best Management Practices (BMPs) when planning harvest activities on all forest types, it may be most critical in cove hardwoods. Cove sites are characterized by deep soils and slopes that are often steep, with an increased risk of soil erosion. A well-planned harvest including the implementation of BMPs will minimize soil loss, while allowing the landowner to meet his or her forest management objectives.

PINE

Type Establishment

Traditionally, Tennessee is considered a hardwood state. Hardwoods will grow in all regions and there is significant established industry to utilize this resource. However, pine is increasing in importance. About 20 percent of the state's forest lands consist of pine or pine-hardwood types. Pine offers the landowner the advantage of higher per acre yields on poor sites. Sites which might be suitable for planting pine include old fields, ridgetops, eroded hillsides and poor southwest slopes. Although pine will grow well on almost any site, it does respond as site quality improves. Elevation, soils, aspect, moisture and winter temperature all impact where a pine species will grow. On good sites, hardwoods must be controlled to insure adequate pine survival and growth.

There are several species of pine that grow well in the state. Each species has special needs and requirements for survival and some are more commercially valuable than others.

Loblolly pine is fast growing and produces many valuable products including pulpwood, lumber, plywood and poles. One drawback of loblolly pine is that it is not a native species to many counties of the state. Cold winter temperatures plus heavy snows and ice storms may inhibit loblolly from maturing.

Tree improvement programs in Tennessee have been partially successful in breeding trees that can perform well in Tennessee and resist cold and ice damage. Virginia pine is preferred on poorer sites and at higher elevations. It is an excellent tree for erosion control or for site reclamation following mining. Due to its shorter needles and steeper branch angles, Virginia pine is much more resistant to snow and ice damage than is loblolly. Virginia pine does not grow as rapidly as loblolly and yields fewer economic products at maturity.

Shortleaf pine occurs naturally in many areas of the state, usually on good sites. It is also planted primarily for sawtimber production. Although it will make excellent pulpwood, it will take much longer to mature than loblolly or Virginia pine.

Eastern white pine grows naturally in eastern Tennessee and prefers a good site with adequate moisture. In the past few years, eastern white pine has been widely planted for Christmas trees and for ornamental transplant stock. Large eastern white pines are valuable for lumber used in pattern making for the furniture industry. Currently, timber sales are generally for sawlogs and logs for log homes.

Harvesting, Regeneration and Cultural Methods

Harvesting methods for pine basically consist of group selections and clearcuts. Single tree selection is not preferred because pines are shade intolerant and must be established under even-age conditions. A modified shelterwood method or a seed tree harvest can be utilized if natural regeneration is planned.

After harvesting is complete, the site should be prepared for regeneration. The method of regeneration will largely dictate the type of site preparation necessary. Less-intensive forms of regeneration require less-intensive forms of site preparation. A more detailed discussion follows in the section titled "Stand Conversion."

Pines can be regenerated by natural seeding, direct seeding or by planting seedlings. The methods differ both in cost and effectiveness. The landowner must fully understand the ramifications of each method beforehand.

A modified shelterwood harvest or a seed tree cut can provide for natural pine regeneration. This technique requires the harvesting of all trees, except for those mature, cone-bearing trees left behind to provide seed. As seed drops and germinates, the new stand starts to fill in below. Once sufficient regeneration is present, harvest the seed trees and complete the operation.

Seed tree regeneration offers the most cost-effective means of regenerating pine. It does have some significant limitations, however. First, the landowner must regenerate to the same species that was growing before. A tract that was forested with shortleaf will come back to shortleaf. This negates any opportunities to

work with genetically improved materials and the enhanced growth characteristics that come with such stock. Second, stocking can be a hit-or-miss proposition. In years of good seed production, adequately-stocked to over-stocked stands are common. Similarly, in poor years of seed production, under-stocked stands may occur. Third, removal of seed trees frequently causes damage to the regeneration. And finally, seed trees are subject to lightning strikes, wind throw and ice damage.

Direct seeding is a variation of natural seeding. Following a group selection or clearcut, pine seed is broadcast on the harvest area by airplane, helicopter or ground equipment. Positive attributes associated with this method include moderate cost, the opportunity to switch from one species of pine to another and the use of genetically improved seed. As with natural seeding, the main drawback to direct seeding is the amount of seed that actually germinates. Frequently, too many seed germinate and stands with too many trees clumped in an area may result.

Planting nursery grown seedlings is the most common method of regenerating pine. It is also the most expensive means. Success rates are high if proper procedures and techniques are used. Advice from a professional forester can help the landowner achieve a good planting job.

A forester can help the landowner locate proper species, find a good seed source, and locate quality seedlings. Most nurseries grow two types of seedlings—woods-run and genetically improved. Because woods-run seed is collected from a variety of trees, the seedlings produced exhibit great variety in size, shape, growth, etc. This variation results in a plantation that may not grow at an optimum and uniform rate.

Genetically-improved seedlings are produced from seed collected from preferred seed sources or seed orchard. Each tree in the orchard has certain superior characteristics. As the superior trees produce seed, their offspring receive their genetic traits. This results in a forest more genetically equipped to handle the harsh realities of the local environment. For example, genetically-improved loblolly pines grown for Tennessee landowners have traits that enable them to survive freezing winter temperatures. If available, the landowner should use genetically-improved planting stock, even though it is slightly more expensive than woods-run stock. Seedlings should be ordered in the summer prior to the planting season, which runs between December and April.

Availability of labor and equipment, along with local site conditions, determine the decision to hand- or machine-plant. If the site is steep or rocky, hand-planting may be the only alternative. On well-prepared sites, survival and growth are usually superior when seedlings are machine-planted. Tractors (crawler or farm type) in the 50-75 horsepower range are ideal for pulling a planting machine.

The spacing of trees in a plantation is determined by the objectives of the landowner. Wider spacings produce salable trees earlier. An 8 x 8, 7 x 9, 7 x 8 or 6 x 10-foot spacing is recommended. This gives each tree about 56 to 64 square feet of growing space and makes thinnings possible in 12 to 18 years. With a wider spacing, there are reduced planting costs, minimum mortality before thinning and increased growth rates.

After pine is successfully regenerated, either by seeding or planting, intermediate treatments may be required. Hardwoods must be controlled during the early years of the plantation to achieve maximum pine growth. Failure to do so probably will produce a mixed pine/hardwood forest.

Possible methods of removing hardwood competition are:

1. Foliar application of herbicides

Recommendations for specific herbicides cannot be made with any reliability since their authorized use is subject to rapid change. Only herbicides approved by the Environmental Protection Agency can be used. Consult a professional forester before the use of such chemicals and follow the manufacturer's label. Foliar applications of herbicides are done most efficiently and safely using a helicopter equipped with a drift-control system. Ground applications are also possible using tractor-mounted sprayers or hand crews.

2. Stem application of herbicides

This can be done by applying EPA-approved chemicals to an axe-made frill around the tree, or with tree injectors at the base of the tree. This treatment is most effective during the growing season. Some new herbicides can be sprayed directly to the stem and absorbed into the tree through the bark. This technique is called a basal spray treatment.

3. Girdling

Girdling involves the use of an axe or hatchet to remove a ring of bark around the tree. Some species have a tendency to "bridge" the girdle and live. For a more effective treatment, apply EPA-approved herbicide to the girdle, as in stem application.

4. Prescribed burning:

Fire can be used to reduce fuel and brush in older pine stands. Stands must be 15 to 18 feet tall and have stems diameters at 4 to 6 inches. Used under the right fuel moisture and weather conditions, and properly supervised, fire is a useful tool for pine management. It can have disastrous results, however, if improperly used. A state burning permit is required. Consult with a professional forester before any prescribed burn.

If overstocked (such as from direct seeding), pre-commercial thinnings may be needed during the first five years if the stand is to achieve any reasonable growth. Pre-commercial thinning can be achieved by removing pines in strips with bush hogging, discing or applying herbicides.

If one of the landowner's goals is to grow sawtimber, a first commercial thinning may be necessary at ages 12 to 18. Two thinning systems are in general use today: (1) free thinning, leaving the best trees in the stand for the final harvest cut, and (2) row thinning, removing every second or third row of trees.

The number of trees left after thinning depends upon the carrying capacity of the land. As the stand ages, for a given site the fewer the trees per acre that can be maintained. There are several factors to consider when determining how many trees to remove in a thinning from a pure pine stand, such as, stand density, growth, site, crown age, the vigor, etc. Consult a professional forester prior to determining which trees and how many trees to remove in a thinning.

Finally, protect pine stand from insects, disease and wildfire. A landowner must periodically check the trees. If the area has a history of wildfire problems, firelines may be needed around the perimeter of the pines. Disease and insect outbreaks can be partially controlled through salvage harvesting operations.

Wildlife habitat value of the pine stands depend on many factors, including the species composition of the under- and mid-story. Stands with honeysuckle as the primary species covering the forest floor have high carrying capacities for deer and turkey. A dogwood mid-story, with stems 2 inches DBH and over, provides soft mast (pulpy fruit) in the fall. Sapling- and pole-size mid-story provides cover for deer and grouse. Log-road re-

vegetation after a cut can provides useful amounts of forage.

Stand Conversion

Converting hardwood stands to pine is a management option that some landowners may wish to consider. Extremely poor hardwood sites generally are more economically productive if reforested in pine. Stand conversion is only recommended following a clearcut. Methods of conversion include:

(1) Clearing. On flat ground and on moderate slopes, land clearing is an excellent conversion technique. This is the most expensive method, but is generally also the most successful. The clearing process usually involves shearing the remaining brush and cull trees from the ground with a crawler tractor-mounted blade, piling the brush in windrows, burning and single or double discing with a heavy offset tandem disc.

(2) Use of herbicides. Stand conversion with herbicides commonly consists of foliar spray applied by helicopter equipped with a drift control system. Mist-blower applications, except inside large acreages, tend to drift. The amount and species of brush on the land determines the actual formulation of spray mixture. After full leaf development, spray areas, control burn in late August or September and then plant or seed with the desired species during the winter.

(3) Use of fire. Following a clearcut, a controlled burn is often adequate to remove undesirable brush and suitably prepare the area for planting. Use of fire is dependent on weather conditions, but it is a valuable and relatively inexpensive site preparation tool.

Erosion associated with stand conversion may result from land clearing or plowed fire lines. However, erosion can be limited by clearing only slopes of less than 25 percent, piling windrows continuously on the contour, discing on the contour and planting on the contour. Building waterbars on firelanes will also reduce erosion. Normally, after the first growing season, there is an adequate cover of grass and weeds to prevent any significant amount of soil movement.

Marketing of Forest Resources

Many marketing opportunities exist for the Tennessee forest landowner. These range from the sale of timber to the sale of access for hunting. With this great diversity of forest products, it is almost impossible to specify any one set of possibilities as being “the best” for a particular owner. Since the prime producer of income to the forest landowner is the sale of timber and wood products, this aspect of the landowner marketing possibilities will be stressed. Because of the complexities associated with the sale of timber, the landowner should seek assistance from a professional forester (private consultant, state service forester, Extension forester or industrial forester) as early as possible. Given the landowner’s objectives, the forester can assist with the design of a sale to best meet those goals. In many cases, harvesting to achieve financial goals is consistent with the achievement of other goals. Regardless of the objectives of the timber harvest, consideration must be given to the re-establishment of the stand. Again, the professional forester can help the landowner decide on a regeneration plan that fits his or her goals.

There are several ways to designate harvestable trees. These have already been discussed in connection with appropriate silvicultural practices for each forest type. In any selective harvest, trees should be marked to be cut on both the bole as well as the stump.

Before making a sale, determine the volume of the trees to be sold. Such a volume determination will usually involve an assessment of quality and species identification. The only reliable method is to estimate the volume of all trees to be cut with assistance from a professional forester. The volume will give the landowner an inventory of the forest products he or she intends to sell.

Volume determination can also be achieved by measuring or scaling the products after they have been harvested. This can take place at the harvesting site or at the mill that purchased the products. This method of inventory doesn’t give the landowner any prior information about the sale and could result in a poor marketing decision.

After specifying which trees to cut and determining stand volume, a selling price must be established. The landowner can simply determine the stumpage price of each species, size and quality tree, and multiply by the volume to determine the total price for the sale. The local state service forester or other landowners who have recently made sales are good sources of price information.

The best way to sell timber is to solicit sealed bids. Research has proven that sealed bids are the best way to receive the highest price for timber. By inviting sealed bids, landowners 1) exploit the total market for timber, 2) develop competition among all the buyers, 3) notify the buyers of condition of sale, 4) may be assured that at least a minimum acceptable price will be reached, and 5) may prevent collusion among buyers.

An alternative is to advertise or auction the standing timber. Advertise sales by mail, in trade journals, local papers and by word of mouth. The key to successful timber marketing is to be patient. Since

timber is not a liquid asset, and the wood markets tend to be volatile and cyclic, it may require six to 18 months to receive fair market value for standing timber. Be patient.

Timber sales which contain high value products like veneer logs and cooperage bolts should be considered differently. Landowners will likely receive a greater monetary gain by selling these products separately. In some cases pulpwood and sawtimber may be effectively marketed separately. Prices may different enough between products to warrant special consideration.

A timber sale contract should be constructed early in the marketing process so that potential buyers will completely understand the terms and conditions of the sale prior to submitting bids. Seek competent legal aid during this process. A contract provides for methods of measurement, prices, termination dates, access, liabilities for damage and other aspects that may be of importance to a particular landowner. Sellers should include as part of their contract that Tennessee Best Management Practices be followed in the timber harvest. The seller should inspect the sale area during and after completion of the harvest to assure compliance with the contract.

Forest landowners have many non-timber products that can be marketed. Gravel, stone, and sand are always in high demand. Vegetative materials like ginseng root are readily sold to herb buyers. The commercial and ornamental nursery industry buys numerous young trees and saplings from growers. They also buy mulch in the form of tree bark, sawdust and pine straw. All these products are derived from the forest and can be sold for the benefit of the landowner.

Hunting access represents another readily marketable commodity for the forest landowner. As competition for public hunting property increases, hunters continue to vie for private property for a exclusive place to hunt. Lease arrangements or a day use fee system are the most common agreements reached between landowners and hunters.

Sources of Assistance for Landowners

There are many sources of information for landowners on how they may better manage their forest lands and where they may market the products.

The Tennessee Division of Forestry (TDF) provides services in timber management and to a limited degree in timber marketing. TDF is also the public agency that approves the eligibility of landowners for government cost share programs, such as the Forest Stewardship Program. The Forest Stewardship Program is designed for forest landowners who have multiple use objectives and intend to implement forestry stewardship practices on their land. Enrollment offers landowners opportunity to participate in the Stewardship Incentive Program (SIP) for government cost share assistance for such practices as wildlife habitat improvements, road construction improvements, tree planting, fencing for water quality improvements, etc. The state service forester can give the landowner information with regard to these valuable subsidies.

The Extension forester of The University of Tennessee Department of Forestry, Wildlife and Fisheries serves as a source of educational assistance and technical information for landowners. This service is available through Agricultural Extension Service county agents. Assistance is also available in certain areas from the Soil Conservation Service, the Tennessee Valley Authority and Tennessee Wildlife Resources Agency.

In addition to public sources of information, private consulting foresters provide valuable landowner services, particularly in the area of timber sales administration and marketing. A list of consulting foresters in Tennessee is available from most Tennessee Division of Forestry offices.

Landowners who are committed to wise forest management are eligible to enroll at no cost in the American Tree Farm program, which is administered in Tennessee by the Tennessee Forestry Association (TFA).

Landowners who are committed to wise forest management are eligible to enroll at no cost in the American Tree Farm program, which is administered in Tennessee by the Tennessee Forestry Association (TFA). Tree Farm foresters will help the landowner develop a management plan designed to meet his or her goals, and will periodically inspect the tree farm at no charge. Many of Tennessee's best-managed forests display the familiar green and white, diamond-shaped "Tree Farm" sign.

Several of Tennessee's forest products companies provide a service to landowners who are interested in practicing forestry. These companies offer agreements in which landowners receive professional assistance and services in return for a commitment to practice intensive forestry. A list of these programs is also available from the Tennessee Forestry Association.

Appendix

Agencies Assisting Landowners

State Forester
Tennessee Division of Forestry
P. O. Box 40727, Melrose Station
Nashville, TN 37204
(615) 360-0724

Extension Forester
The University of Tennessee
Agricultural Extension Service
P.O. Box 1071
Knoxville, TN 37901-1071
(615) 974-7346

State Conservationist
Soil Conservation Service
675 US Courthouse
801 Broadway
Nashville, TN 37203
(615) 736-5471

Executive Director
Association of Consulting Foresters
of American, Inc.
5400 Grosvenor Lane, Suite 300
Bethesda, MD 20814-2198
(301) 530-6759

Forestry Leader
Tennessee Valley Authority
Forestry Building
Norris, TN 37828
(615) 494-9800

Executive Director
Tennessee Forestry Association
P.O. Box 290693
Nashville, TN 37229
(615) 883-3832

GLOSSARY

alluvial soil A soil consisting of recently water-deposited sediment and showing practically no soil horizon development.

basal area The area of the cross-section of a tree stem including bark, generally at breast height (4.5 feet from the ground).

Best Management Practices Harvesting and silvicultural guidelines developed to reduce the amount of soil erosion resulting from logging and other forestry-related activities.

carrying capacity The maximum number of a given species that can survive on an area without deterioration of the environment.

cleaning A cutting made in a stand not past the sapling stage. This releases the best trees by removing less desirable individuals of the same age which overtop them.

climax forest The final stage in natural plant succession in a given environment. The plant community has reached a highly stable condition, and will not change in composition unless there is a change in climate and/or soil.

commercial forestland Forest lands capable of growing merchantable forest products, and not being withdrawn from such use.

cruise A survey to locate and estimate the quantity of wood on a given area according to species, size, quality and possible products.

cutting cycle The planned interval of time between successive cuttings.

DBH Diameter at breast height. The average stem diameter, outside bark, at 4 1/2 feet above ground.

dominance The influence that a species exerts, measured by the total cover or mass that it occupies within a community.

epicormic branching A branch that sprouts from a dormant bud on the stem of a woody plant.

even-age A silvicultural system wherein the age difference between the youngest and oldest trees is less than 20% of the length of the rotation.

forest stand A community of trees, sufficiently uniform in composition, age and spatial arrangement to make it distinguishable from adjacent plant communities.

forest type A category of forest defined by its particular vegetative composition; i.e., the predominant species that occupy the area.

frilling Girdling by making a series of downward and overlapping incisions; usually done for the introduction of herbicides.

intermediate cutting Any type of tree removal from a stand which takes place between the time of its formation and the final harvest cutting.

pioneer species A plant capable of invading disturbed areas and persisting until replaced by successor species having more exacting environmental requirements.

pole Trees that are from 4-to-10 inches in DBH.

prescribed fire Controlled application of fire under carefully supervised conditions to achieve planned objectives.

release Freeing a tree(s) from competition by eliminating species that are interfering with optimum growth performance.

rotation The number of years between the regeneration of a forest stand and its final harvest cutting.

salvage cutting Utilization of trees that are dead, dying or deteriorating.Usually following a natural diaster like a wildfire, storm, or insect.

sanitation cutting The removal of dead, damaged or susceptible trees, to prevent the spread of insects and/or disease.

sapling Trees that are less than 4-inch DBH and more than 3 feet tall.

scarification Disturbance of the surface layer of soil that supports forest vegetation, thereby exposing the mineral soil and making it receptive for seed germination and plant growth.

site An area considered in terms of its environment, particularly as this determines the type and quality of the vegetation the area can support.

site index A measure of the relative productive capacity of a site. The height of the dominant trees in a stand at a specific age for a single species.

site preparation Removal of unwanted vegetation, branchwood and other residue on the ground before the establishment and forest regeneration of an area.

soil series The basic unit of soil classification, consisting of soils that are alike in all major profile characteristics of the surface layer.

soil type A sub-category of a soil series, based mainly on the surface layer texture; i.e., percentage of sand, silt and clay.

stocking level Refers to stand density; i.e., the proportion of an area that is actually occupied by trees, and compared to the desirable number for best growth.

stumpage The value of standing timber as it stands uncut.

succession The gradual replacement of one plant community by another, over time, brought about by environmental changes of the area. The final stage is termed climax.

thinning Cuttings made in immature stands in order to stimulate the growth of the remaining trees and to increase the total yield of useful products from the stand.

timber stand improvement (TSI) All intermediate cuttings intended to improve species composition, stand composition and tree growth.

tolerance The ability of a plant to grow satisfactorily in the shade and competition of other trees.

uneven-age A silvicultural system wherein trees of at least three or more age classes are present. Usually resulting in a forest of trees of different sizes, species and heights.

weeding A cutting made in a stand to reduce competition from undesirable vegetation during the seedling stage of forest development.

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