Improvement Cutting in Bottomland Hardwoods

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Do bottomland hardwood forests respond to improvement cuts? Do growth rate and stand quality increase enough to make up for the extra effort and, sometimes, outright expense of improvement cutting? Ten years of growth on some plots on the Delta Experimental Forest near Stoneville, Mississippi, indicates that the answer to both questions is "yes".

Many of the larger trees in present cut-over bottomland forests are damaged, poorly-formed, and low in value. The prospective crop of sound, clear, straight trees of the more desirable species is younger and sparser than a good forest manager would like. Such a situation has been brought about by repeated fires and by high-grading—frequently for inferior products such as ties or fuel wood.

A test of the recuperative powers of run-down bottomland forests was established on the Delta Experimental Forest in 1940. At that time the 80-acre area selected for the study was a typically under-stocked second-growth bottomland forest, with a high proportion of undesirable trees, including many culls.

FIGURE 1.—*Left: In 1940, when it was partially released from the competition of other trees, this thrifty Nuttall oak was 8.8 inches in d.b.h. Right: In 1951 it measures 15.6 inches—a gain of 6.8 inches in 11½ growing seasons. For the inside story of this growth, see Figure 2. (Photographs by Mississippi Agricultural Experiment Station and U. S. Forest Service)*

How the Cut Was Made

In preparation for the cut, the species on the area were divided into three groups depending on their value for lumber and their suitability for the site. The most desirable species for the site were considered to be sweet gum, cottonwood, ash, persimmon, mulberry, bald cypress, and Nuttall, willow, and water oaks. Next came intermediate species like American elm, hackberry, red maple, sweet pecan, sycamore, and willow. The species classed as poorest were overcup oak, bitter pecan, honey and water locust, cedar, elm, box-elder, and weed species such as haw and swamp privet.

Two degrees of improvement cutting were tried. Neither affected any trees smaller than six inches in diameter at breast height. In the light cut, no trees six to thirteen inches in diameter were removed except those damaged, decayed, seriously grubby, poorly formed, or likely to die, or those seriously interfering with much better trees. In trees 14 inches in diameter or larger, all those of the poorest species were cut, along with those of the intermediate and best species that did not seem capable of developing a log suitable for factory lumber or slack staves. Also cut were any trees of the intermediate species that were interfering with four inch or larger trees of the most desirable species.

The heavy cut removed everything six inches in diameter or larger except thrifty, healthy trees that belonged to the most desirable species and contained or were capable of producing a standard sawmill log. In practice the heavy cut differed from the light chiefly in that it took out a higher percentage of the cordwood-size trees.

No particular brief is held for these marking rules. It is now thought that they penalized less desirable species too heavily and that marking should be mainly based on the quality of the individual tree, rather than on its species. Nevertheless, while the cutting in 1940 may not have been exactly what would be done now, it was much better than no cutting at all.

The cut was made in the spring of 1940. Of the trees that were removed, those 14 inches in diameter and larger were sawed into lumber or timber for the use of the Mississippi Agricultural Experiment Station. The smaller ones were left in the woods.

In trees 14 inches and larger in diameter, the heavy cut took all but 330 board feet (International ¼-inch rule) from an original stand of 1,780 board feet. In the light cut, 320 board feet per acre were left of an original stand of 1,280 board feet.

In trees between six through thirteen inches in diameter, the heavy cutting left 22 out of 71 trees per acre, while the light cut left 39 out of 84.

To check on the value of the improvement cutting, several acres were left uncut; these plots had 1,815 board feet of saw-timber per acre and 76 trees between six and thirteen inches in diameter.

From Jungle to Forest

After cutting, the plots were protected but otherwise left alone. They quickly took on the appearance of a jungle, as openings created by the cutting filled up with tree reproduction, weeds, briars, and vines. Here and there in patches the cream of the original stand—vigorous, well-formed poles and small saw-timber—stood up conspicuously. By 1945, however, benefits of the cut started to appear, and remeasurement of the plots in 1950 showed a very encouraging response to the improvement work.

On the areas with the lighter cut, saw-log volume had increased to 1,825 board feet per acre, which was six times as much as had been left in 1940. In other words, the timber had

FIGURE 3.—*Sweet gum thicket before and immediately after release cutting in 1940. Trees with one white spot were cut. (Photographs by Mississippi Agricultural Experiment Station)*

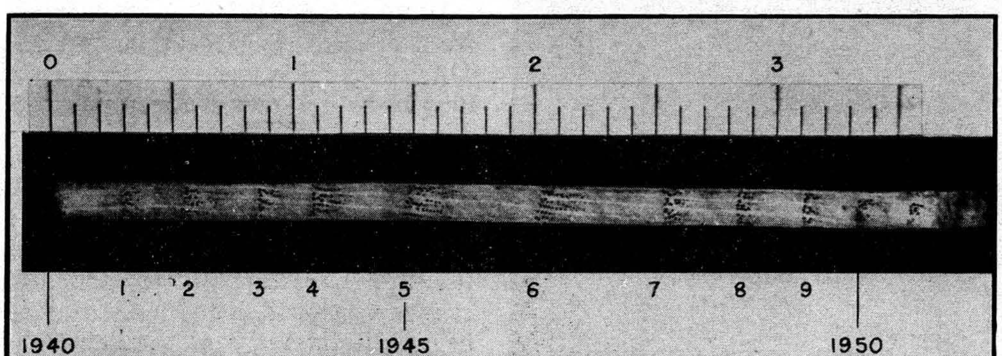

FIGURE 2.—*Section of wood from the Nuttall oak in Figure 1. By 1945 and 1946 the tree was growing more than an inch in diameter yearly (photograph shows radial growth; diameter growth is twice as much). Recently it has slowed down again, a sign that further release is needed. (U. S. Forest Service photograph)*

increased in volume at an average rate of 47 per cent simple interest per year. The heavily cut plots had boomed along at 39 per cent—from 330 feet in 1940 to 1,630. The uncut plots grew at the rate of 14 per cent; they went from 1,815 board feet per acre in 1940 to 4,340 in 1950.

Good as this growth on the treated areas has been, it is only a foretaste of better things to come.

In the last five years, growth per acre per year on the cut plots has been about 200 board feet, or 2½ times what it was in 1940 to 1945. The uncut plots are still growing the most volume per acre yearly (about 250 board feet), but their volume growth is not increasing much (see table 1). Before 1955, yearly growth on the cut plots should catch up with and pass that on the uncut plots. Once this happens, the uncut stands will also soon lose their last remaining advantage: their heavier total volume per acre.

Table 1.—Volume Growth in Treated and Untreated Bottomland Hardwoods

	Volume Growth Per Acre Per Year		
	1940-1945	1945-1950	1940-1950
	Bd. ft. (International ¼-Inch Rule)		
Light cut	83	219	151
Heavy cut	75	184	130
Uncut	238	267	253

Volume is only half the story anyway—maybe the less important half where improvement cutting is concerned. What about the quality of the timber that has grown in these last ten years?

The 1950 examination showed that the treated plots are stocked with sound, vigorous trees, largely of the most suitable species for the site. The uncut plots have a heavy stand of poorly formed, grubby, partly decayed trees of less desirable species. If an improvement cutting were made now, even under the less stringent present-day marking rules, 67 per cent of the board-foot volume of trees 14 inches d.b.h. and larger would have to be removed from the uncut plots. The plots that were cut in 1940 do not need another improvement cut. If one were made, however, it would remove only seven per cent of the volume on the lighter cut plots and only four per cent on the heavier cut plots.

Take the Worst, Leave the Best

What made the improvement cutting a success? The marking rules, as we know now, were not ideal, yet they met the basic requirement for successful improvement cutting. That is, they left a nucleus of the very best trees of all sizes including saw-timber, and they removed the undesirable trees so that this nucleus had almost complete freedom to grow.

Equally as important, the cutting was done without excessive logging damage to the desirable trees that were 11, 12, and 13 inches in diameter. By 1950, most trees of these sizes, plus some as small as nine inches, became large enough to yield nominal saw-logs. These two actions—leaving well-formed, vigorous saw-timber to grow, and releasing well-formed, vigorous poles from competition—account for the healthy, fast-growing stands which are now growing high quality saw-timber at constantly increasing speed.

Do bottomland hardwoods respond to improvement cutting? They certainly do. By 1960, the cut stands will have much more saw-log volume than they had before the cut in 1940, and this volume will be very nearly all in trees of the highest growth capacity, quality, and grade.

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