

Don't overlook those **BOTTOMLAND HARDWOODS**

Wetlands can produce
excellent hardwoods
and shelter for game

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Mature bottomland hardwood stand with clean understory is result of good management

From Virginia to Texas, there are about 30 million acres of forests in swamps, creek margins, and river bottoms. These bottomland areas can be efficient producers of high-quality hardwoods, and they are unexcelled as habitat for many species of game and nongame birds and animals.

In fact, the southern bottomlands are extremely diverse in species, sites, wood qualities, and uses. Stands may be even- or many-aged with essentially one or, more commonly, over 20 commercial species. Factors entering into management decisions about these stands are generally recognized and discussed in this article. The landowner should realize, however, that sound judgment, experience, and advice of a professional forester are needed for a good management program.

Management Choices

Fully stocked mature stands with high-quality sawtimber

trees of good species are the exception in bottomland forests. But where they exist, we may assume that the forest is beyond the need for thinning and ready, or will become ready, for a regeneration harvest. The landowner has a choice among five systems of harvest that will lead, in varying degrees, to the establishment and development of new stands:

Single-tree selection. Single, commercially mature, suppressed, or damaged trees are removed at frequent intervals. The amount of cutting should be controlled by growth of the stand, as determined by periodic inventories.

This method is difficult to use and can lead to several problems. There is a tendency to cut the largest and best trees, thereby reducing overall stand quality. Too often, only sawtimber trees are removed and the small openings created are immediately dominated by midstory trees that may be cull or undesirable species, such as eastern hophornbeam or American hornbeam.

Also, since selective cutting opens a stand gradually and limits the amount of sunlight reaching reproduction, the new regeneration is usually of more shade tolerant species, many of which are slower growing and less valuable. Vines may be more of a hindrance to reproduction in small single-tree openings, since the young trees do not grow fast enough to shade out the vines.

Group selection. Group selection amounts to clearcutting in patches ranging from perhaps $\frac{1}{2}$ acre to 2 acres. Openings larger than 2 acres might be termed clearcuts since most of the reproduction they contain is unaffected by the surrounding overstory. The opening should be completed by harvesting all merchantable pulpwood and cutting or deadening undesirable trees down to 1 inch dbh. Regeneration will include trees of intolerant species that will have enough sunlight to continue developing. When carefully applied, this system may provide the biological advantages of a clearcut without disturbing aesthetics.

Shelterwood. Under this system, trees are harvested in stages to nurture reproduction. In effect, the procedure is heavy thinning and complete weeding prior to final harvest. It is used most often to regenerate heavy-seeded species, particularly the oaks. After reproduction becomes established, the shelter trees are removed in one or more cuts. The system is not recommended for species that are intolerant in the seedling stage.

Clearcut. All merchantable trees are cut over an area greater than 5 acres; the remaining trees of undesirable species should be deadened or cut to promote favorable sprouts; that is, stumps should be no more than 6 inches high. Another option following harvest is to shear all remaining trees, again leaving stumps at or slightly above ground level.

Clearcutting is best suited where there is ample advance reproduction and where the trend is toward even-aged management in large blocks.

There is usually a good mix of tolerant and intolerant species in bottomland hardwood clearcuts. Species may be difficult to ascertain, though, because clearcut areas may go through a jungle-like stage for five to eight years before the growth of individual tree stems restores a forest appearance to the area. Trees of good commercial species will ultimately develop into a codominant position even though sprouts of undesirable species may dominate in the early stage. Due to their relatively slow height growth, trees of various red oak species may be in an intermediate crown position for the first 20 to 30 years. But evidence is mounting that several of the oaks may ultimately reach a codominant position.

Abused Stands

Far more common in the bottomlands than fully stocked, high-quality stands are the abused stands resulting from years of wildfire, highgrading, liquidation cuts, or other destructive influences. Sometimes, if a stand is not too rundown, an improvement cut to remove overmature, damaged, and dying trees of marketable size and quality will suffice. Purpose of the improvement cut is not to regenerate, but to favor continued development of the remaining desirable species.

More often, though, an appropriate course of action is to begin regenerating the least productive areas, assuming there is no inherent site problem. Since commercial loggers must have a minimum of 1,200 to 1,500 board feet per acre in logs of acceptable quality, some growing stock trees will likely be sacrificed. To favor regeneration, openings should be free of trees larger than 1 inch dbh.

Size of opening is important to the development of reproduction. Assuming they are circular, openings should be a minimum of $\frac{1}{2}$ acre (about 165 feet in diameter). Smaller openings will help desirable trees become established, but will restrict their continued development. They may be overgrown

by less desirable competitors. Larger openings, including those of several acres in size, will nearly always result in satisfactory regeneration establishment and development.

Considering the fundamentals of regeneration, the landowner must decide on a minimum opening size best suited for his or her objectives. Openings of $\frac{1}{2}$ to 1 acre may be appropriate for a 40-acre tract, whereas 5-acre openings might better suit the person with a 500-acre forest.

Stands under management are often in even-aged groups of trees, covering from less than 1 acre to several acres in size. An early decision in developing stands is whether or not to do precommercial thinning, weeding, or individual tree release. Although such practices may be desirable to improve growth and development of select trees, they are probably not economical for most growers, even in extensive stands. Thus, the first thinning is usually when codominant trees are 8 to 10 inches dbh. Thinning will remove many weakling trees 5 to 8 inches in diameter, the minimum size for most commercial pulpwood harvests. Most of the vigorous dominants should be left to grow.

Some species—chiefly eastern cottonwood, black willow, sweetgum, baldcypress, yellow-poplar, and the tupelos—typically occur in even-aged almost pure stands. Assuming that trees of these species will grow at the rates listed for them in the 6- to 12-inch class in the table, eastern cottonwood may be ready for a first thinning in about 15 years and sweetgum in about 30.

A second thinning might occur when codominants average 14 to 16 inches dbh and a third when they average 20 to 22 inches. Basal area of leave trees should average about 85 square feet in 70 trees per acre after the second thinning and 100 square feet and 35 trees per acre after the third. With proper thinning, mixed stands on an average to good site should grow to 22 inches dbh and may yield about 15,000 board feet per acre in about 60 years.

Artificial Regeneration

Planting. Hardwood planting in southern bottomlands has been concentrated on eastern cottonwood, sycamore, sweetgum, and to a much lesser extent, green ash, and the red oaks. Research at Stoneville, Mississippi, however, shows that all major commercial species can be successfully planted. Planting sites have included old fields, but the norm has been on cleared and site-prepared forested lands.

Four major rules for hardwood planting were developed after early research, and recent experience has substantiated their value.

1. Plant species suited to the site. Most hardwood species are site sensitive, and selecting the wrong species for a site can be disastrous. The most common mistake is to plant a water-intolerant species on a wet site. As a general rule, very water-tolerant species can grow well on moist, well-drained sites, whereas water-intolerant species cannot adjust to wet site conditions.

The U.S. Forest Service's Southern Forest Experiment Station has formulated a guide to aid the landowner in recognizing sites suitable for growing hardwoods, *A Practical Field Method of Site Evaluation for 14 Important Southern Hardwoods and Hardwood Suitability for and Properties of Important Midsouth Soils*.

2. Use good stock. Vigorous seedlings should be selected for planting. For most species, this means seedlings that are a minimum of 24 inches tall and $\frac{1}{4}$ -inch diameter at the root collar. Nurseryman's instructions should be followed for care of stock before it is planted. An important point is not to allow seedlings or cuttings to dry during storage.
3. Plant properly. Seedlings should be planted with the root collar slightly below, never above, ground level. Root

collars 3 or 4 inches below ground level should not reduce survival. Seedlings of nearly all hardwood species can be successfully root pruned to fit a dibble bar hole, about 4 inches wide and 9 inches deep. Machine planting is an option, but bottomlands are usually too wet to be suitable for machine planting.

4. Care for the plantation. Cultivating to control weeds is desirable, even necessary for cottonwood, and it benefits the early growth of most species. It is not essential for the survival of some species such as green ash and most oaks. But without some kind of vegetation control, natural regeneration may invade and grow about planted seedlings.

For most planted hardwoods, best growth occurs on sites that are of medium texture, moist, yet well drained. Pattern of growth will vary among species. For example, intolerant species such as eastern cottonwood and sycamore will grow most rapidly during the first 10 years after planting, whereas the red oaks grow slowly early but their growth rate increases. Codominant trees on the best sites will average in 18 years about 110 feet in height for eastern cottonwood, 70 feet for sycamore, 65 feet for green ash and sweetgum, and 55 feet for red oaks.

Annual merchantable pulpwood yields over the same time period will average, per acre, about three cords for eastern cottonwood, two cords for sycamore, one and one-half cords for sweetgum and green ash, and one cord for red oaks. In 20 years, eastern cottonwood plantings can produce over 8,000 board feet (Doyle) per acre in trees 13 inches dbh and larger. It would probably take the other species from 30 to 45 years to match the 20-year yields of cottonwood.

Plantation spacing should be 12 by 12 feet if the developing stand is to be thinned but not pruned. Even if pulpwood is the sole objective, a 12- by 12-foot spacing, without thinning, will allow codominant trees to reach about 8 inches dbh with little volume reduction compared with closer spacing.

Direct Seeding of Oak

A recent trend in regenerating old fields and in supplementing the oak component in complete forest openings of an acre or more is the sowing of acorns by hand or machine. Acorns of Shumard, cherrybark, water, and Nuttall oaks sown at depths of from 1 to 6 inches deep have successfully reestablished oaks in several hundred acres of abandoned agricultural fields and in recently harvested openings in the natural forest.

Generally, about one-third to one-half of the acorns sown will result in a living seedling after one year. Satisfactory results can be obtained from year-round sowing provided acorns have been kept viable

through proper storage. While well-defined guidelines on oak seeding are not yet available, the latest information can be obtained from the Southern Hardwoods Laboratory, Box 227, Stoneville, Mississippi 38776. □

Ten-year average diameter growth rates for trees free to grow in unmanaged stands on average bottomland sites¹

Species	Diameter class at beginning of 10-yr. growth time			
	6-12 inches	14-18 inches	20-28 inches	30 + inches
	-----Inches-----			
Sweetgum	2.80	2.85	3.05	2.30
Red oaks	3.60	4.30	4.45	3.25
White oaks	2.40	2.50	2.90	2.70
Ashes	2.05	2.30	2.85	2.65
Tupelos	2.85	3.15	3.25	3.00
Pecan	2.60	3.55	3.60	3.10
Cottonwood	6.30	5.85	6.30	4.65
Willow	3.80	5.45	5.50	4.20
Overcup oak	2.05	2.20	2.10	2.15
Water hickory	1.95	2.00	2.30	2.55
Baldcypress (second-growth)	2.30	2.60	3.20	2.70
Miscellaneous rapid growers ²	3.20	3.30	3.80	3.70
Miscellaneous slow growers ³	2.00	2.10	2.50	2.30
Average	2.55	2.80	3.00	2.80

¹ Putnam, J. A., Furnival, G. M., and McKnight, J.S. 1960. *Management and inventory of southern hardwoods*. U.S. Dept. Agric., Agric. Handb. 181. 102 p.

² American elm, maples, American sycamore, honeylocust, waterlocust.

³ Cedar elm, winged elm, black tupelo, hickories, sugarberry.