SILVICULTURAL CUTTING OPPORTUNITIES IN OAK-HICKORY FORESTS OF WEST VIRGINIA

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Abstract: Analysis of cutting opportunities for oak-hickory forests of West Virginia reveals a storehouse of economic opportunity. The potential cut from silviculturally sound thinning, regeneration, and harvest opportunities totals 100 million cords, or 60 times the current annual harvest of growing stock volume from the state. On the stump, the conversion value of this material totals $2.4 billion. Moreover, the good housekeeping associated with this silviculture would improve timber productivity and quality.

INTRODUCTION

During the early 1900's, West Virginia was a lumbering giant. In 1909, some 1,500 mills in the state produced 1.5 billion board feet of lumber to feed the needs of a growing industrial Nation. Unfortunately, "cut and move" was the rule in those days and little attempt was made to revegetate the landscape (Clarkson 1965). Wildfires followed the logging to complete the virtual destruction of the forest. Many believed the resource was ruined and never would return to the way it was.

But a recent inventory shows that West Virginia's woodlands are well on the road to recovery (Gansner et al. 1990). And the wood-using industry has taken notice. Log exporters and domestic mill operators are looking to West Virginia for more high-quality logs and bolts (Widmann 1990). Also, more of the small and low-grade material that has had limited markets in the past is finding its way into products such as pulpwood, pallets, and fuelwood. Concurrently, resource managers and policymakers, determined not to repeat the mistakes of a reckless past, are emphasizing cutting practices that are environmentally sound. The time is ripe to reevaluate cutting opportunities in the Mountain State.

This study looks at cutting opportunities for oak-hickory forests of West Virginia, a 9.2-million-acre resource that accounts for four-fifths of the state's timberland and is a major contributor to local and regional economies. Effects of timber prices, characteristics of ownership, woodland accessibility, traditional cutting practices, and other factors that influence the economic availability of timber were not considered in the analysis. An

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assessment of how these variables affect timber supplies would be extremely difficult and perhaps meaningless at a time when timber inventories and growth seem more than adequate to satisfy most current needs.

Instead, we have identified the acreage of timberland and yields of timber associated with recommended silvicultural cutting practices for the oak-hickory timber type. This same procedure could be used to determine cutting opportunities for all 118 million acres of the oak-hickory timber type in the Eastern United States. With modification, this approach could be used to analyze other forest types.

PROCEDURE

West Virginia's oak-hickory forest exhibits virtually every stage of stand condition and development. Our first task was to sort this highly variable resource into general yet well-defined cutting opportunities that are in keeping with the principles of sound silviculture (Roach and Gingrich 1968). A cutting decision guide that incorporates information about acceptable tree stocking, stand size, and recommended removals of timber was used (Fig. 1). The guide indicates, for example, that a well-stocked (B+) sawtimber-size stand with more than 50 percent of its sawtimber volume in trees 16 inches d.b.h. and larger should be harvested. B-level stocking is the lower limit of full stocking based on a stand's d.b.h., basal area, and number of trees per acre. Harvest opportunities with harvest volumes of more than 8,000 and less than 8,000 board feet/acre are identified as opportunities 1 and 2, respectively. A well-stocked sawtimber-size stand with less than 50 percent of its sawtimber volume in trees 16 inches d.b.h. and larger should be thinned to B-level stocking so that residual trees will make most efficient use of the site. Thinning opportunities in sawtimber stands where the recommended cuts amount to more than 5 cords and less than 5 cords/acre are recognized as opportunites 3 and 4, respectively. And so on. In all, 10 distinct cutting opportunities are identified by the guide.

The cutting decision guide was used to sort data from 1959 inventory plots from the latest forest survey of West Virginia (DiGiovanni 1990), representing 9.2 million acres of oak-hickory timberland. This separated the resource into cutting opportunities and provided information for estimating the acreage and stand characteristics for each opportunity (Table 1).

Information on tree d.b.h. and merchantable height was used to estimate total volume in cords and sawtimber volume in board feet (Scott 1979, 1981). Dollar values are based on tree-value conversion standards for tree species in the Northeastern United States.[2] These standards represent consistent regional measures of a standing tree's net value (marginal value

[2]DeBald, Paul S, and Martin E. Dale. Tree value conversion standards revisited. Research Paper, Northeastern Forest Experiment Station. [In preparation]

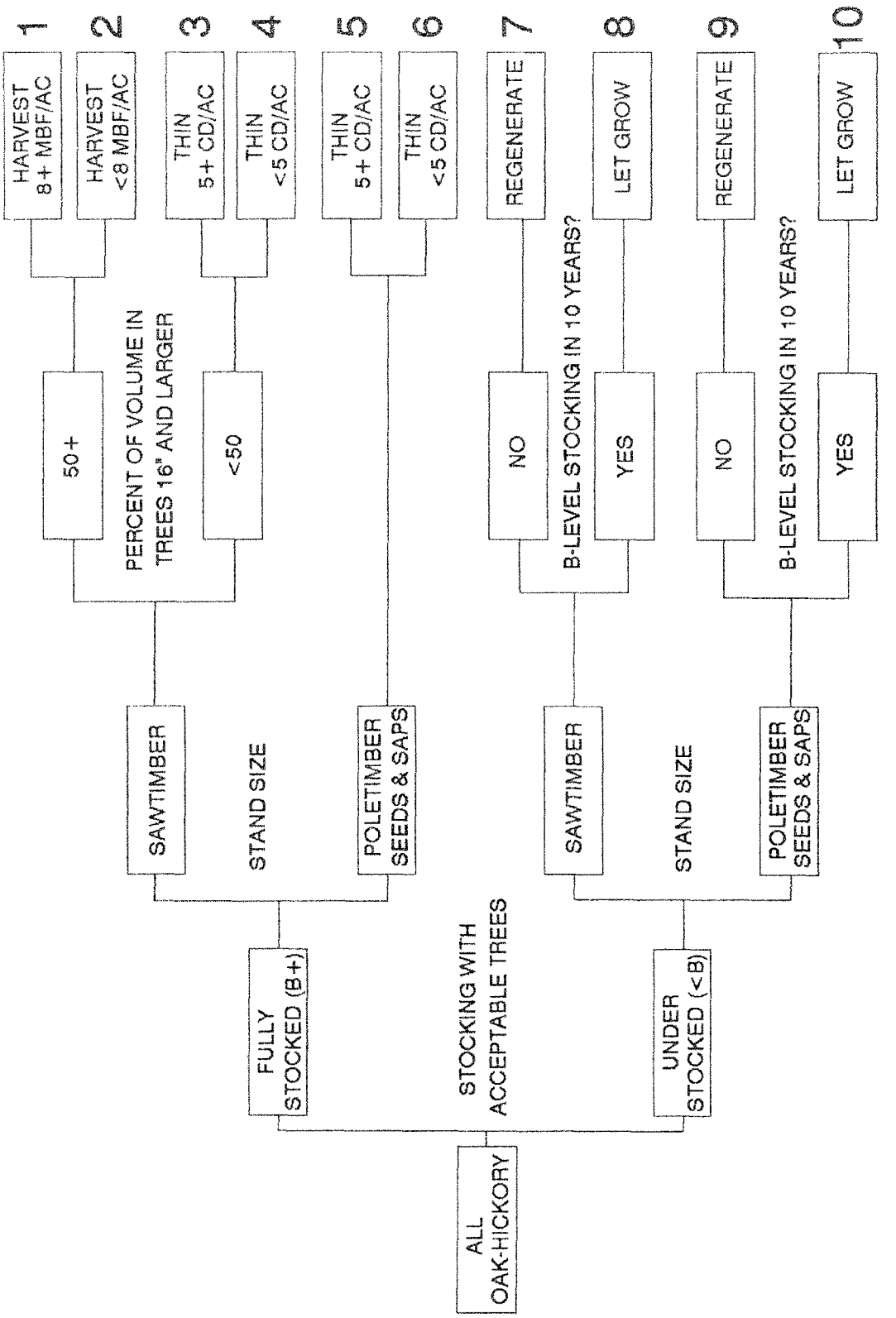

Figure 1. Guide for sorting oak-hickory forest into cutting opportunities.

Table 1.--Acreage and stand characteristics of cutting opportunities in oak-hickory forests of West Virginia

Cutting Opportunity	Area	Average d.b.h.	Basal area per acre	Stand volume per acre		Stand value per acre
				Total	Sawtimber	
	Thousand acres	Inches	Ft^2	Cords	Mbf	Dollars
1. Harvest fully stocked mature sawtimber stand (removals 8+ Mbf/acre)	1,065	10.5	139	34.7	10.9	1,139
2. Harvest fully stocked mature sawtimber stand (removals <8 Mbf/acre)	1,078	8.4	122	23.4	5.9	582
3. Thin fully stocked immature sawtimber stand (removals 5+ cords/acre)	,773	8.9	137	30.5	7.1	564
4. Thin fully stocked immature sawtimber stand (removals <5 cords/acre)	743	8.7	109	22.9	5.4	375
5. Thin fully stocked poletimber, sapling, or seedling stand (removals 5+ cords/acre)	513	7.3	129	24.7	3.4	312
6. Thin fully stocked poletimber, sapling, or seedling stand (removals <5 cords/acre)	1,088	6.8	106	17.2	2.3	188
7. Regenerate understocked sawtimber stand that will not reach full stocking in 10 years	1,030	10.9	67	13.7	3.7	267
8. Let grow understocked sawtimber stand that will reach full stocking in 10 years	1,297	9.7	94	20.4	5.3	419
9. Regenerate understocked poletimber, sapling, or seedling stand that will not reach full stocking in 10 years.	980	6.5	50	7.3	1.0	74
10. Let grow understocked poletimber, sapling, or seedling stand that will reach full stocking in 10 years	609	7.4	84	15.3	2.1	149
All areas	9,476	8.9	102	20.8	4.9	425

or shadow price) in the production of 4/4 (1-inch) lumber, allowing for the cost of conversion. They account for a tree's species, diameter, merchantable height, and tree grade (based on butt-log grade measures). For example, a 16-inch-diameter northern red oak (*Quercus rubra* L.) with a grade 2 butt log and merchantable height of 2 logs was valued at $29. For trees other than hardwood sawtimber, merchantable height, d.b.h., and cull estimates were converted to net volumes and assigned value based on recent local stumpage price information. For example, pulpwood stumpage averages about $5 per cord.

PLENTY OF CHANCES FOR CUTTING

Some 3.1 million acres, about one-third of West Virginia's oak-hickory timberland, could use some thinning (opportunities 3 through 6). Another 2.1 million acres are in mature sawtimber stands that are ready for harvest (opportunities 1 and 2). More than 40 percent of the resource is inadequately stocked with acceptable growing stock, that is, trees of commercial species that are not rough or rotten. More than half of this understocked forest is not expected to reach an acceptable level of stocking in 10 years and should be regenerated (opportunities 7 and 9). Nearly 2 million acres of understocked forest that are projected to reach an acceptable stocking level during the next decade can be left to grow (opportunities 8 and 10). Stands representing every cutting opportunity are fairly well distributed in all regions of the state (Fig. 2).

As expected, stand conditions vary greatly for the 10 cutting opportunities. Per-acre statistics for opportunity 1 are most impressive: nearly 35 cords of total volume, including 11,000 board feet of sawtimber, with a total worth of more than $1,100. At the other extreme is opportunity 9: averaging only 7 cords of total volume, including 1,000 board feet of sawtimber, worth less than $75 per acre.

Species composition is no surprise. The oaks combined account for the largest share of the resource but other commercial species are abundant (Fig. 3). Yellow-poplar (*Liriodendron tulipifera* L.) and other high-value hardwoods (sugar maple--*Acer saccharum* Marsh., black cherry--*Prunus serotina* Ehrh., white ash--*Fraxinus americana* L., and walnut--*Juglans nigra* L.) combined make up one-fourth of the inventory. Hickory (*Carya* spp.), red maple (*Acer rubrum* L.), beech (*Fagus grandifolia* Ehrh.), and basswood (*Tilia americana* L.) also are well represented.

TOTAL CUT AMOUNTS TO 100 MILLION CORDS

The cut associated with all of the silvicultural opportunities totals 99.6 million cords (Table 2). That is a lot of wood, amounting to 60 times the current annual harvest of growing stock volume from the state. Included in this harvest is 25 billion board feet of sawtimber. On the stump, the conversion value of these removals amounts to $2.4 billion.

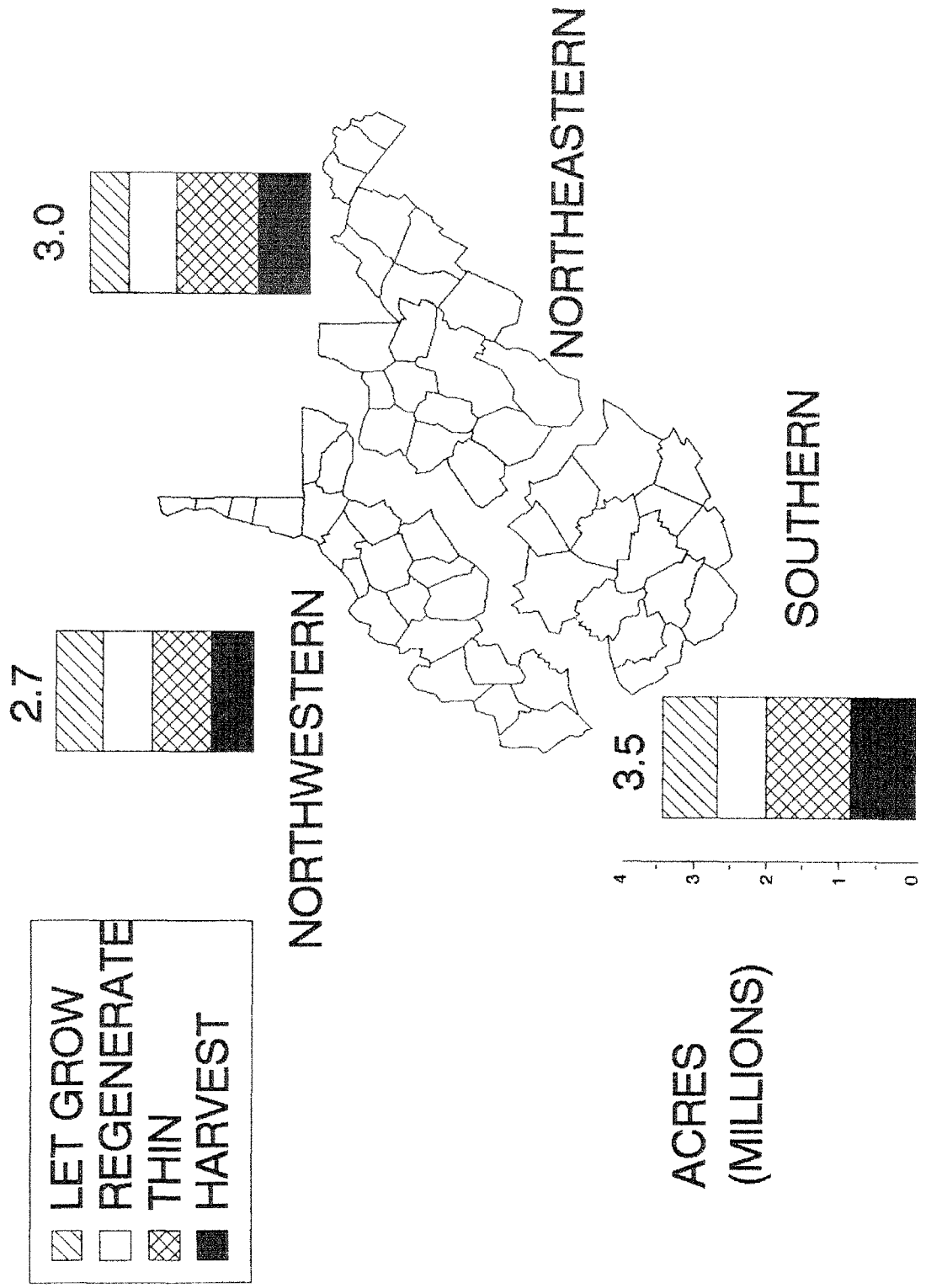

Figure 2. Geographic distribution of cutting opportunities in oak-hickory forests of West Virginia.

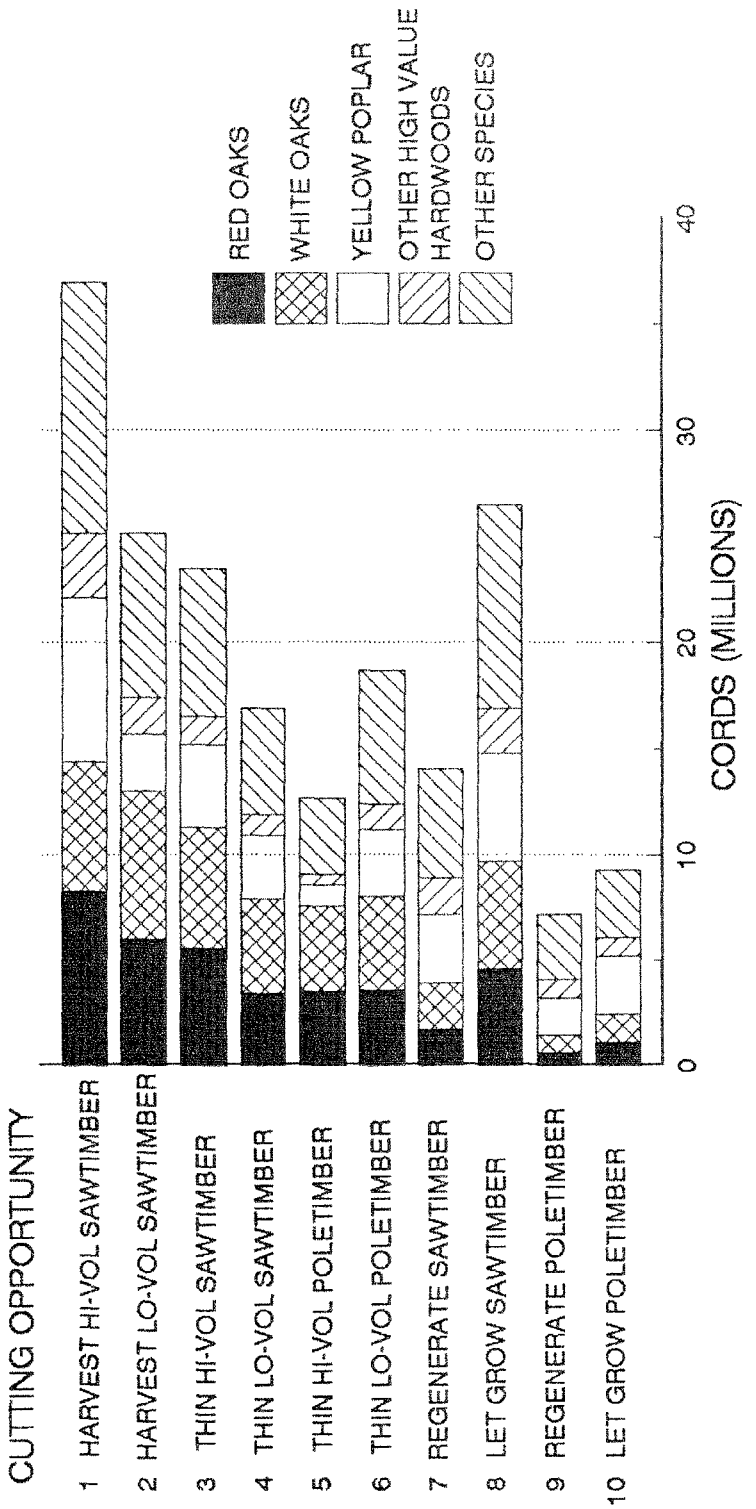

Figure 3. Distribution of inventory volume, by cutting opportunity and species group, oak-hickory forests of West Virginia.

Table 2.--Potential cut by opportunity in oak-hickory forests of West Virginia

Cutting opportunity	Per acre			All acres		
	Total volume	Sawtimber	Value	Total volume	Sawtimber	Value
	Cords	Mbf	Dollars	Million cords	Mmbf	Million dollars
1. Harvest fully stocked mature sawtimber stand (removals 8+ Mbf/acre)	34.7	10.9	1,139	36.9	11,651	1,214
2. Harvest fully stocked mature sawtimber stand (removals <8 Mbf/acre)	23.4	5.9	582	25.2	6,380	627
3. Thin fully stocked immature sawtimber stand (removals 5+ cords/acre)	9.3	1.9	115	7.2	1,479	89
4. Thin fully stocked immature sawtimber stand (removals <5 cords/acre)	2.5	0.6	35	1.9	390	26
5. Thin fully stocked poletimber, sapling, or seedling stand (removals 5+ cords/acre)	9.0	1.2	85	4.6	593	44
6. Thin fully stocked poletimber, sapling, or seedling stand. (removals <5 cords/acre)	2.4	0.3	22	2.5	345	24
7. Regenerate understocked sawtimber stand that will not reach full stocking in 10 years	13.7	3.7	267	14.1	3,774	275
9. Regenerate understocked poletimber, sapling, or seedling stand that will not reach full stocking in 10 years	7.3	1.0	74	7.2	1,005	73
All acres	10.9	2.9	258	99.6	25,617	2,372

From the standpoint of operability, the most lucrative options are harvesting opportunities 1 and 2 with cuts per acre exceeding 20 cords of total volume, including more than 5,000 board feet of sawtimber. The value of removals associated with the 2.1 million acres in opportunities 1 and 2 totals $1.8 billion. Other opportunities are reasonably attractive. For example, the regeneration of understocked sawtimber stands, opportunity 7, yields an average of nearly 14 cords per acre, including 3,700 board feet of sawtimber. By contrast, thinning opportunities 4 and 6 have per-acre cuts averaging fewer than 3 cords. While these thinning chances would be snubbed by most professional loggers, they might be of interest to the occasional fuelwood cutter with a chain saw and pick-up truck.

Oaks account for about 40 percent of the total volume (38 million cords) and 70 percent of the total value ($1.6 billion) included in the cutting prescriptions (Figs. 4-5). Northern red oak alone accounts for 25 percent of the value. Two-fifths of the sawtimber harvest is in trees with butt logs of grade 2 or better (Fig. 6). The quality of material taken in harvesting and regeneration operations is much better than that removed in thinnings where improvement cutting tends to leave the better trees in the woods.

CUTTING WOULD ENHANCE TIMBER PRODUCTIVITY

Dramatic improvements in timber productivity and quality would result from sound cutting practices. An individual-tree growth simulator was used to project gains in yield that might be expected over the next two decades from thinnings of similar forest stands in Pennsylvania (Gansner et al. 1987). Gains in timber yield (over no treatment) averaged nearly 4 percent. Poletimber, seedling, and sapling stands would net bigger gains in volume than sawtimber stands. But much more impressive than the gains in timber volume would be improvements in quality and value. Assuming prices remain constant, projected increases in timber value attributed to thinning averaged nearly 12 percent over 20 years. If these stands were left unthinned, their compound annual rates of value growth will average nearly 3 percent . If they were thinned, value growth rates on the residual stands would average more than 4 percent.

ROOM FOR INDUSTRIAL EXPANSION

The bottom line is that West Virginia's 9.2 million acres of oak-hickory forest represent a storehouse of economic opportunity. The potential cut from silvicultural thinning, regeneration, and harvest operations amounts to 100 million cords. Moreover, the good housekeeping associated with this environmentally sound cutting would result in significant improvements in timber productivity and quality. Obviously all of the cutting couldn't be done at once. The amount that might be undertaken remains a big question. At least one major flooring firm has taken advantage of the timber supply situation by establishing a new mill in the state. Further developments will require some tough decisions based on the interaction of a multitude of complex socioeconomic factors such as:

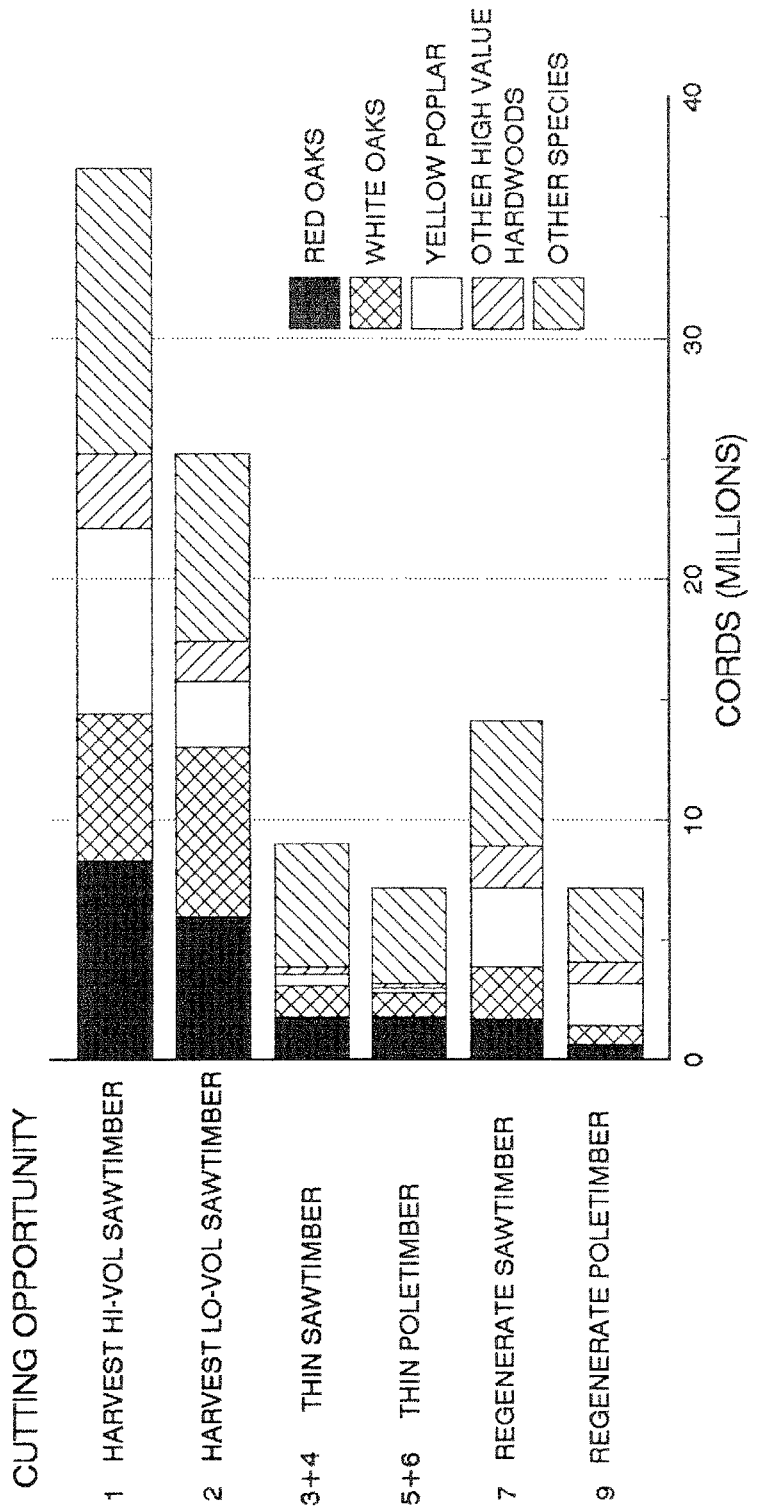

Figure 4. Potential cut of timber volume, by cutting opportunity and species group, oak-hickory forests of West Virginia.

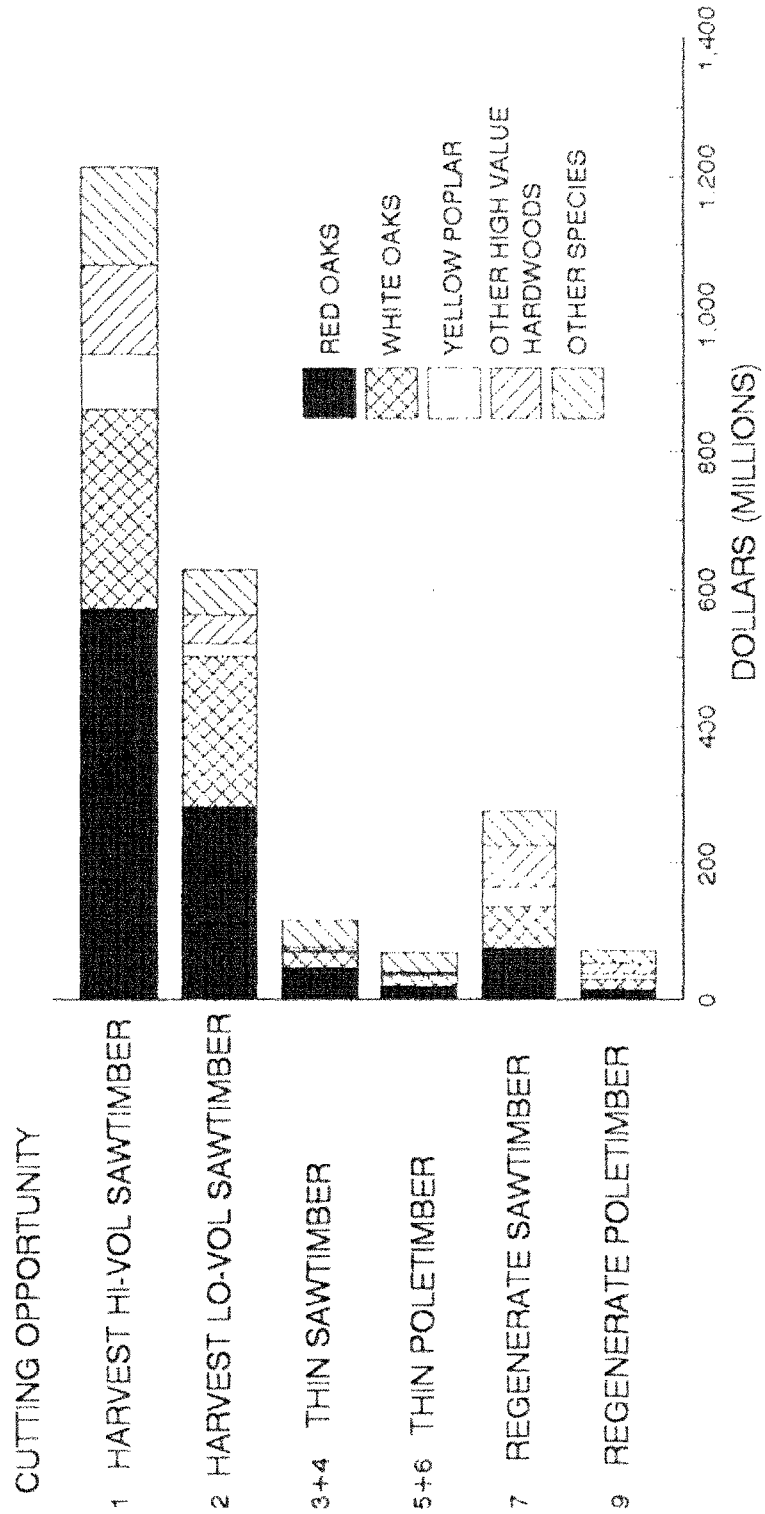

Figure 5. Conversion value of potential cut, by cutting opportunity and species group, oak-hickory forests of West Virginia.

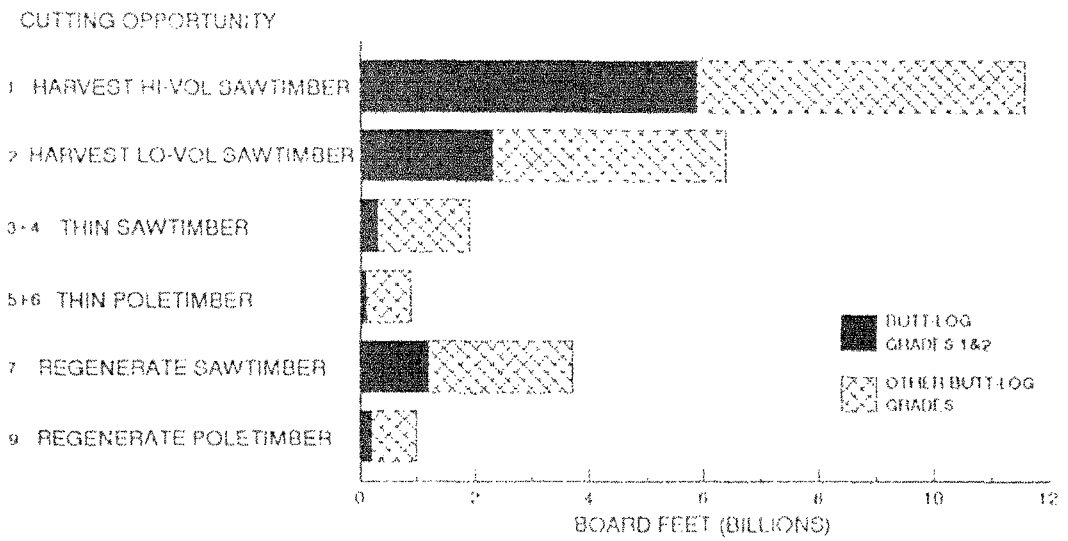

Figure 6. Potential cut of sawtimber volume, by cutting opportunity and tree grade, oak-hickory forests of West Virginia.

* Changes in timber demand, utilization, and operability.

* Attractiveness of local business climates to an expanding timber industry.

* Attitudes of woodland owners and other citizenry toward increased timber cutting.

* Desires to maintain a balanced distribution of age classes and sustainable flow of quality timber.

* Continued use of traditional cutting practices such as diameter-limit cutting and clearcutting of immature stands in place of recommended silviculture.

* Inadequate regeneration, especially where deer populations are high.

Given today's conditions, major increases in silvicultural cutting would have to be spread over the next several years. Only time will tell how this works out. At any rate, there is no denying that physical supplies of timber reveal a potential opportunity for significant expansion in wood use.

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