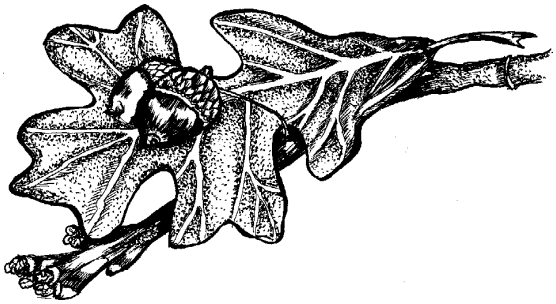

# Arkansas

## Upland Hardwood Forest Management Guide

Sponsored by
American Tree Farm System
Arkansas Forestry Association

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# Preface

As a landowner, you realize that there are many options when it comes to deciding how to best care for your valuable resource. That's why the Arkansas Forestry Association (AFA) created this *Upland Hardwood Forest Management Guide* through a grant from the American Tree Farm System.

Whether you intend to maintain your hardwood forestland for aesthetic beauty, wildlife habitat, recreation or timber production, there are practices and applications that will enhance your forestland and help you achieve your objectives. The information and resources found here can help you make sound decisions about your forest assets.

In addition to an overview of Arkansas' forests, this guide provides essential information about evaluating your forestland, developing a management plan and seeking professional assistance to help you achieve your objectives.

Hardwoods are harvested to produce income, regenerate a stand, accelerate growth of residual trees, and change the species mix to benefit wildlife or future timber value. However, harvesting must be planned with an eye toward the next generation of trees. All too often hardwood forests suffer from high-grading—taking only the best over time. The residual poor-quality trees have little potential for developing into merchantable timber and oaks cannot regenerate in the small openings that are created without sufficient sunlight.

This publication describes how you can manage hardwood stands to perpetuate oaks. While it explains management options, it is not a substitute for personal advice from a professional forester. As you plan a management strategy, seek the advice of a forester through the Arkansas Forestry Commission, county conservation district, consulting firm, industry forester or independent forestry consultant.

If you are interested in keeping up to date on landowner education and assistance programs as well as issues that affect landowner rights, now is the perfect time to join AFA and become part of Arkansas' forestry community. As an AFA member, you will receive monthly member updates, notices of landowner education programs and legislative updates during legislative sessions. These are just a few of the benefits that come with association membership.

For more information, please call the toll-free landowner message line at 1-888 MY TREES, the AFA office at (501) 374-2441 or e-mail us at afa@arkforests.org.

# Introduction

Forests are an ideal investment because they are a renewable resource that provides timber, wildlife, clean air and water, and recreation. With proper management, your forests will give you and future generations many happy returns. The most productive and enjoyable forests are healthy and vigorous ones. Your forests and woodlands may take decades to recover from a wrong move in forest management.

Arkansas' professional foresters can help you develop goals for your woodlands. Foresters will work closely with you to create forest plans and help you carry out your objectives. The *Arkansas Forest Landowner Assistance Directory* provides contact information for a variety of professional resources. Take the first step in forest management and contact a professional forester. Together, you can make the most of your valuable resource.

# Arkansas' Forests Today

We are fortunate to have an abundance of forestland. Arkansas' forests have grown by more than one million acres since 1988. This increase is due to the fact that every year, forestry professionals and others plant nearly 80 million tree seedlings. Following are the results of the 1995 Arkansas forest survey conducted by the U.S. Forest Service:

Arkansas' Total Land Area — 33,328,200 acres
- Arkansas' Total Forestland — 18,778,600 acres (56.3%)
- Productive Timberland — 18,382,000 acres (55.2%)

Timberland Ownership in Arkansas:
- Public — 3,198,400 acres (17.4%)
- Forest Industry — 4,531,600 acres (24.7%)
- Nonindustrial Private Individuals — 10,652,100 acres (57.9%)

Forest Acres by Forest Type:
- Pines — 5,048,300 Acres (27.5%)
  Pine in plantations — 1,842,000 Acres
- Oak-Pine — 3,143,000 (17.1%)
- Oak-Hickory (Upland Hardwood) — 7,138,000 (38.8%)
- Bottomland Hardwood — 3,048,800 (16.6%)

Taken as a whole, the forests of Arkansas are primarily made up of

hardwoods. More than 72 percent is in hardwoods, or hardwood-pine mixtures. Only 27 percent of the forest is pine. To put it another way, three out of four forest trees are hardwoods, and one out of four is pine.

The Arkansas forest is primarily a privately-owned forest. About 58 percent is held by non-forest-industry farmers, other individuals and nonindustrial corporations. They all manage their forestland according to their own particular objectives, such as timber production, aesthetic beauty, recreation or wildlife values.

Arkansas' forest industry owns 25 percent of the state's forestland, and the remaining 17 percent is in public ownership including the Ouachita and Ozark-St. Francis National Forests.

With an annual payroll of more than $1 billion, forest industry in the state employs more than 43,000 people. Looking at the whole picture, the forestry community provides $5.8 billion to the state's economy every year. That's about $2,000 for every man, woman and child in the state. And each of these dollars passes through about seven wallets, one of which was probably yours.

Arkansas forests are healthy, diverse and productive, and they continue to improve. The forestry community is taking care of Arkansas' forests for the long run, because we all need them to last forever.

# Arkansas Forest History

## Conditions at Time of Settlement

Arkansas was 96 percent forested when permanent settlers arrived early in the 19th century. The forest was diverse. Bottomland oaks, gums, other hardwoods and cypress made up the Delta's virgin forest. Shortleaf and loblolly pines and pine-hardwood mixtures predominated in the Coastal Plain. In the Ouachitas, shortleaf pine and pine-hardwood mixtures occupied the drier sites; hardwoods were found on the moister, cooler locations. Oaks, gums, and other hardwoods predominated in the Ozarks; scattered shortleaf pine and pine-hardwood mixed types were found on sandstone and chert soils.

## The Exploitation Era, 1880-1930

Development of a railroad network in the 1880s opened up access to the forest. Large lumber companies from the Lake States and Midwest arrived; bought up large tracts; began harvesting and milling lumber for sale to Midwestern and eastern cities.

Production peaked in 1909. By the late 1920s, the boom was over. Many of the big mills had closed or moved west. Small, portable

sawmills moved in, able to use the scattered, smaller timber left behind. The state's first pulp mill, which opened in 1928, also was able to use smaller timber.

In 1929, at the end of the exploitation era, an informal forest survey estimated conditions as follows:

- Forest area — 22 million acres
  (10 million acres less than time of settlement)
- Privately owned — 20 million acres (about 91%)

Proportions of forest area by major forest types.

- Southern pines — 23%
- Mixtures of hardwoods and pines — 36%
- Upland hardwoods — 16%
- Bottomland hardwoods — 25%

No estimate was made of relationships between yearly growth and yearly removals. But it is safe to assume that removals far exceeded growth. Conditions were pretty grim.

## Recovery Era Through World War II

"Cut out and get out" had not been the universal rule. Early on, a number of farsighted lumber companies began efforts to assure timber supply sustainability on their own lands by practicing selective logging, reserving parent trees to reseed harvested areas, and protecting their lands from wildfire. In the late 1920s, they came together to form what is now the Arkansas Forestry Association to push for a law against willful woods burning and to establish a state forestry agency to provide statewide forest fire protection. Statewide fire protection coverage was finally attained in 1953.

In the public sector, 1.1 million acres of federal public domain land were dedicated to use as national forests in 1907 and 1908 and the U.S. Forest Service began protecting them against fire and trespass.

These efforts plus a reduction of lumber production during the 1930s Depression resulted in substantial improvement by the years immediately following World War II. A 1953 survey revealed that timber supply sustainability had been reached.

Yearly pine growth exceeded removals by 11 percent. Hardwood growth exceeded removals by a whopping 63 percent. And, wildfire protection had proven highly successful for the 60 percent of the state covered by the program.

## 1953 to 1988

The 1953 Forest Survey was the first formal statewide survey of Arkansas forest conditions conducted by the Southern Forest Experiment Station of the U.S. Forest Service.

Highlights of the 1988 survey:

- Forest area — 17.25 million acres
  (almost 2 million less than in 1953)
- Privately owned — 14 million acres (about 82%)

Proportions of forest area by major forest types:

- Southern pines (planted) — 9%
- Southern pines (natural) — 15%
- Mixtures of hardwoods and pines — 18%
- Upland hardwoods — 42%
- Bottomland hardwoods — 16%

Comparisons with 1953 conditions were startling. Although there was a loss of almost 2 million forest acres, pine timber inventory had increased by 92 percent, hardwood inventory by 95 percent.

These had developed in spite of a 40 percent increase in lumber production, a tenfold increase in pulp production, a more than 100 percent increase in yearly pine harvests, a 13 percent increase in yearly hardwood harvests, and an explosive increase in forest-based outdoor recreation, tourism and public concern for other non-timber values—particularly on public lands.

This productivity increase was due to many factors. Public investments in fire protection had brought yearly losses down to 42,000 acres by the late 1980s. Private investments in large scale pine planting starting in the 1970s began to have an impact.

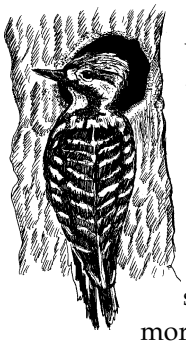
Investments in research, education and technical assistance to the state's 160,000 non-industry private owners contributed. Much of the effort emphasized pine productivity improvement because of long-term high demand in relation to supply.

Over the past 60 years, the Arkansas forest resource has evolved from a devastated condition to a highly productive one. The challenge will be to continue to enhance and broaden this productivity to meet a broader spectrum of current and emerging needs, now and in the future.

# Establishing Management Objectives

A managed forest is a healthy, productive forest; however, a clear set of management objectives is necessary to achieve this desired state. Each landowners' objectives are different and account for a variety of uses. By applying improvement techniques, you can achieve these goals.

## Wildlife



Forest improvement helps create diverse wildlife habitat. Woodland openings for natural regeneration can attract wildlife such as deer and songbirds that thrive near edges where open areas and woodlands meet. Thinning to release crop trees provides nesting cavities for woodpeckers, owls, squirrels and other wildlife species.

Hardwood stands with a high percentage of oaks can provide excellent food and cover for wildlife. Each wildlife species has unique habitat requirements, so start by learning more about the species that interest you most.

## Recreation and Aesthetics

Healthy, productive woodlands provide valuable intrinsic qualities for the forest landowner. Birdwatching, hiking and hunting are just a few of the recreational opportunities a healthy forest can provide.

If aesthetics is your main goal, you may wish to favor trees that produce beautiful flowers, radiant fall colors, interesting bark color or texture, diverse types of branch structures, or a mixture of tree species including hardwoods and conifers.

## Timber Production

When efforts are made to improve a forest, the time necessary between timber harvests is reduced, growth rates of high-value trees increase, and the species composition of the forest can be improved to include desired species of trees.

Forest improvement involves providing necessary growing space for high-quality trees and creating an environment for the natural regeneration of the forest. Productivity, wildlife habitat, recreation, water quality and other environmental conditions are all taken into consideration.

# Determine Condition of Forest

Seek assistance from natural resources professionals (forester, wildlife biologist, etc.), depending on your objectives. As you evaluate your forest, look at:

- soils
- tree species composition, quality, age, size, stocking, regeneration
- timber market opportunities
- wildlife habitat

## Soil Quality

The relative abundance, quality, and growth rates of hardwoods depend on site quality.

Best hardwood sites are usually medium-textured soils. White oak should be favored on finer-textured soils.

Roots tend to penetrate more deeply in soils with medium-textured subsoils than into those with predominantly clay subsoils, which have slow internal drainage in the wet spring months and resist root penetration in the dry summer months.

Best hardwood sites are generally north-facing and east-facing gentle sloping, concave, or lower slope positions, and creek bottoms. Poorest sites are narrow ridge tops, south- facing and west facing steep, convex upper slopes. White oak should be favored on the better south and west slopes.

Neither white nor red oak species are recommended for management on loamy, sandstone soils. Not only is oak productivity low for these soils, but tree form and log quality are also poor. Recommend shortleaf pine on these sites.

For soils information consult the Natural Resources Conservation Service (NRCS) County Soil Survey book.

# Developing a Management Plan

Forest management can be fairly complicated and it is always a long-term process. For these reasons, a management plan should be developed and used to direct activities toward landowner objectives. Management plans for woodlands attempt to guide natural conditions and processes so benefits and costs are predictable and comply with owner objectives.

Management plans have to account for existing conditions, the potential for changing these conditions or maintaining them, and the

probable results of activities proposed. Such plans incorporate information gathered through careful examination of the resources to be managed. Then this information provides the basis for recommendations about what actions to take to reach desired goals. Analyses of costs and potential product returns (financial and otherwise) are often provided in management plans.

A generalized list of elements in forest management plans includes the following:

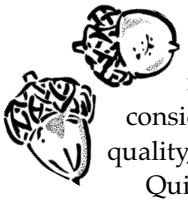
- statement of ownership objectives and constraints for the property
- stand descriptions, including site characteristics
- maps identifying tract location, boundaries, natural features and timber types
- recommended practices, with schedules of when activities should be carried out on each stand;
- financial analyses and information on costs/benefits
- explanatory attachments describing specific practices or environmental concerns

## Who writes management plans?

Forest management plans can be written by those with the necessary knowledge of forestry practices, understanding of forest growth, and information about circumstances that affect management decisions on the tract in question. Usually this combination of attributes belongs to professionals educated specifically in forestry schools to work in government agencies, private industry and as privately employed consultants. Differences exist among these groups and the types of plans they prepare, though the essential elements of all their plans remain similar.


Consult the Arkansas Forest Landowner Assistance Directory for a detailed listing of professional services available to forest landowners, as well as the Arkansas Forestry Commission consultant list. Contact AFA at (501) 374-2441 to request a copy of this information.

**Arkansas Forestry Commission (AFC)** foresters provide many services for free to taxpayers, including examining tracts of timber and writing management plans. Contacted directly or through county extension agents or Natural Resources Conservation Service, they will arrange to meet with landowners, examine the land in question, gather



appropriate data, and develop a plan for forest management aimed at productive timber growth but also considering other environmental factors such as wildlife, water quality, and recreation opportunities.

Quite often, state agency foresters recommend obtaining services of professional consultants to handle timber sales and especially complicated management problems requiring continual attention to detail. In many cases, state agency foresters can arrange to have certain practices carried out for the landowner by private contractors. Some activities can be conducted by AFC itself, though sometimes for a fee. Usually the plans written by AFC foresters will specify which activities fall into each category.

**Forest Products Companies** needing to supply raw material for processing mills will sometimes offer landowners assistance in planning forestry management. Plans will be written to establish and maintain forests for timber production. Reduced rates for having forestry operations performed will usually be assessed. Plans written by industry foresters may resemble the management system used by the company in question, and may or may not take into account other considerations beyond timber production. Landowners should inform the company of other land management goals.

**Forestry Consultants** provide a full range of services related to forest management, from timber appraisals (determining market value of the harvestable stands) to detailed management plans for any desired objective. It is advisable to obtain at least three references. Consultants earn a percentage of the timber sale for their services, and the may charge daily or hourly rates for other management services.

However, when tracts requiring frequent attention are involved, consultants often arrange work on a retainer basis, with a set fee for the range of management services required throughout a specified time period. For owners having considerable acreage of substantial value, such arrangements more than pay for themselves, especially when absentee owners are involved.

Because consultants establish a client relationship with owners, working to further the owner's interest, greater expenditures of time and effort can be expected. Moreover, because consultants receive a percentage of timber sale proceeds, they actively seek ways to enhance timber values and obtain top prices at harvest time.

In almost all cases, consultants more than pay for their fees by obtaining higher values for forest harvests than would be received by owners negotiating sales on their own with buyers. As a result of this

payment for service to a consultant, the landowner should expect a more detailed plan based on a more detailed assessment of the standing timber and other resources on the tract. Variability in consultants' performance dictates, however, that landowners choose carefully from among the consultants operating in an area and establish a clear understanding of what services will be performed for the fees paid.

Finally, for many landowners, the added expense of obtaining a consultant's aid can be a valuable investment returned many times over by sustained attention to the landowner's interests in profitable forest management.

# The Planning Process

Simply presented, the process for creating a forest management plan follows these steps:

- consider goals of management
- examine the resource to determine important characteristics
- define objectives for management, consider alternative systems for reaching the objectives
- choose the most reasonable alternative for each forest unit
- develop specific prescriptions for each forest unit (stand)
- organize priorities for action and schedule activities

No plan can succeed if it has not accounted for the existing situation. Thus, obtaining the information about what timber and other resources occupy your land is the first step in the planning process. You may already have knowledge of your forest's condition just from having observed its characteristics. For the formal plan, however, an examination by someone trained to gather the important specific data is needed. Contact a forester appropriate for your circumstances and arrange a timber examination to get this basic information.

You should have some fairly well defined ideas about what you can expect to accomplish with your woodlands. If not, now is the time to take stock of the situation and sort out what you want to do.

## Your Objectives

The forester who examines your woodland is trained to take the information gathered and, with knowledge of your objectives and constraints, write a management plan for your forest. Whether the forester works for the Arkansas Forestry Commission, a forest products company, or is with a consulting firm, he or she will probably promote

the idea of timber management above all other objectives because this is the objective that promises you the highest financial returns for your investment.

Knowing this, you should be prepared to consider the timber management option realistically and see how it fits with any or all other objectives you might consider. Quite often no conflict arise. Rarely are management objectives are mutually exclusive. Discussing your objectives with the forester before he or she writes a management plan for your land is essential.

Then these objectives, as the forester understands them, should be stated explicitly somewhere prominent in the plan, as a reminder to everyone who encounters it. Because forest management is a long-term proposition, someone years in the future will need this document to carry out the intentions you established today. Even you, years in the future, may have difficulty remembering what your objectives were when the plan was first devised. Moreover, this document records facts that may be useful in the future for estate planning and taxation.

## The Planning Document

Management plans vary according to the degree of complexity in the forest, the complexity of objectives, the degree of complexity in the recommended practices, the time and money available to develop plans, and the person developing them. Real-world circumstances dictate the composition of the plan developed for any specific forested tract.

In general, the less diversified the forest for which a plan is to be written, the less complicated will be the plan drawn. On tracts with one timber type of approximately one age for example, the plan can be fairly simple if timber production is the primary or sole objective. But even in such uniform forests, size may complicate the plan because a large tract will probably not be cut all at once. In such cases, periodic cuts producing fairly equal volumes of timber, hence fairly equal income, may be desirable, but this requires a better plan of action.

No matter how complex the situation and the resulting plan, certain features should be included in the planning document. The following sections discuss parts of the planning document and information used to compose those parts.

### Map and Area Descriptions

A map is usually provided with every written plan. It should be drawn to scale (which should be identified on the map) and the mapping method should be indicated. Major landmarks and access routes should

be identified for easy reference, as should buildings and other human-made structures on the property. Indicate water bodies and streams by showing the direction of the streamflow.

The major feature on maps drawn for forest management purposes is the delineation of timber types. Each stand is outlined and labeled in some way for easy reference. Stands with similar characteristics may be labeled the same and combined for management purposes, especially if similar stands in different locations on the tract are small. Areas without forest cover are also drawn on the map and labeled.

Because the map is only a graphic presentation of spatial relationships between timber types and other land uses, verbal descriptions have to be given for each area indicated. These are often provided along with the management recommendations for the areas. Usually the information you receive in the plan is summarized from the data gathered while the forester is in the field examining your woodland.

The descriptions have to be informative enough that the reasons behind the recommended forestry practices will make sense, but the descriptions do not have to be filled with technical details gathered in the field and that few people but foresters would understand.

## Plan components

Typically, the essential information your plan includes, arranged in a format convenient for the forester and you to use, will be the following:

1. **Area or field number**—referring to the area outlined on the woodland.

**2. Approximate number of acres**—for each area, computed from the map.

**3. Forest types or species and age**—providing a brief description derived from the field data; including statements about the condition of the stands, their growth potential, multiple-use characteristics, etc.; and explaining the reasons for the recommendations that follow.

**4. Recommended management practices (prescriptions)**—identifying the overall forest operations on the stands and the specific actions to be taken at each stage to keep the plan in progress; general dates for when these operations should be carried out and indications of who should take the actions are normally included.

This is the technical part of the plan, but it should be written in general enough terms that it can be easily followed. The practices recommended are usually not fully explained in this section of the plan, but explanations are often given in attached materials. Primarily, this is a working schedule for the landowner or his agents to follow, amending

the schedule as circumstances dictate. It should be designed for flexibility and to leave as many future options as possible.

**5. Environmental considerations**—identifying the areas of special concern and particular regulations affecting the operations recommended. Water quality, for example, must be maintained, so special treatment along streams and around ponds or lakes may be proposed. Where specific multiple-use considerations are part of the landowner's objectives, any practices specially included in the plan should be highlighted.

## Financial Analysis

In many cases, a financial analysis of the management plan is developed and provided. This requires determinations of present values, projections of growth and yield with various forestry practices applied, determinations of future operational costs, and projections of future harvest values. In short, even the best current analyses must remain approximations subject to changes in any and all of the factors cited.

Nevertheless, such approximations are invaluable for planning and in most cases well worth the effort to develop. Certainly not every plan nor every landowner needs this information, but the higher the value of the resources involved and the larger the tracts under consideration, the more important will this information be to decision making.

With the advent of computer technology in forest planning, such analyses are obviously easier to develop. However, we must emphasize that computer generated analyses remain only as good as the assumptions about costs and prices that are entered into the computer programs. These assumptions are only as good as (1) the information available to the person doing the analysis and (2) that person's knowledge and insight in working with the information. In general, then, management plans ought to include financial analyses where those analyses will be useful for decision making and when proper caution is applied in their development.

## Updates and Recordkeeping

The time period covered by a management plan will vary, according to the complexity and specific circumstances involved. Usually the plan will cover at least a five-year period, but plans to regulate a forest over a rotation could provide general guidance for several decades.

Longer-term plans have to provide for updating alterations. Flexibility in scheduling and practices is necessary to reflect changes in conditions, markets, and landowner preferences. Predicting market

conditions and setting harvest dates years in advance are basically tentative acts, subject to change as the time for action approaches. Landowners need to understand that, as the situation changes, they may need to make radical alterations in the prescribed activities for specific stands. Usually the longer the planning period covered by the document, the more likelihood that changes will be needed.

Every activity done in the forest should be documented with complete records. Such records, besides being important to management decisions, are necessary for tax purposes.

Such information provides a measure of the plan's success and a basis for making adjustments in the plan. Periodically, a professional forester should review these records and the plan to monitor its appropriateness to the current situation.

Because management plans vary with the authors, the complexity of the forest situation involved, and the aims of the owners requiring plans, we cannot arbitrarily say what every plan will or should include. You have to decide which means for developing a plan suits your situation. That decision will likely determine the components and amount of detail in the plan you receive.

Above all else, the plan should be consistent with your objectives, in so far as these objectives are consistent with sound forestry and environmentally safe practices. Professional foresters are trained to adhere to a code of ethics and work to apply their professional experience for the good of society as well as individuals. This means they will work with you to realize reasonable objectives to develop workable plans, and for you to benefit it from the opportunities your forest can offer.

# Woodland Improvement

## Timber Stand Improvement

As hardwood stands grow, they may need some cutting or other cultural practices to encourage desirable trees, increase growth rates, control species composition, improve tree quality, or enhance wildlife habitat.

By manipulating certain elements in the forest through Timber Stand Improvement (TSI), a forest can be healthier and more productive, as well as meet the land use objectives and needs of the private forest landowner. Improvement cuts often remove trees that are too small or low quality to be sold as timber. Such cuttings are most economical when marketable pulpwood or fuelwood can be produced or when the

potential value of residual trees significantly increases.

TSI involves releasing crop trees, killing cull trees, and thinning trees that are overcrowded. Following this work, the remaining trees will have access to more sunlight, nutrients, and water, and will be able to grow better. TSI measures can often be accomplished with little or no out-of-pocket expense. For example, the cost of thinning, salvage, sanitation, and release benefits can be offset by the sale of the stumpage.

Practices will vary depending on tree size. Tree stands commonly are classified by the average diameter of their dominant trees as follows:

less than 1"= seedling
1" - 4" = sapling
5" - 9" = poletimber
10"+ = sawtimber

TSI measures include:

- Weeding young stands to remove weak, diseased, or other undesirable trees—making room for more valuable trees to grow.
- Releasing vigorous young trees for faster growth and better quality by removing overtopping trees.
- Pruning the lower stem of selected trees to produce knot-free timber for sawlogs, veneer logs, and other products.
- Removing cull trees to free growing space taken up by deformed or defective trees that aren't marketable.
- Sanitation cutting to remove trees infested with insects or diseases—thus protecting the remaining stand.
- Thinning to regulate stocking.

Thinnings should start at ages 15 to 20 years, and be followed by periodic thinnings at about 10-year intervals. Leave the best trees (crop trees) spaced as uniformly as possible throughout the stand. In a first thinning, it will probably be impossible to remove all of the undesirable trees and still retain a 60 percent stocking and adequate spacing.

Thinnings cannot be continued indefinitely. In general, if a stand has been thinned regularly, stop thinning oaks at 60 to 70 years on average sites, and 50 to 60 years on good sites. Twenty to thirty years before the final harvest, management concerns should be the establishment and development of oak advance regeneration.

## Identifying Crop Trees

To improve a hardwood stand containing oaks, you need to identify crop trees—those you wish to favor. If timber production is your main

goal, then a potential crop tree should be:

- a marketable species
- well formed, with a vigorous crown in the main canopy
- larger in diameter than surrounding trees
- straight stemmed and nearly free of live branches and large dead branches for the lowest 20 feet of poletimber or larger trees and for half the total height of saplings without V-shaped forks in the stem (U-shaped forks above 25 feet are acceptable) without large cracks, seams, or wounds in the bark

Stump sprouts are acceptable if they originate at or below ground level and meet the above criteria.

If wildlife is the primary goal, then crop trees may include: tree species that produce edible seeds (mast), e.g., oak, walnut, hickory, cherry trees with holes and cavities that may serve as dens

If aesthetics is your main goal, you may wish to favor trees that produce beautiful flowers, radiant fall colors, interesting bark color or texture, diverse types of branch structures, or a mixture of tree species including hardwoods and conifers.

## Seedling and Sapling Stands

In seedling and sapling stands you may need to control trees that suppress crop trees, to eliminate undesirable species, and to thin stump sprouts.

Overhead shade can kill young oaks or cause them to develop poor form as they bend toward the light in canopy openings. During or immediately after a harvest, control undesirable sapling-, pole-, and sawtimber-size trees that shade desirable reproduction. You may leave scattered large trees for several years for wildlife or aesthetic purposes, but kill them later if they create too much shade over desirable trees.

Control undesirable tree species that compete with crop trees when stand height averages at least 25 feet (10 to 20 years old). By delaying removal until this stage, there will be fewer trees to remove and stands will be more accessible. Stump sprouting by undesirable trees generally will not be a problem in the shaded understory of these young, dense stands, so chainsaw felling can be effective and may cost less than applying herbicides.

When growing trees for timber production, thin sprouts growing from a single stump to one or two dominant sprouts that have good form and are connected to the stump below or near the ground. Thin when sprouts are about 10 years old (2 to 3 inches in diameter).

## Poletimber and Sawtimber Stands

Oak stands managed for timber should be kept fairly dense until the bottom 20 to 25 feet of the stems are essentially free of live branches. This generally will occur when trees are 40 to 50 feet tall (30 to 45 years old). At this stage thin stands to stimulate diameter growth of crop trees.

Release no more than 100 crop trees per acre. Ideally, crop trees should be 20 to 25 feet apart. However, if they are scarce or unevenly distributed, you can leave two trees as close as 10 feet as long as you treat them as one tree when thinning.

Remove trees with crowns that encroach on those of crop trees. Free all sides of sapling and small poletimber size trees and at least three sides of larger trees. Trees below the main canopy will not affect crop tree growth, but you may cut them if they are marketable. Do not damage crop tree stems and roots while thinning stands. Repeat thinning every 15 to 20 years.

## High-Graded Stands

If you are starting with a stand that has been previously high-graded, you may be able to rehabilitate it by applying several improvement cuts. High grading means that the desirable trees have been removed, leaving less-desirable and less-merchantable tree species.

Release crop trees and thin heavily if there is a market for pulpwood or fuelwood. If not, apply a noncommercial crop-tree release. When the few good trees reach harvest size, regenerate the stand to produce a healthier, higher-quality stand.

## Pruning

Hardwood trees grown for timber are most valuable when their lower 20 to 25 feet are straight and free of limbs. Proper density will help; however, hand-pruning may be needed in understocked stands and plantations. Pruning is time-consuming and therefore expensive. Prune only high-value species such as black walnut and northern red oak.

When a seedling or sapling stem develops a fork, cut off one side of the fork to create a single central leader. When trees reach poletimber size, remove lower limbs. Using a saw, cut live branches close to the stem without wounding the stem; prune dead branches close to their base, but do not cut through any live wood. Confine pruning to the first 16 feet or to half the total tree height, whichever is less. Thus, a 20-foot tree may need a second or third pruning as it grows in height.

Caution! Do not prune oaks between mid-April and mid-July to minimize risk of oak wilt.

## Natural Regeneration

Oaks regenerate naturally from seed (acorns) and from stump sprouts.

Large acorn crops occur every two to five years or more. Compared to many other tree species, however, oaks do not produce many seeds. Most acorns remain directly beneath the crown of the tree where they fall, although a few are spread by animals.

Fallen acorns deteriorate rapidly if not protected from drying. Leaf cover provides some protection, but several inches of mineral soil cover works even better for keeping the acorns moist and minimizing damage by insects and other animals.

Acorns from white, swamp white, and bur oak begin germinating in the fall immediately after the acorns drop; northern red, black, and northern pin oak acorns germinate the following spring. During germination and first-year growth, seedlings can survive in low light. Thereafter, they need more light to survive as time progresses.

The ability to stump sprout vigorously after drought, fire, or other damage gives the oaks a distinct advantage over other hardwoods. This ability varies by species, age, diameter, and site quality. In general red oaks sprout most readily. Sprouting declines as trees grow older and as tree diameter increases. Few oaks larger than 17 inches in diameter will sprout. Oak trees are more likely to sprout on good-quality sites than on poor sites.

## Shade Tolerance

Oaks are only moderately tolerant of shade, and young oaks need full sunlight to outgrow their competitors. This means that in oak stands that have a dense overstory and understory there will be few oaks in the understory. When overstory trees are harvested or die of natural causes, the understory trees (called advance reproduction) are released to grow, creating a stand of shade-tolerant tree species and a few oaks that originate from stump sprouts.

## Harvest

If you want to perpetuate oaks, a carefully planned harvest will provide the sunlight and space oak seedlings need to survive. Oak stands are ready to be harvested and regenerated when trees are

economically mature, when large numbers of oaks are dying from any cause, or when a stand is stocked with poor-quality or undesirable trees.

Oaks reach economic maturity when they are about 16 inches in diameter (measured 4-1/2 feet above ground) on poor sites, 20 inches on good sites, and 24 inches on the best sites. It will take 60 to 90 years to produce such trees on good sites and 90 to 120 years on poor sites.

## Regeneration

Natural regeneration is the least expensive way to grow oaks. To regenerate oaks in a mixed hardwood stand, work with a forester and follow these steps:

### Measure Regeneration Potential

Have a forester inventory the advance reproduction and the overstory to determine the ability of the stand to regenerate itself. The number of oak seedlings needed to stock a stand depends on their height, since large seedlings are more likely to survive than small seedlings.

When seedling numbers do not meet stocking goals, the forester should evaluate stump sprout potential. If both seedling numbers and stump sprout potential are inadequate, you still may get satisfactory regeneration from acorns. Rely upon acorns for regeneration only in years when there is a good acorn crop. As a general rule, a stand must be at least 50 percent mature oak to be a good acorn producer.

### Evaluate and Plan to Control Competition

Plants that overtop oak seedlings eventually will eliminate them. Control competitors by chemical or mechanical treatment depending on the size, density, and species of plants. A forester can determine whether control is warranted.

Foliar herbicides will control ferns, shrubs, and trees less than 10 feet tall. They work best when applied in late summer or early fall. Protect oaks by cutting oak stems taller than 3 feet before applying the herbicide. Cut stems will resprout.

Control large shrubs and saplings by applying herbicides as a basal spray or stem injection. Kill larger trees by felling and applying herbicide to the stump or by girdling with an axe or chainsaw and applying herbicide to the girdle. These treatments are most effective in mid- to late summer.

Caution: Be sure to contact a forester for regulation and recommendations concerning herbicides and their applications!

Undesirable shrubs and small trees also can be killed by mechanical uprooting before, during, or after logging. Expose the roots but do not cut or break off the stems because that leads to sprouting. Oaks generally survive this treatment because of their deep roots and ability to sprout after top injury. Apply this treatment when the ground is not frozen, avoiding severe soil displacement.

If adequate advanced regeneration exists, you should not need to control ground vegetation that grows up following the final harvest. The oak reproduction may appear to be buried under dense growth, but it will emerge after four to six years.

## Releasing Crop Trees

Crop trees need to be released from competition if they are to remain healthy and grow fast.

### Apply a Regeneration System

A regeneration system is a combination of harvest and other activities that creates conditions favoring tree regeneration.

To satisfy oak seedling light requirements, openings must be at least 1/2 acre (160-foot diameter circles). An opening of at least 2 acres (200 feet wide) is recommended, however, because smaller openings are costly to manage and harvest and have a larger proportion of their area in "edge," increasing the potential for adverse edge effects (reduced oak seedling growth due to shade from border trees; increased branching of border trees, reducing their wood quality). If deer browsing is a problem, openings of at least 4 acres are desirable.

If your main objective is to grow timber, there is no reason to limit stand size. If your objective is to provide periodic timber harvests and encourage wildlife diversity, harvest small blocks of timber at planned intervals (e.g., 10 to 15 years) to create a mix of stand ages. Across a forested landscape only one to two percent of the forest needs to be regenerated each year on average.

Regeneration systems that will satisfy oak light requirements are group selection, clearcutting, and shelterwood.

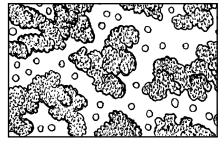
## Group Selection

Group selection is cutting all trees larger than 2 inches diameter in an area from 1/2 to 2 acres. This system leaves too much shade for continued survival and growth of numerous oak seedlings, but it is superior to harvesting individual mature trees scattered throughout the

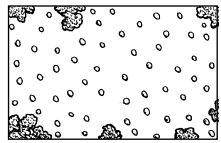
woodland. The relatively small openings may be desirable for aesthetics or encouraging wildlife.

Select areas to be cut that contain advance oak reproduction and mature trees. If advance reproduction is lacking, either (1) delay harvest until a year when there is a good acorn crop, (2) apply a shelterwood harvest followed several years later by a group selection, or (3) harvest by group selection and plant oak seedlings in advance of the harvest.

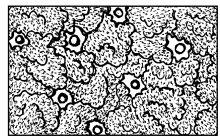
If necessary, control understory vegetation before or during the harvest. During or after the harvest, remove or kill all trees larger than 2 inches in diameter. Cut unmerchantable/poorly-formed oaks as low as possible to encourage sprouting from near ground level. Use herbicides on undesirable species that produce vigorous stump sprouts.



**Shelterwood**



**Clearcut**



**Seed Tree**

Prepare for the next harvest by controlling understory competition and applying a shelterwood cut in another 10 percent of the stand. In this way, the entire stand will have been regenerated to oak after 10 cuts.

## Clearcutting

Clearcutting here means to cut all trees larger than 2 inches in diameter in an area larger than 2 acres. Clearcutting is recommended when regeneration potential is adequate.

Clearcut areas that contain advance reproduction and mature trees. If advance reproduction is lacking, delay harvest until there is a large acorn crop or harvest and plant oak seedlings.

Before or during the harvest, control understory vegetation if necessary. During or after the harvest, remove or kill all trees larger than 2 inches diameter. Cut unmerchantable oaks as low as possible to facilitate sprouting from near ground level. Use herbicides on undesirable species that produce vigorous stump sprouts.

## Shelterwood

The shelterwood system is recommended when oak regeneration potential is inadequate or uncertain. It involves two or more harvests several years apart in the same stand. The first harvest is a thinning and the final harvest is a clearcut or group selection.

The first harvest removes some merchantable timber as well as undesirable species. It creates holes in the canopy that permit sunlight to

reach oak seedlings and stimulate their growth and may encourage residual oaks to produce more acorns. Light levels can be regulated by the amount of thinning to favor acorn germination and oak seedling survival while suppressing competition from undesirable trees and shrubs.

Make the first cut after a large acorn crop, if possible. Leave the best trees of any desirable species and all unmerchantable oaks capable of producing stump sprouts. Remove all other trees larger than 2 inches diameter, including seed producing trees of undesirable species. This cut should leave a parklike stand with a 60 to 70 percent canopy having no major gaps. It is better to leave too many trees than too few, or you may encourage competition in the understory.

A good acorn crop within two years of understory removal usually will assure adequate reproduction. If a good acorn crop does not occur within three years, control understory competition a second time, preferably during a good acorn year.

Make the final cut when a forester determines that the advance reproduction is adequate. This cut releases seedlings and yields more merchantable timber.

## Monitor Competition and Oak Development

Inspect the stand the first year after applying a regeneration system. Determine whether the number of oak seedlings and stump sprouts is adequate and evaluate competition from undesirable vegetation. If oak regeneration is not adequate, plant oak seedlings. Control any competition from undesirable trees and shrubs.

## Artificial Regeneration

Artificial regeneration refers to planting tree seedlings or seeds. Use it only as a last resort for establishing oak, since planting seedlings is expensive and direct seeding is not dependable. However, you may need to plant or seed to reforest open fields, to supplement natural regeneration, or to introduce oaks where acorn-bearing oaks are scarce.

Plant northern red oak when growing oaks for timber production on good sites. Consider planting a mixture of desirable species such as oak, walnut, and white ash if they are suitable for the site and seed sources are not present. This will create a more diverse stand, reducing the potential for insect and disease problems.

Plant white oak on poor, dry sites for wildlife or aesthetic purposes.

Oak seedlings are the most common planting stock, but acorns are sometimes planted.

## Planting Seedlings

Plant large seedlings (at least 3/8-inch stem diameter) with fibrous root systems. During transport and planting, keep seedlings cool and roots moist and protect them from direct sunlight and wind. A planting bar works fine for small seedlings; plant seedlings with large root systems in holes using shovels or augers.

Dense, young stands force trees to grow straighter and to self-prune branches at an early age. On forest sites plant oaks 20 to 25 feet apart; other trees (even though they may not be oak) will create the necessary density.

In open fields, plant trees 8 to 10 feet apart within rows and 10 to 12 feet apart between rows. This closer spacing will promote earlier crown closure, which will shade out understory weeds while producing high-quality trees. Spacing can be varied to permit access by weed-control equipment.

Animals may harm oak seedlings. Discourage rodents by keeping the area immediately surrounding the seedlings as weed-free as possible during the early years. Moderate browsing by larger animals usually can be tolerated. However, to discourage severe browsing, you may need to fence entire stands or use tree shelters.

Tree shelters are tubes about 3 to 4 inches in diameter and 2 to 5 feet high that can be placed over oak seedlings. They protect seedlings from animals. They also modify the microclimate around seedlings much like a miniature greenhouse.

Tree shelters stimulate seedling growth, but are expensive. On harsh planting sites, or sites where animal damage is likely to be severe, use 50 to 100 shelters per acre to assure the survival of a minimum number of oak seedlings.

Control competition for about three years after planting. Herbicides are practical and economical; cultivation may be used in field plantings. Contact a forester for specific advice.

## Planting Under Shelterwood

Planting under shelterwood gives oak seedlings time to become established before the overstory is removed and competing vegetation invades. Before planting follow the harvest and understory control procedures described previously for the shelterwood system.

Plant in early spring following the first shelterwood cut. Irregular spacing is acceptable. Plant in spaces lacking acorn-bearing trees or where competition is minimal. If the seedlings are 3/8 inches in diameter or greater, plant two for each crop tree wanted; if smaller, plant three

times as many seedlings as crop trees desired.

Remove the overstory during the dormant season three to six years after planting when seedlings are at least 2 feet tall. Any seedlings damaged during harvest will resprout. Control stump sprouts of undesirable species. Remove competing trees that invade after overstory removal when they are 1 to 4 inches diameter (about 10 years old).

## Planting in a Clearcut or Group Selection Opening

Control understory vegetation before or immediately after overstory removal. Harvest the merchantable trees and remove or kill all residual trees. Control stump sprouts of undesirable species.

Plant seedlings in early spring following the harvest where desirable reproduction is lacking. Irregular spacing is acceptable. Control invading competition around planted seedlings for about three years.

## Planting in an Open Field

During the fall before planting, control vegetation with herbicide followed, when feasible, by plowing, disking, or rototilling. Treat either the entire site or strips at least 6 feet wide. After planting control competing vegetation as needed, usually for three years.

## Planting Acorns

Acorns are less expensive to acquire and plant than seedlings. Acorn planting is rarely successful, however, because of pilfering by rodents and lack of competition control. The following procedures may increase your chances of success.

Collect mature acorns as soon as they drop. Keep them cool and moist. Place them in a tub of water and discard the floaters. Sow white oak in the fall, as soon as possible after collecting; sow red oak immediately in the fall or, if necessary, delay until the following spring.

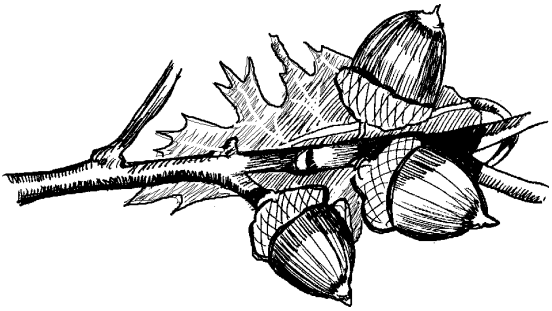
Germination probably will begin in storage and accelerate when the temperature is raised. Only plant acorns that develop small white roots (broken roots will resprout).

After controlling understory vegetation, plant acorns in openings at least 1/2 acre in size (the larger the opening, the better) that are fairly free of litter and logging debris. Plant acorns 1 to 2 inches deep in spots several feet wide, 3 or 4 acorns to a spot. Sow at least twice as many spots as trees wanted. For added insurance, cover some of the planted acorns with small tree shelters. Bury the bottoms of the shelters several inches deep to discourage digging by squirrels.

## Forestry Vendors

Many individuals and companies offer tree planting and timber stand improvement services to Arkansas landowners. For a list of forestry vendors in your area, contact the Arkansas Forestry Association or any Arkansas Forestry Commission office.

As with any professional service, landowners should request a written contract. This agreement will specify the service(s) to be provided and stipulations that guarantee service(s) provided.



# Upland Hardwood Forest Protection

## Insects and Disease

Upland hardwood trees are susceptible to many insects and diseases. The annual combined loss due to insects and diseases is often more than the losses to forest fires.

Some losses to insects and diseases are unavoidable. However, most losses can be avoided through proper forest management. Landowners with possible damage should promptly call a forestry professional or Arkansas Forestry Commission forester for an evaluation.

The following table contains information on the most common insects and disease problems of upland hardwoods.

## Fire Protection

During the post-Civil War period of 1865 to 1910, discovery of Arkansas' natural resources led to widespread exploitation of the forest resources. Forest fires commonly followed logging so land could be cleared for agriculture. During the 1920s, destructive wildfires in Arkansas stimulated interest in a conservation movement that lead to the creation of the Arkansas Forestry Commission (AFC) in 1931. A part of the AFC's mission is to prevent and suppress wildfires. Since 1992, fires in Arkansas have destroyed or damaged timber on an average of 32,800 acres annually.

Mature hardwood forests should be protected from fire. Small surface wildfires kill seedlings and small trees, especially if the soil and litter are dry. Some wildfires kill productive stands of large trees. Although a wildfire may not kill a tree, it may leave a fire scar where disease can enter, especially on hardwoods. In addition, fire injuries often lower the sale value of timber by half or more. Fire-weakened trees may also be attacked by insects or felled by wind, years after the fire.

To help protect a forest from fire, a firelane can be constructed around the perimeter of the property. For large forest tracts, firelanes can be used to divide the tract into smaller units and also serve as roads. They should be at least 15 feet wide. Typically, firelanes are constructed by a dozer; however, they can be annually maintained with a farm or wildland disc.

Firelane construction and maintenance should always follow Best Management Practices, discussed in the following section on Sustainable Forestry.

Some wildfires can consume all the litter and impair the ability of watersheds to absorb rainfall. Soil erosion can occur which will cause a reduction in productivity of the site, and reduction in quality of water in streams because of soil sedimentation. Fire early in the life of a forest (0 to 15 years) may actually encourage desirable species. This relationship is not well understood.

## Destructive Grazing

For forest improvement to be successful, the woods must be protected from livestock grazing. Grazing reduces soil quality because livestock compact the soil on the forest floor. Compaction prevents feeder roots from getting necessary air supplies through the soil, and allows organic mulch to be washed away by water before the nutrients can be absorbed into the soil.

# Sustainable Forestry

## Best Management Practices (BMPs)

BMPs are common-sense, economical and effective practices that minimize soil disturbances and consequent water quality problems during forest activities.

Planning can be the least costly and most resourceful activity available to a landowner. Consultation by a forest resource professionals prior to the commencement of forest management operations can help solve many potential problems.

Locations of roads, stream crossings, log skidding and loading areas, identification of streams and buffer strips are among many items that can be identified and planned on maps prior to the start of any on-the-ground activities. Walk over the harvest tract and be knowledgeable of the terrain features that require attention in planning.

To protect these plans, inform all contractors and individuals involved in your forest management activities of these decisions and utilize written contracts that include BMP stipulations in the execution of the management activities.

Widely accepted and commonly adopted practices include the following considerations.

- Locate roads out of Streamside Management Zones (SMZs) and far enough from zones to allow sufficient distance to disburse the impact of flooding rains before entering streams. SMZs are the forested areas adjacent to stream channels. The purpose of SMZs is to reduce the quantity of sediment and water from a harvested area that reaches a stream and to prevent water temperature increases.

**Streamside Management Zone**

- Maximize the use of gently sloping terrain by constructing roads along contours and the crest of ridges-not straight up and down slopes.
- Place culverts and appropriate bridge type crossings when crossing water courses to ensure that stream banks are stable during usage to minimize erosion. Always keep stream-crossing

locations to a minimum and cross streams at right angles.

- Use seeding and mulching on locations subject to excessive erosion. Close off access to roads that are no longer needed.
- Plan skid trails to follow contours, if unable to do so, then avoid prolonged use of one skid trails and, upon completion, seed mulch and waterbar all trails subject to erosion.
- Locate landings on level locations not subject to erosion. Avoid areas adjacent to streamsides and buffer strips. Seed landings subject to erosion before leaving tract.
- Harvest only mature timber from SMZs so stream shading, water filtering, and bank stabilization is not destroyed.
- Fell trees away from streams and remove any debris or tops in streams and SMZs.
- Perform site preparation activities such as soil ripping, shearing, chopping, and windrowing of vegetation along contours.
- Minimize mechanical disturbance around streamside area.
- Firelanes should be seeded to prevent soil erosion. Seeded firelanes can also serve as a food source for wildlife.
- Keep chemicals out of streams and SMZs. Use all chemicals in accordance with label directions.
- Properly dispose of containers and keep accurate records of all chemical usage.
- Properly close out the forest management activity.

Prior to completion of the job, thoroughly walk the area out to ensure all BMP objectives are completed and met. Examine the area again within two months to check for needed maintenance such as road seeding, waterbars, and stream bank stabilization. This will help ensure future productivity and long-term integrity of the site.

## Protecting Soil and Water Quality

Most soil erosion and water quality problems associated with woodland management result from soil disturbance during road construction, harvesting, and site preparation for regeneration. Water quality also can be affected by herbicides and pesticides.

BMPs reduce the impacts of forestry activities on soil and water. Contact a forester for information regarding BMP guidelines. Here are a few general rules to follow:

- Do not scrape away the topsoil when clearing sites for regeneration. Use equipment that will mix the soil in place or scarify patches (e.g., disks, rock rakes, anchor chains, or patch

and row scarification machines).

- When skidding logs, stay away from stream channels and avoid long, straight, steep grades. Keep skidders off steep slopes as much as possible by winching logs to a more level area.
- Construct broad-based dips and lead-off ditches to channel water off roads and skid trails.
- On highly erodible soils, log when the soil is dry or frozen.
- Locate log landings on level or nearly level sites, away from streams and poorly drained areas.
- Leave buffer strips between the harvest area and streams or lakes. You may selectively harvest trees in buffer strips if you do not disturb the surface litter and vegetation. Promptly remove tree tops from water bodies.
- Do not harvest trees that shade trout streams.
- Minimize stream crossings. Build appropriate structures when crossing streams to protect stream beds and banks and permit free flow of water.
- Follow federal and state regulations for herbicide and pesticide use to prevent contamination of surface and ground water.

## Aesthetics

Some woodland management activities create conditions that some people consider to be unsightly. Here are some practices that will help protect the beauty of oak woodlands.

- Use forest management methods that can minimize visual impacts such as single tree and group selection cuts and small patch clearcuts.
- Leave corridors of trees along well-traveled public roads to enhance visual quality.
- Use irregular shaped cuts that follow terrain features and topography.
- Maintain a mixed tree species composition.
- Minimize logging residue by utilizing as much of the felled material as possible. Keep as much logging debris as possible at the cut location and not the log deck and loading area.
- Reseed bare soil areas immediately.
- Leave scattered groups of trees in clearcuts.

For more information about Arkansas Best Management Practices, contact any Arkansas Forestry Commission office.

## Tree Farm Program


Tree Farmers are forest landowners who have been recognized as good stewards of their property. They have had to meet certain requirements of good forest management and have had to demonstrate a dedication to the wise use of natural resources.

There are over 70,000 Tree Farms throughout the nation, including more than 3,800 in Arkansas.

Arkansas is more than one-half forest land. Most of this forest land is held in private, tax-paying ownership. Also, most of this land is capable of producing renewable forest crops as well as providing other valuable benefits to society and the forest owner.

## How to participate

A prospective tree farm is carefully inspected by a forester at no charge, for the following items:

- At least 10 acres are required for certification.
- Privately owned, tax-paying forest lands qualify for Tree Farm certification (certain Scout, 4-H, and municipal lands may qualify).
- A forest management plan. The objectives of the forest owner are important in judging performance.
- Protection must be provided from insects, disease, fire and destructive grazing.
- Harvesting of forest crops is important to utilize the renewable forest resource and to improve the growth of timber.
- Dedication to growing repeated forest crops.
- Other improvements to the land such as tree planting, timber stand improvement, pruning, stream improvement and wildlife habitat improvement.

Tree Farm is a registered trademark of the American Forest Foundation. To have a Tree Farm representative contact you to inspect your Arkansas forest land, please contact Susan Glaze at the Arkansas Forestry Association, (501) 374-2441.

# Economic Considerations

Landowners often ask if it pays to own and manage hardwood stands. The correct economic answer to such a question is that "it depends." Financial returns may be competitive with other investments, depending upon strength of local markets, quality of trees, stocking levels of desirable species, site quality, size and location of the tract and several other factors. The purpose of this section is to present the process for financial analysis used in evaluating alternatives. The intent is to help the landowner understand the framework for analysis and evaluate options presented by professional foresters and consultants.

Financial analyses are made in a variety of ways, using different assumptions, and varying measures of performance. You must have a grasp of these basic concepts to make the correct financial decisions for your particular situation. Nonindustrial private forest landowners (NIPF) commonly ask one of two questions: "Should I buy land and manage it for timber production?" Or, "since I already own the land (and intend to keep it) should I grow trees and invest in more intensive timber management?"

The first question relates to the complete timber production investment while the second concerns the return on specific treatments or marginal analysis. The main difference between the analyses of the two questions lies in handling. Assume that a landowner does not intend to sell his or her land under any circumstances and merely wants to know whether or not to make an additional investment. Then he or she may choose to exclude land costs and consider only marginal analyses. However, the basic process of financial analyses and economic decision-making are the same whether one is considering the complete timber production investment or marginal analysis.

## Framework For Financial Analysis

The first step to any financial analysis is to identify all possible options or alternatives. This may include comparisons between forestry versus certificates of deposit, stocks, bonds, mutual funds, or other investments. When you ignore the opportunity of selling the land it may also include options such as forestry versus agricultural use or different management options for a timber stand (planting, natural regeneration, precommercial thinning, commercial thinning, fertilization, weed control, or just leaving the stand to grow). Each option or alternative must be considered suitable for the landowner's or investor's goals. It must also specify a management activity schedule to accomplish that

option.

The second step is to determine the yield response to each treatment. For forestry treatments, the additional quality and quantity of timber available as a result of each treatment must be forecast for estimated harvest times. The estimates of yield response require growth projections using yield models and stand tables. Since there is usually uncertainty associated with these projections, it is wise to compute a range of yields based on each treatment. This way minimum and maximum financial returns are calculated.

The third step is to estimate the costs and revenues that occur with each option. These costs and revenues may be one time, annual, or periodic costs. Examples of one-time costs may be site preparation and planting. Annual management costs include those costs that are usually deductible on a yearly basis from Federal and State taxes. They include salaries, professional fees, maintenance of roads, fences and equipment, fire protection, insect and disease control, and annual property taxes. Periodic expenses may include thinning, fertilization and weed control. Although revenues largely accrue when the stand is harvested, revenues from commercial leases or other recreational uses and mineral revenues may occur.

The process of estimating costs and revenues over time is called developing cash flows. Each activity, when it is to be done, the amount to be done and the cost per unit value are all specified. For example, site preparation will be done in year 0 on 100 acres at a cost of $50 per acre, or harvest of 100,000 board feet of timber will occur at year 30 producing an income of $85 per thousand board feet.

Special Note: Although we may know the cost and prices for each activity, the cost or price of an activity at some future time involves estimates. Costs and prices change over time due to inflation and to differences in the rates of change relative to one another. The rate of value change is usually an annual percentage change of the current value. For example, we may know that red oak is selling for $85 per thousand board feet, today. We may expect a real price increase of 2 percent per year over inflation. If inflation is included in the percentage of price increase, it is a nominal rate as opposed to a real rate. Either way to estimate costs and prices in the future is acceptable as long as they are all done consistently.

The fourth step of financial analysis is to compute financial returns. Financial returns are usually computed on an after-tax basis, or presented both before and after tax. Income tax laws and regulations can have a large effect on financial returns because annual taxes are a cost to

the landowner. Some tax benefits can add to expendable income. Recent changes in the tax laws have altered the use of capital gains and affected how management costs, taxes and interest are deducted from gross income. A landowner/investor should be aware of how taxes are handled in computing financial returns.

A sensitivity analysis should also be done when computing financial returns. As discussed above, financial analyses demand that assumptions are made concerning costs, prices, yields and discount rates. Low or high estimates can lead to unrealistic calculations of financial returns and to the wrong decision A sensitivity analysis changes each assumption and computes the returns under a range of conditions.

The final step in any financial analysis is to compare investment returns and select the best option. Landowners should remember that any one measure of financial return or performance does not convey all the important information about an investment. Although returns may look extremely profitable, an investor may not have the capital needed to make an investment. Financial analyses usually do not consider multiple forest management goals which include wildlife management and recreation in addition to timber production. In most cases, some profit will be traded away to meet nonmarket goals. A landowner needs to make these goals clear and concise before financial analyses will help in decision- making.

## Financial Investment Criteria

The most useful measures of financial performance recognize that money in hand today is worth more than the same money received at some future date. This "time value" of money is handled by discounting costs and revenues, which occur at different times, to the same point in time, and comparing them. It is also for this reason that treatment options must be compared for investments of the same length or for investments that extend to a common year. The "discount rate" (cost of capital) is the minimum annual rate of return that is acceptable for the investment.

The four performance criteria below are useful in deciding whether to undertake a certain forestry project and in choosing among mutually exclusive alternatives. Mutually exclusive means that you can do one or the other (plant soybeans or cottonwood trees), but you cannot maximize both on the same piece of land. Again, it is wise to remember that no measure of performance can convey all information about an investment.

Net Present Value (NPV) — In this analysis, each cost and revenue is

converted to its present value using the "discount rate." For example, assume a thinning operation will cost $50 per acre 10 years from now. Then, the actual cost in today's terms (assuming a discount rate of 8 percent) is $50 divided by (1.08) or $23.16. The sum of all discounted costs (negative) and revenues (positive) is the net present value (NPV). It is the increase in the present value of the landowner's wealth from undertaking the project. A net present value greater than zero means that the project will earn a profit of the discount rate plus an amount equal to the NPV. If NPV is a positive value, then the project is worthwhile. In choosing between mutually exclusive alternatives, the project with the highest NPV is preferable. NPV is the most accurate performance criteria to use.

Rate of Return (ROR) — The rate of return (ROR) is also known as the return on investment or the internal rate of return. ROR is the most commonly used measure of financial performance. It is, by definition, the discount rate that results in a net present value (NPV) equal to zero when all costs and revenues are discounted to the present. If the rate of return exceeds the discount rate, then a project is acceptable. Between mutually exclusive projects, the project with the highest ROR is chosen. A characteristic of ROR is it measures profitability as a ratio (earnings to invested capital) rather than as an absolute dollar amount (as does NPV). The ROR also assumes that any intermediate revenues are reinvested at the same rate. While ROR must be found by trial and error, computer programs are available to simplify this task. ROR has the advantage of being directly comparable to rates of return on other readily available investment opportunities (i.e., certificates of deposit, stocks, bonds, etc.).

Benefit/Cost Ratio (B/C) — The benefit/cost ratio (B/C) is found by discounting all costs and revenues (benefits) to the present as in NPV calculations above. Then, the ratio of benefits to costs is computed. A ratio greater than 1.0:1 shows that a project is acceptable because the benefits exceed the costs. Between mutually exclusive investments, the project with the highest ratio should be chosen. A ratio of 1.2:1 means that $1.20 of benefits are produced for every S1 invested.

Annual Equivalent Value (AEV) — This measure is also known as the equal annual equivalent. It is simply the net present value (NPV) expressed as an annuity. AEV permits comparisons between investments that have annual returns (agriculture) with projects that generate periodic returns (timber). The project with the highest AEV is selected when comparing mutually exclusive investments.

# Assistance

There are many private and government organizations that provide professional forestry assistance. Please consult the *Arkansas Forest Landowner Assistance Directory* or contact any Arkansas Forestry Commission office for more information.

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