

# Forestry for Envirothoners

## Forest History

## Protection

Forests probably covered about half of prehistoric Tennessee, as they do today

Native peoples purposely set fires to provide better grass for the animals they hunted and to clear trees and brush from their farms.

Frequent fires favored oak, chestnut, pines and grasses, and gave the country an open park-like look. Fire also benefited many kinds of wildlife, especially bison, elk, and deer.

In 1900 there were only about 9.4 million acres of forest, compared with 14.4 million today. During the early 1900's the trend toward less forest reversed. Depleted fields were no longer farmed and grew up into forest.

Forests were hit hard by the chestnut blight, a fungus accidentally imported from Asia. American chestnuts had no immunity to this fungus, and so between 1930 and 1940 the blight killed them all, except for an occasional short-lived sprout. The chestnut had been one of our most common and useful trees. Its disappearance was a blow to wildlife as well as to people.

Forests provide us with wildlife habitat, timber, beauty, places to recreate, a clean water supply, wild plant products and other benefits. Forest benefits can be enhanced through protection and intelligent management.

A well-managed forest must be protected from wildfire, erosion, grazing and insect/disease epidemics. Landowners should also guard against exploitive logging, that is, taking only the best trees with no thought for the future.

Landowners are responsible for the damage done if their debris fire escapes. A permit is required to burn debris outdoors between October 15 and May 15.

Landowners should exclude livestock from their forest because they compact the soil, increase runoff and erosion, kill young trees and damage older trees.

Loggers should use Best Management Practices (BMPs) to protect streams during logging. BMPs are a set of guidelines designed to keep sediment from roads and skid trails out of streams. Some BMP's:

- Plan and mark the locations of roads and log skidding trails
- Minimize the length of skid trails and access roads
- Locate roads as far from water as possible
- Avoid sensitive areas such as wet ground
- Do not make roads and skid trails too steep
- Build roads so that water drains off at frequent intervals
- Protect streamside areas, leaving trees where appropriate
- Avoid crossing streams
- If a stream must be crossed, build an adequate structure to protect it

- After logging is completed, install water bars on skid trails and seed all roads and landings

Only a few forest insects and diseases pose serious threats. Foremost among these are the gypsy moth, the southern pine beetle, and decay.

Gypsy moth. The Northeast has been infested with this defoliator for decades. The boundary of the infested area currently extends midway across Virginia. While timing can't be predicted accurately, forest managers should plan ahead for its arrival. Oaks, especially the white oak group, are the moths' preferred food. Mature and over-mature stands of upland oak may experience high mortality during the first few years of infestation. To lessen the impact, landowners can

- Harvest stands of mature oak and replace them with young vigorous stands
- Cull out weak and aging oaks
- Favor a mix of species, especially yellow poplar, ash and sugar maple (on appropriate sites).

The southern pine beetle attacks members of the yellow pine group (loblolly, shortleaf and Virginia pine.). Signs of infestation include dime-sized blobs of white pitch, holes in the bark the size of birdshot, and red and brown needles. Treatment is to cut infested trees and all healthy trees within one to two tree lengths.

Decay is the leading cause of timber loss in Tennessee. Decay losses can be lessened by taking care not to damage trees when logging, and by excluding fire and livestock.

## Shade tolerance

The combination of growing conditions in a particular spot (water, soil, nutrients, drainage, solar exposure) is called "*site quality*".

Many tree species preferred for timber and wildlife habitat need full sun. Trees that need full sun are called *shade intolerant*; species that can live in the shade are called *tolerant*.

If they have full sun, intolerant species will generally outgrow their shade-tolerant competitors. They develop straight knot-free boles because they self-prune or shade prune (lower limbs die and drop off). However, they must have full sunlight to develop well. This is one reason patch or clear cutting is so popular among foresters.

## Wood

The primary commercial timber species in the Mid-South are red oak, white oak, yellow poplar, ash, hard maple, hickory, walnut, cherry (locally), and loblolly pine.

The most valuable logs are straight, long, large diameter, nearly cylindrical, and free of defects.

The usable lumber volume of a log is measured in board feet (BF). A board foot is 144 cubic inches and can be imagined as a 12" by 12" by 1" tile, or as a 2" by 1" by 6-foot board, or other combination that equals 144 cubic inches. Board foot measure figures in wood volume lost from waste in manufacturing (sawdust, slabs), so that a cubic foot of log yields only about 7 board feet instead of 12.

Board foot volume is based on diagrams and formulas (log rules) of how mills might saw logs of various sizes. The Doyle rule is most commonly used in the Mid-South. It is fairly accurate for large logs but underestimates small logs. The International rule is more accurate and is used by State foresters.

Chipwood, used for paper and panel products, brings a lower price than sawtimber. Chipwood comes mostly from loblolly pine and low quality hardwoods. It is measured in cords or tons.

### Timber Management - Silviculture

How timber is cut is crucial in determining the makeup of the future forest. The aim of *silviculture* is not merely to harvest timber, it is to regenerate a forest of fast-growing, well-formed trees of desired species. Timber cutting is also used to manage wildlife, water yields, and appearance. A variety of options are open to the landowner .

**Patch or clearcutting** (removing all trees in an area greater than ½ acre) is used to manage species that require full sunlight

This method benefits most species of wildlife by creating forest edge habitat and producing a variety of nutritious foods. Relatively small clearcuts are best for most species. Relatively large clearcuts (say, more than 50 acres) are beneficial but sub-optimal for most wildlife.

Harvesting **small groups** (¼ to ½ acre) of trees can regenerate white oak, ash, red maple, cherry and white pine, which are intermediate in shade tolerance. A few less tolerant species may also regenerate toward the centers of

openings. While not optimal for timber production, this method provides a good compromise between timber, wildlife and scenic objectives. It is well suited to small ownerships.

**Individual tree selection** management is suited only to trees that reproduce and grow well in the shade. This excludes oaks and most other highly desirable trees in the Southeast. The only timber species in this region that can be grown on a sustainable basis using this method is sugar maple.

Maintaining **two ages of trees** at all times in a given stand is an option in oak forests where scenery and certain wildlife species (squirrels, birds) are important considerations.

**Thinning** is an intermediate cutting method used to increase growth of the “crop” trees.

**Shelterwood/understory removal** can encourage oak regeneration. *Understory* trees are removed to allow enough sunlight for oak seedlings to grow; after a few years the *overstory* trees are harvested.

**High grading** where only the most valuable trees are cut, is not a silvicultural method. High-grading seldom results in good regeneration. Repeated high-grade logging generally reduces the commercial value of the forest. High-grading has been by far the most common cutting method in the mid-south because it is the most profitable in the short term.

All good silvicultural systems provide sufficient sunlight for desirable species to grow, and remove unwanted trees - the “junk”.

Trees in an adequately stocked stand should not be cut prematurely, nor left too long after maturity. Sawtimber is often cut when it is just large enough to sell (16 to 20 inches in DBH) – and just at the time it is increasing rapidly in value. On the other hand, trees left past their prime grow slowly and lose wood to storms, insects, disease and decay.

A timber sale is an important event for the landowner *and for the forest*. It is highly advisable to hire a professional forestry consultant to help sell timber..

### **Timber Management Terms and Tools**

To determine how well trees are utilizing the growing space, foresters use a measure called *basal area*. Basal area is the surface area in square feet of all the “stumps” 4.5 feet off the ground on one acre. To determine basal area, mark a point in the woods. Hold a penny at arms length. Keeping the penny centered over the mark, sight on each tree. If the penny fits inside the tree trunk, count the tree. If the penny more than covers the tree, don’t count it. Count every other tree that exactly covers the trunk. Multiply all the counted trees (“in” trees) by ten. This number is the basal area. For example, if you tally 9 “in” trees, the basal area is 90 square feet. If the basal area is too low, there are not enough trees to fully utilize the site, and growing space will be wasted. If the basal area is too high, the stand is too crowded and tree growth will slow. The ideal basal area is higher on good tree growing sites than on poor sites.

To measure the “fertility” (quality) of a timber growing site, foresters measure *site index*,

which is a combination of height and age. To measure height, foresters first select a typical tree for the stand and then use a logger’s tape and a *clinometer*, which measure angles. To measure tree height, walk away from the tree, sighting on the top of the tree with the clinometer. When the clinometer reads 100%, mark the spot and measure the distance to the tree. This distance equals the height of the tree. To measure tree age the forester uses an *increment borer*, which is a metal tube with a sharp edge at one end and a handle at the other. The sharp end has screw threads. The forester twists the increment borer into the tree trunk until he/she thinks it is at the middle. Then he/she extracts the wood inside the metal tube and counts the rings. Each ring is one year. He/she can then look up the site index on set of graphs for that species. Site index is measured at 50 years old for hardwoods. For example, a site index for oak of 70 means that the trees would be 70 feet tall at age 50.

A forester estimates timber volume through a *cruise*. He/she lays out a grid of sample points on a map and goes to each point and estimates the volume. One common way of doing this is called variable radius plot cruising. The forester uses the penny method above, or preferably a *prism* to determine which trees to measure. The prism splits the image of the tree. If the images overlap, the tree is in the plot and is tallied. The diameter at dbh (diameter breast height, 4.5 feet above the ground) is measured either by a diameter tape or more commonly by a *Biltmore stick*. To use the Biltmore stick the forester holds the stick against the tree at arms length, lines up the left end of the stick with the edge of the tree, sights on the right edge of the tree and reads the diameter on the stick. The forester then estimates the number of 16 foot

logs in the tree to the nearest half log. The forester also records the kind of tree: red oak, white oak, hickory, etc. Sometimes the forester also tallies the log *grade*. There are four grades of log: veneer (the best and most valuable), grade one (the next best), grade two and grade three. A tree must have a dbh of at least 12 inches to be merchantable.

### Harvesting

Harvesting is usually done with a large rubber tired *skidder*. Logs are dragged behind the skid by a cable called a *choker*. Logs are usually dragged out in tree lengths. The logs are skidded to a landing where they are cut into log lengths and loaded on a truck

Care must be used to avoid scarring uncut trees. *Bumper trees* can be left to protect more valuable trees along the skid trail, then harvested when the logging job is finished

Another machine used in logging is called a *feller-buncher*. It is often used in harvesting pine. The feller-buncher grasps the tree, cuts it, delimits, and stacks it all in one process. A *forwarder* is a machine that carries stacks of logs to the landing instead of dragging it.

There are two ways to conduct a timber sale: *cutting on shares* and *lump sum*. In the shares arrangement the logger takes the logs to the mill, sells them, and splits the money with the seller (usually 50/50). In the lump sum arrangement the logger pays for the timber up front either in one payment or in installments. Selling by lump sum with sealed bids often brings the seller a higher price. Lump sum sales also avoid landowner liability if the logs cause damage or injury on the way to the mill.

The amount timber brings depends on quality, distance to the mill, sale size (volume), terrain and access, contract restrictions, competition for the sale, and the going rates for timber paid by the mill or veneer buyer.

If other factors are equal, interest among loggers decreases with decreasing sale size. Some tracts are just too small for anyone to log profitably.

### Reforestation

It is important that a high-quality forest be regenerated after logging. Natural regeneration after harvesting hardwoods is abundant from seedlings and sprouts. The challenge is to regenerate the species of trees desired. Many desirable species do not regenerate well in a shady environment. To get them to thrive, the forest must be opened up enough to allow them to get the sunlight they need. More sunlight can be let in by cutting or killing the unmerchantable trees either before or after logging

Oak forests regenerate naturally on dry sites, but on better sites they are easily crowded out by other trees.

In some forests stump sprouts are a common source of new trees after harvest. Only the one best sprout should be left – all other should be cut.

Fast-growing sprouts from undesirable species like red maple should be killed with herbicide so they don't shade out young oak and other desirable species.

**Bare-root seedlings** can be planted in some situations. This method is often expensive.

Pine is the most commonly planted. Unlike pine, hardwoods often don't do well if planted on old fields because the soil is compacted. This does not hinder pine significantly.

Seedling survival will be low unless competing vegetation is controlled during the first 10 years. Options include:

- ◆ clear with heavy equipment
- ◆ spray with herbicide before and/or after planting
- ◆ use prescribed fire to knock back brush
- ◆ manually cut brush around each seedling

Spacing is usually 8 to 10 feet apart for pine and often 12 feet for hardwoods. Planting season is December through March.

### **Wildlife Habitat Management**

Forest management can be tailored to benefit any wildlife species or groups of species. In general, maintaining a diverse habitat with a mix of forest, small openings and *edge* between them will benefit deer, rabbit, turkey, raccoon, quail, grouse and many non-game animals. But it is impossible to accommodate all species at one location. Anything done to the forest will benefit some species and inhibit others.

Here are some commonly-used habitat improvement techniques:

**Create openings** in the forest to provide more sunlight, which in turn produces accessible foods. Openings can include **timber harvests**, seeded **log landings and roads**, long, narrow

**game strips** in unbroken forest, and permanent wildlife **food plots** (at least ¼ acre in size).

**Spread fertilizer and lime** in forest openings (like harvested areas and roads) and under selected acorn producing trees. This will increase browse growth and protein content, and increase seed and insect production for turkey, quail and other birds. Fertilizing under oaks will increase acorn production for deer, turkey and other birds and animals.

**Plant warm season and cool season forage plots.** Legumes, clover and native warm season grasses are good choices. Fescue makes poor food plots

**"Feather" forest edges** (thin the forest near openings to encourage a wide brushy edge).

**Leave buffers along streams:** minimum 50' uncut buffers along each side of perennial streams, and twice that distance along trout streams and in areas managed for songbirds. **Swamps, bogs and other wetlands** demand special consideration.

**Leave 1 to 3 den trees** per acre and as many large **dead trees (snags)** as possible to benefit squirrels, raccoons and birds. Leave a few other trees in a clump around each den tree. Snags should be at least 12" diameter and 10' tall. Create snags where few are present by girdling commercially undesirable trees.

**Build nest boxes** for squirrel, bats, and certain birds if den trees are lacking. Patterns for constructing nest boxes are available from Tennessee Wildlife Resources Agency, 1-800-624-7406.

**Thin crowded stands** to increase tree growth, health and mast (food) production.

Use **prescribed fire** to maintain food plots and native warm season grass plantings, and to improve habitat in pine stands (older than 10-15 years).

**Exclude livestock from the woods.** They compete with wildlife for browse, compact the soil, and damage young trees.

**Make piles of limbs** after timber cutting to provide cover for rabbit, quail, rodents, reptiles, and songbirds.

**Plant blocks of evergreens** to provide hiding cover and winter shelter for many wildlife species. Five acres is sufficient for deer.

Allow **brush and trees** to grow along fences, and provide “**headquarters areas**”- dense brush thickets - to provide cover for rabbit, quail, etc.

**Manage for oak** and other hard-mast-producers by cutting other competing species around them. Conduct periodic timber harvests to regenerate oaks that are past their mast-producing prime in order to assure a future acorn supply. Sawtooth (Chinese) oak, available from the State Seedling Nursery, and blight-resistant chestnut, which can be ordered from several commercial nurseries in Tennessee, are heavy and consistent mast producers.

**Plan ahead for the gypsy moth**, an invasive pest that can devastate oak forests on dry sites. Strive for a diverse, healthy forest. Yellow poplar and sugar maple are avoided by the gypsy moth.

**Protect endangered species.** These usually occur in small, unusual habitats near water and on rock outcrops.

*For questions and further information, contact Tim Phelps, Information & Education Program Specialist, 615-837-5543; [Tim.R.Phelps@state.tn.us](mailto:Tim.R.Phelps@state.tn.us)*

### **Additional Resources**

<http://www.state.tn.us/agriculture/forestry/studentresources.html>

<http://www.utextension.utk.edu/publications/forestry/>