North Central Forest Experiment Station 6.08

CENTRAL HARDWOOD NOTES

Managing Uneven-Aged Stands

Maintaining uneven-aged stands involves cutting trees from a range of diameter classes in such a way that the residual stand has a balanced, steeply descending diameter distribution curve (fig. 1). The objective is to distribute trees by diameter classes so that over time the stand contains trees of different ages and sizes.

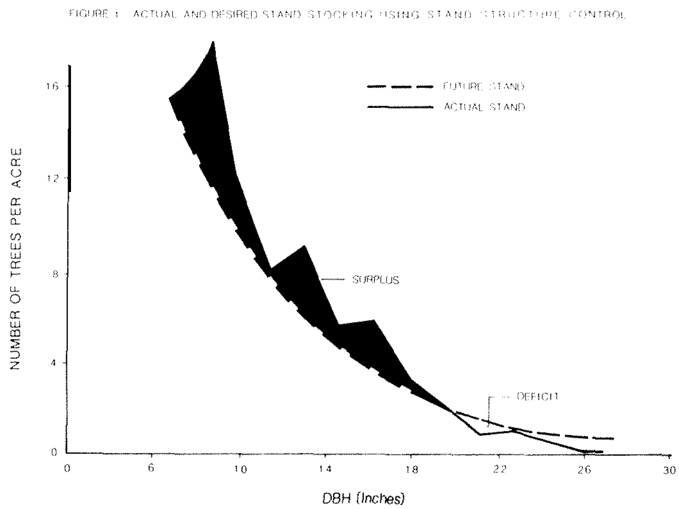

Figure 1.-Actual and desired stand stocking using stand structure control.

How to Structure the Stand

You should first try to conduct an inventory of your stand. With this information you can prepare a diameter distribution curve (see References). The three stand characteristics below can be used to help you determine the diameter distribution curve for future stands.

1. Establish the "largest diameter tree" (LDT) to be retained in the stand. In making this decision consider the optimum diameter of the primary species based on site quality, wind firmness, economic maturity, or the landowner's visual objectives for large trees.

2. Determine a "q-value" to establish the numbers of trees needed in each 2-inch diameter class. The q-value of a stand represents an average quotient between the number of trees in consecutive diameter classes for the stand. A stand with a low q-value such as 1.3 will have more large trees and fewer small ones than a stand with a high q-value of 1.7. A quick way to estimate the q-value of an existing stand is shown in table 1. It may be necessary to start with a relatively high q-value of 1.5 or 1.7, depending on the relative proportions of poles and sawtimber (table 1), working gradually toward a lower q-value such as 1.3 in successive harvests.

Table 1 .-*A quick estimate of q-values for existing stands based on basal area in pole and sawtimber classes*

Percent of basal area in each class		
Pole 6-to lo-inch	Sawtimber 12-inch plus	q-value
55	45	1.7
50	50	1.6
40	60	1.5
30	70	1.3

3. The last step is to set a "residual basal area" (RBA) to control the overall stocking of the stand. For forest types with stocking guides, use the "B" level value of the existing stand *(see* Note *5.02 Stocking Chart for Upland Central Hardwoods).* An RBA range of 65 to 75 square feet can be used for bottomland hardwoods and other types lacking stocking guides. Use **a** higher RBA for above average sites or where lower "q-values" (1.2 to 1.3) are used.

If you cannot conduct an inventory and prepare a complete diameter distribution curve as described above, table 2 will provide you with generalized guides for structuring your stand.

General Marking Guidelines

1. To minimize epicormic branching and post harvest losses don't remove more than one-third of the total basal area in one harvest.

2. Mark trees over the full range of size classes and concentrate the removal of trees in the diameter classes with surplus trees where possible.

3. Don't arbitrarily remove all large merchantable trees, leaving the remainder of the stand untended.

4. If your stand is deficient of trees in a particular size class, leave additional trees in the next smaller size class to correct the deficiency.

5. On steep slopes, mark trees that are in the felling path of larger ones or leave additional basal area (RBA + 10 sq. ft.) to offset possible logging damage.

6. Make frequent prism checks of the residual stand basal area to insure marking is meeting the stand RBA and structure goals.

In previously unmanaged stands or even-age stands with few small trees, the first harvest should remove high risk and some poor quality trees, including suppressed poles that are prone to epicormic sprouting. New regeneration need not be a

Table *Z.-Suggested residual basal area per acre for upland hardwoods managed under the selection system'*

Stand structure diameter grouping (Inches)	Site index 55-64 LDT[2] 16- to 19-inch d.b.h. q-values			Site index 65-74 LDT 20- to 23-inch d.b.h. q-values			Site index 75+ LDT 24-to 28-inch d.b.h. q-values		
	1.3	1.5	1.7	1.3	1.5	1.7	1.3	1.5	1.7
	-(Square feet)-								
Sapling <5.0	5	5	10	5	5	10	5	5	10
Poles 6-l 0	20	25	25	15	25	30	1.5	25	25
Sm sawtimber 12-16	25	20	15	25	20	15	20	20	15
Med sawtimber 18-22	10	5	5	20	10	5	20	10	5
Large saw-timber 24							10	5	5
TOTAL RBA Square feet	60	55	55	65	60	60	70	65	60

[1] Based on "B" level stocking rounded to 5.5 square feet using mid-class diameters of 18, 22, and 26 respectively.
[2] LDT = Largest diameter tree.

primary objective in this cut if advance reproduction is present. Create 4 to 8 small openings (25 to 40 feet in diameter) per acre to enhance the development of any potentially high quality saplings in these gaps.

Remove trees that will not survive over the next 15 to 20 years, but don't reduce the stand below the basal area objective, even if it means carrying some poor quality trees to the next harvest.

Cutting Cycle

The cutting cycle (interval between harvests) can be flexible. You can harvest when the stand has reached 80 percent of full stocking, and you should harvest by the time stocking reaches 90 percent. For most healthy stands, stocking will increase about 1.33 percent per year.

Local operability standards and calculated growth rates for the product, i.e., cordwood, sawtimber, etc., can be used to help determine the cutting cycle. A cutting cycle of 15 to 20 years is probably economically feasible on most average and good sites. A growth rate of 150 board feet per acre per year will provide a harvest of 2,250 board feet per acre after 15 years, for a total harvest of 45,000 board feet on 20 acres. But, do not use board foot volume growth alone to determine when to cut. The diameter classes below sawtimber size must also be considered to maintain your structure goals.

Effects on Species Composition

The species composition of an uneven-aged stand is eventually influenced by whether trees are harvested singly or singly with provision for group selection harvests. Gaps created in the canopy by removing scattered mature trees are not large enough to allow survival and growth of the more light-demanding species, such as yellow-poplar, white ash, black cherry, and oaks. Ecological conditions under single-tree selection are most favorable for shade-tolerant species, such as the maples, hickories, basswood, beech, blackgum, dogwood, and sourwood. If oaks and other more light-demanding species are wanted, openings must be made to provide the necessary growing conditions *(see* Note 3.01 *Principles of Natural Regeneration).*

Group Selection: A Regeneration Method

Successful use of group selection to reproduce midtolerant and intolerant species involves more than simply cutting small patches in the forest at periodic intervals. To promote and maintain a high quality stand, groups of pole and small sawtimber trees that developed after previous harvests must be thinned, some saplings may require release, and scattered large trees beyond group boundaries may need to be harvested. For these reasons, marking for group selection must also include single-tree selection marking between the groups, using the stand structure guidelines.

If oaks are present and are to be regenerated, existing oak advance regeneration should be surveyed. Simply creating openings will not guarantee oak regeneration if existing oak saplings and seedlings are too few and too small. If oak regeneration is inadequate, special treatments may be necessary. (See Note 2.05 *Silvicultural Systems for Oak-Hickory and Oak-Pine,* Note 3.03 *How to Assess the Oak Regeneration Potential in the Missouri Ozarks,* and Note 3.04 *Treatments to Encourage Natural Regeneration.)*

Oak seedlings require about one-third full sunlight for maximum photosynthesis, while the more intolerant bottomland forest species may require more. Table 3 shows the minimum opening size needed to provide one-third full sunlight on various aspects. The diameters of the openings are measured in multiples of the average height of the border trees. For a stand with an average tree height of 70 feet, a 2-tree-height opening would be 140 feet in diameter and occupy 0.35 acre.

Table 4 gives the number of openings that should be made in each cutting cycle to provide space for the development of oaks and other less tolerant hardwoods for three aspects and q-values. These groups can occupy 3 to 9 percent of the stand area and should be dispersed throughout the stand.

Table *3.-Minimum opening size needed on various aspects to provide one-third full sunlight*

Aspect	Opening size: Tree heights’	Opening size: Acres
South & West	1	0.09
Level	1-1/2	.20
North & East	2	.35

[1] Based on average tree height of 70 feet

Table *4.-Number of openings on 20 acres needed in each cutting cycle for optimal stocking of the more light-demanding species (oaks, black cherry, yellow-poplar, etc.)*

		Aspect with required diameter of openings for 1/3 full sunlight’		
Selected q-values	**Area in groups**	**South & West 70 feet**	**Flat 105 feet**	**North & East 140 feet**
	(Percent)	- - - - - *(Number of openings)*[2] - - - - - - - - -		
1.3	3	6	3	2
1.5	5	11	5	3
1.7	9	18	9	5

[1] Based on 70-foot average tree height.

[2] Based on the average area occupied by a 2-inch sapling at B-level stocking and the target number of trees in the 2-inch class of 35 trees per acre (q-l .3), 70 trees per acre (q-l .5), and 115 trees per acre (q-l .7).

Locate Groups

- Where natural regeneration is occurring
- Where large diameter trees are to be harvested
- In pockets where trees are dying naturally
- In areas with excessive numbers of trees of a particular size class
- In the path of natural seed fall of desired species
- Where special wildlife habitats are benefitted

Effects on Quality

Single-tree selection develops good stem quality in shade tolerant hardwoods as the tighter crown closure and bole shading discourages forking and excessive branchiness. The less shade tolerant species, when regenerated in openings, will also develop high-quality stems because of the inherent self-pruning abilities. Crop trees left along the borders of gaps or openings may develop epicormic branches that will persist and eventually degrade tree quality. This can be reduced by leaving smaller trees along the margin of gaps to screen crop trees behind them.

Logging damage to some of the residual trees is an unavoidable result of applying the selection system. Generally, the percentage of trees injured is low enough that future management is not adversely affected. If good logging practices are followed, trees with injuries severe enough to cause degrade should comprise less than 10 percent of the residual basal area, although damage up to 20 percent can occur (see Note 8.02 Logging Damage).

References

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