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# AN ASSESSMENT OF TIMBER RESOURCE VALUES IN ARKANSAS<sup>1</sup>

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## ABSTRACT

The Arkansas forest lands have long been and will continue to be an important contributor to the state's economy. Today, Arkansas forests cover 52 percent of the land area (Hines and Vissage, 1988). These forests are classified by physiographic characteristics into four timber regions. The timber removed from forested lands provides direct and indirect employment for approximately 40,000 people within the Arkansas manufacturing sector (Kluender and Willett, 1989). This paper describes county and region level information, identifies standing timber volumes, net annual timber growth, net annual timber removals, and associated dollar values. Timber stand data are used to determine areas suitable for new facilities or expanding existing wood-based manufacturing facilities. This study also identifies opportunities within each region for wood-based manufacturing growth.

## INTRODUCTION

Arkansas is blessed with bountiful forest lands. These forests cover 52% of the total land area in Arkansas (Hines and Vissage, 1988). Arkansas' forests are customarily grouped into four regions based on physiographic characteristics. The regions include the Delta, Coastal Plain, Ouachita, and Ozark (Figure 1). The Delta region consists primarily of hardwood forests and covers 21 counties (Hines, 1988a). Twenty

Pine forests total 1.5 million acres. Other Coastal Plain forest types include oak-pine (1.4 million acres), oak-hickory (1.4 million acres), and bottomland hardwoods (1 million acres). Forest industries own 50% of the Coastal Plain's forest lands (3.26 million acres). The twenty counties that make up the Coastal Plain have 6.44 million acres of forest lands (Hines, 1988b). The Ouachita region covers only 10 counties, however the region is 68% forested. The primary forest types include oak-hickory and loblolly-shortleaf pine, covering 1.1 and 1.0 million acres, respectively. The USDA Forest Service is the largest forest landowner in the Ouachita region. National Forests account for 41% of the region's total forest land (Hines, 1988c). The fourth region, the Ozark region, is located in northwest Arkansas (Figure 1). Dominant forest types are oak-hickory (4.2 million acres) and loblolly-shortleaf pine a distant second (502 thousand acres) (Hines, 1988d).

The availability of wood volume is an important factor regarding additions or expansions to wood-based manufacturing facilities. The location of a wood-based manufacturing facility is a complex problem. Major considerations include adequate raw material supply, sufficient demand for the products produced, reasonable access to markets, labor in adequate supply, adequate capital funding and the ability to meet all governmental regulations applicable to operation of the firm (Kluender *et al.*, 1991). This study is limited in scope to identifying the available raw material supply. Questions not considered include market information, owners willingness to sell their timber, and available employment.

Forest statistics necessary to determine the availability of wood volume start with the identification of growing stock volume and its stumpage value. Growing stock volume is the cubic-foot volume of sound wood in growing-stock trees at least 5.0 inches in diameter at breast height. The stumpage value is the dollar amount the market is willing to pay for standing wood volume. Growing stock volume alone does not reveal the presence of other wood-based manufacturing facilities and their demand upon the forest resources. Statistics necessary to capture the wood volume available for industry expansion include net-annual-growth of growing stock and net-annual-removals. Net-annual-growth is the average net annual volume increase for the inter-survey period (Hines and Vissage, 1988). Net-annual-removal is the average annual volume of growing stock trees removed from the inventory by harvesting, land clearing, or changes in land use. These two pieces of information lead to the calculation of growth to harvest ratios and finally, net-available wood volume. Growth-to-harvest ratios are calculated by dividing the net-annual-growth by net-annual-removals. If a growth-to-harvest ratio is greater than 1.0 to 1.0, then the forest is increasing in total volume. If a

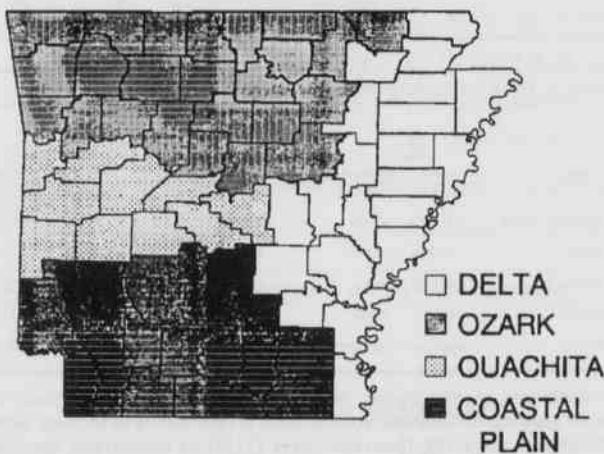


Figure 1. Arkansas' four timber regions classified by physiographic characteristics.

percent of the Delta region is forested. Hardwood forests cover 1.7 million acres while pine forests total 131 thousand acres. The Delta region's largest ownership group is non-industrial private forest landowners. The Coastal Plain region is heavily forested (73%). The dominant forest type is pine comprised of loblolly and shortleaf pines.

<sup>1</sup>This paper is approved for publication by the director Arkansas Agricultural Experiment Station.

growth-to-harvest ratio is less than 1.0 to 1.0, then harvests exceed net-annual-growth. Harvests or removals in excess of net-annual-growth deplete the growing stock. This is referred to as timber mining. Such harvesting practices are not sustainable and work against long-term economic development (Kluender *et al.*, 1991). Net-available wood volume is wood growth added annually to the growing stock volume, net of removals. Throughout this paper the term "available" means annual wood growth available in excess of annual harvest. All of these statistics were necessary to the completion of the objectives of this study.

Two necessary conditions must be met for expansion of wood-based manufacturing facilities. First, net-available volume must be available in sufficient quantity and the correct species to meet the raw material needs of the mill on a yearly basis. Second, to maintain production over an extended period of time, withdrawals from the forest (harvests) should be such that growing stock volume will not be reduced once the mill is in place. Accordingly, a growth to harvest level that will provide a sufficient buffer for expected increased harvests must be selected to identify potential mill locations. In most cases, a ratio of 1.2:1.0 should be sufficient. This buffer will allow a mill to increase harvesting levels without cutting into the growing stock volume if available volumes are sufficiently high (Kluender *et al.*, 1991).

Forest resource sufficiency is a measure of its ability to supply raw material to wood-based manufacturing facilities. When timber harvest levels are very near the level of annual timber growth (*i.e.*, growth to harvest ratios of 1.0:1.0), increased timber supplies must come from either: a) forests in other states or countries, b) from the growing stock volume, or c) additions to the annual timber growth through increased plantings and management of existing timber stands (O'Laughlin and Williams, 1988).

The objectives of this study were three-fold. The first objective was to identify the growing stock volume and calculate the associated stumpage value. The second objective was to identify net-annual-growth, net-annual-removals, and calculate the growth to harvest ratio by county and region. The third objective was to calculate the available wood volume by county and region.

A concern in an aggregate analysis of this type lies with the forest survey statistics, which are based on permanent plots located state-wide. Sampling error ranges from a low of 1% to 2% to over 50% in some counties, depending upon the number of plots assigned (Hines and Vissage, 1988). As more plots are aggregated, sampling error decreases for the area represented. Our opinions and comments reflect findings from analyzing aggregate volumes, net-annual-growth and removals of pine and hardwood tree species, subject to the errors described above.

#### METHODS

USDA Forest Service publications by Hines, (1988a,b,c,d) provided the basic data analyzed for this study. Data analyzed included: growing-stock volume of pine and hardwood trees, net-annual-growth and net-annual-removals. Products by species group examined included pine sawtimber, pine pulpwood, hard-hardwood sawtimber<sup>2</sup>, soft-hardwood sawtimber<sup>3</sup>, and hardwood pulpwood. Growing stock volume published in cubic foot volume was converted to board foot volume and cords. This conversion was necessary to apply the stumpage values published by the Cooperative Extension Service (Geisler, 1992). Dollar values for growing-stock volume were calculated from stumpage prices published in *Forest Marketing Bulletin*, (Geisler, 1992). Pine and hardwood growing-stock volumes were used to identify Arkansas' existing total forest volumes. Species groups were further divided into two product classes (sawtimber and pulpwood). Sawtimber trees are live trees that contain at least one 12-foot log, or two 8-foot logs in the saw-log portion. Sawtimber volume is the volume of the saw-log portion of growing-stock sawtimber trees. All growing-stock volume that did not meet saw-log specifications was classified as pulpwood.

<sup>2</sup>Hardwood species such as oaks, hickories, and green and white ash.

<sup>3</sup>Hardwood species such as gums, yellow-popular, cottonwood, basswood, red maple, aspen and willow.

Once growing-stock volume was classified as either sawtimber or pulpwood, market value was established based on stumpage prices from the *Forest Marketing Bulletin*. The stumpage values used were \$205 per MBF Doyle scale for pine sawtimber, \$18 per cord for pine pulpwood, \$120 per MBF Doyle scale for hard-hardwood sawtimber, \$80 per MBF Doyle scale for soft-hardwood sawtimber, and \$8.50 per cord for hardwood pulpwood (Geisler, 1992). Stumpage prices listed for pine and hardwood species were multiplied by growing-stock volumes by product class to calculate dollar values of standing live trees by county and region. Net-annual-growth and net-annual-removals were used to calculate growth to harvest ratios and net-available volume.

The determination of net-available volumes was the primary focus of this paper. Net-available volume was calculated by subtracting net-annual-removals from net-annual-growth. This study identified net-available volume by species and product classification. Net-available volumes were then converted to their appropriate dollar values by multiplying volume by product class times the appropriate stumpage value.

#### RESULTS AND DISCUSSION

##### GROWING STOCK VOLUME AND VALUE

Arkansas' growing stock volume exceeds 64 billion board feet of timber valued at \$12 billion (Tables 1 and 2). This is enough wood to pave a 24-foot wide boardwalk of 2 X 4s to the moon, circle it, and return

Table 1. Growing stock volume by species.

Region	Pine		Hard Hardwood		Soft Hardwood	
	Sawtimber MMBF	Pulpwood MM CORDS	Sawtimber MMBF	Pulpwood MM CORDS	Sawtimber MMBF	Pulpwood MM CORDS
COASTAL PLAIN	20,560	9,890	7,748	10,806	3,279	7,217
DELTA	619	626	5,171	4,576	3,311	3,229
OUACHITA	8,428	5,397	2,273	6,805	725	1,794
OZARK	2,845	2,697	8,550	20,015	1,586	2,589
TOTAL	32,452	18,609	23,742	42,201	8,900	14,828

Table 2. Growing stock timber value by species.

Region	(Values in Thousands of Dollars)					
	Pine		Hard Hardwood		Soft Hardwood	
	Sawtimber	Pulpwood	Sawtimber	Pulpwood	Sawtimber	Pulpwood
COASTAL PLAIN	4,214,821	183,212	1,309,480	91,847	262,320	61,344
DELTA	126,936	115,177	873,815	38,893	264,880	27,446
OUACHITA	1,727,822	99,851	384,205	57,843	5,800	15,249
OZARK	583,225	49,886	1,444,933	170,130	126,880	22,006
TOTAL	6,652,804	344,526	4,012,432	358,713	659,880	126,045

to earth with another 24-foot walkway. Even with this huge volume of wood growing in Arkansas' forests, there is opportunity to increase wood volume because 196 thousand acres (11%) of timberland are non-stocked. An additional 4.2 million acres of timberland are understocked.

Pine timber has a greatest value of this states timber inventory at \$7 billion or 58% of the total. The Coastal Plain region of Arkansas has the greatest percentage (63%) of pine sawtimber and (53%) pine pulpwood of the four regions (Table 1). Pine sawtimber in the Coastal Plain region is valued at \$4.2 billion (Table 2). The total pine sawtimber value in the state exceeds \$6.6 billion. Additionally in the Coastal Plain, pine pulpwood exceeds \$344 million.

This state's hard-hardwood sawtimber volume is concentrated in the Ozark (36%) and the Coastal Plain (32%) regions. Hard-hardwood sawtimber in Arkansas is valued at over \$4 billion (Table 2). The Ozark and the Coastal Plain regions have hard-hardwood growing stock volumes valued at \$1.4 and \$1.3 billion, respectively.

The Delta and Coastal Plain regions have 73% of the soft-hardwood growing stock volume (Table 1).

The Delta region has 37% of the soft-hardwood sawtimber volume while the Coastal Plain region has 26%. Stumpage values are \$264 and \$262 million for the two regions, respectively.

Hard-hardwood pulpwood reserves are greatest in the Ozark region (47%) but soft-hardwood pulpwood is greatest in the Coastal Plain region (48%) (Table 1). Arkansas' hardwood pulpwood surpasses a value of \$484 million (Table 2).

**GROWTH TO HARVEST RATIOS**

Figure 2 illustrates the growth to harvest ratios for all tree species and products combined. Pine timber is under heavy cutting pressure in much of the pine regions of Arkansas. The Coastal Plain and Ouachita regions have harvest to growth ratios less than 1.0:1.0 for pine species (Table 3). While several counties in these two regions have harvest to growth ratios greater than 1.0:1.0, the regions in aggregate have a growth to harvest ratio of less than 1.0:1.0. The Ozark and Delta regions have a growth to harvest ratio greater than 1.0:1.0 for pine species (Table 3). This is due largely because wood-based manufacturing facilities requiring pine timber have not been attracted to the low growing stock volumes of pine in these regions. The Ozark and Delta regions, under current harvesting levels, are adding pine volume to timber inventory.

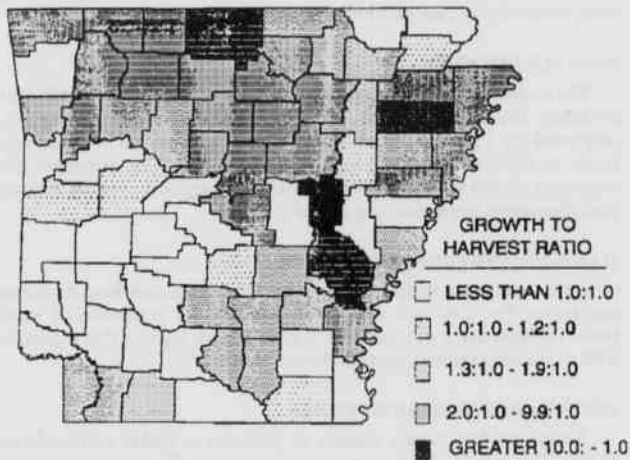


Figure 2. Growth to harvest ratios by counties combining all species and wood products.

Table 3. Growth to harvest ratios by tree species and forest regions.

Region	Growth to Harvest Ratio	
	Pine	Hardwood
Coastal	.92	1.09
Delta	1.48	2.07
Ouachita	.67	1.77
Ozark	1.97	3.65

All four regions have growth to harvest ratios exceeding 1.0: 1.0 for hardwood species. The Ozark region has a 3.65:1.0 growth to harvest ratio for hardwood species (Table 3). The Delta region's growth to harvest ratio for hardwood species is 2.1:1.0. Figure 2 emphasizes that aggregate growth to harvest ratios greater than 1.0:1.0 are found in the Ozark and Delta regions.

**NET-AVAILABLE VOLUME AND VALUE**

There is no net-available-volume of pine sawtimber for new industries for the Coastal Plain and Ouachita regions, in aggregate (Table 4). However, a small four county area in the Coastal Plain region of southwest Arkansas produces an estimated \$8 million annually in net-available pine sawtimber (Figure 3). Other groups of counties have net-available timber volume and growth to harvest ratios greater than 1.2: 1.0. The availability of this resource would have been masked in the region-only analysis. The importance of county level data analysis and interpretation is confirmed.

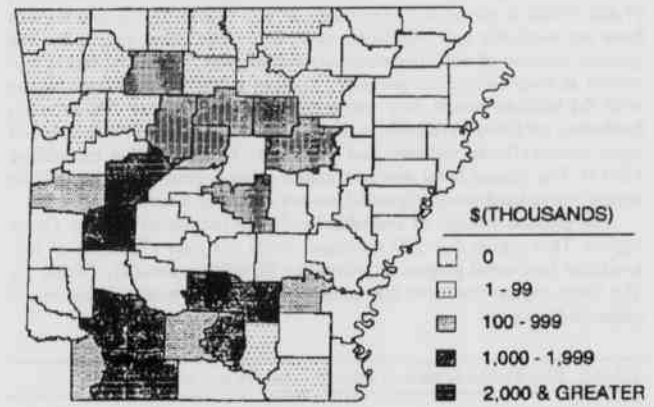


Figure 3. Value of available pine sawtimber in thousands of dollars at \$200 per MBF Doyle scale.

Table 4. Net-available timber volume by species and region.

Region	Pine		Hard Hardwood		Soft Hardwood	
	Sawtimber MMBF	Pulpwood MM.CORDS	Sawtimber MMBF	Pulpwood MM.CORDS	Sawtimber MMBF	Pulpwood MM.CORDS
COASTAL PLAIN	20,560	9,890	7,748	10,806	3,279	7,217
DELTA	619	626	5,171	4,576	3,211	3,229
OUACHITA	8,428	3,397	2,273	6,805	725	1,794
OZARK	2,845	2,697	8,550	20,015	1,586	2,589
TOTAL	32,452	18,609	23,742	42,201	8,900	14,828

The Ozark region has 77 million board feet of available pine sawtimber valued at \$14 million annually (Table 4). The Delta region has 6 million board feet of available pine sawtimber annually. Net-available pine sawtimber for new or expanding wood-based manufacturing facilities is limited.

By our selection criteria of positive net-available volume in the presence of growth to harvest ratios exceeding 1.2:1.0, there is no available pine pulpwood in the Delta, Ouachita, and Ozark regions. Some individual counties do have growth to harvest ratios greater than 1.2:1.0, but the region level analysis masks these areas. The Coastal Plain region has a small volume available totaling 75 thousand cords (Table 4). Two

areas of net-available pine pulpwood were identified within the Coastal Plain region. The first area contains Calhoun, Ashley, Bradley, Cleveland, and Dallas counties. The second area is Columbia and Lafayette counties. Localized studies are recommended to determine if the net-available pine pulpwood could sustain increased harvests due to wood-based manufacturing facilities expansions or new plants.

Hard-hardwood sawtimber is available in all four regions (Table 4). However, the Ozark region has the largest concentration of net-available hardwood sawtimber valued at \$44 million (Table 5). Four counties have growth value exceeding \$3 million, for a total of over \$12 million annually. These counties include Madison, Marion, Newton, and Searcy in extreme north central Arkansas. Additionally, five adjacent counties have annual growth valued at \$2 million and five counties have growth valued at \$1 million per year. The total annual hard-hardwood timber available from these fourteen counties exceeds \$27 million per year (Figure 4). The total net-available hard-hardwood timber in the state is 639 million board feet annually (Table 4) valued at \$76 million annually (Table 5).

Net-available soft-hardwood sawtimber totals 189 million board feet (Table 4) and is valued at \$15 million per year (Table 5). All four regions have net-available soft-hardwood sawtimber. The Delta region has the greatest volume of soft-hardwood sawtimber with 77 million board feet valued at over \$6 million per year. A close second is the Ozark region with 64 million board feet worth \$5 million per year. There is no hardwood pulpwood available in the Coastal Plain region (Table 4) based upon net-available volume and growth to harvest ratios exceeding 1.2:1.0. The region level analysis masks areas within the Coastal Plain region where hardwood pulpwood has net-available volumes.

The greatest volume of available hardwood pulpwood is in the Ozark region. This region has 537 thousand cords per year (Table 4) of net-available hardwood pulpwood valued at \$5 million annually (Table 5). The Delta region produces 106 million cords of net-available hardwood pulpwood per year.

Table 5. Net-available timber value by species and regions.

Region	Pine		(Values in Thousands of Dollars)		Hardwood Pulpwood
	Sawtimber	Pulpwood	Hardwood Sawtimber Hard	Soft	
COASTAL PLAIN	0	1,351	13,152	2,032	0
DELTA	1,240	0	13,464	6,128	1,056
OUACHITA	0	0	5,916	1,776	180
OZARK	14,780	0	44,124	5,152	5,372
TOTAL	16,020	1,351	76,656	15,088	6,608

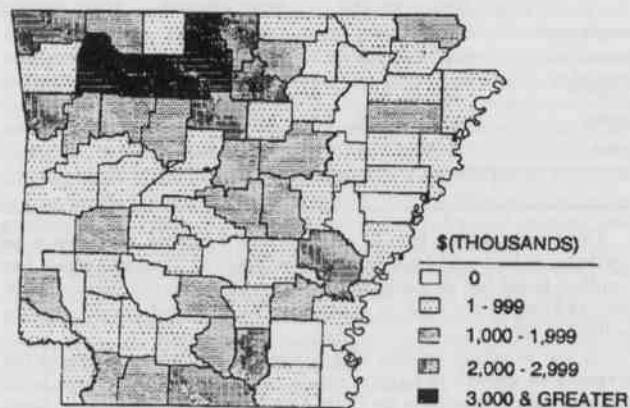


Figure 4. Value of available hard-hardwood sawtimber in thousands of dollars at \$120 per MBF Doyle scale.

SUMMARY

GROWING STOCK INVENTORY AND VALUE

Growing stock volume is the basic capital asset of a forest. Arkansas' growing stock volume has a value exceeding \$12 billion dollars. Total growing stock volume in the state was 64 billion board feet (18 billion cubic feet). The largest portion of this value is contained in the pine forests. Pine sawtimber value is \$6.6 billion dollars. Additionally, pine pulpwood value exceeds \$300 million for a total pine value of \$7 billion dollars (58% of the total timber value).

PINE SAWTIMBER

There are two areas within the state where available pine sawtimber might sustain expansion of wood-based manufacturing. The first is a small area contained in the southwestern portion of the Coastal Plain region consisting of Columbia, Hempstead, Lafayette, and Nevada counties. These counties are producing \$8 million of available pine sawtimber annually. Additionally, net-available pine volumes from Miller and Ouachita counties annually are valued at over \$400 thousand per year. The second area with available pine sawtimber is in the Ozark region of Arkansas. Over \$14 million of available pine sawtimber is produced in this region annually (Table 5). This region and the state would benefit from expansion of wood-base manufacturing facilities using the available pine sawtimber in these two areas.

PINE PULPWOOD

The present availability and growth to harvest ratios of pine pulpwood prohibits any expansions of wood-based manufacturing using pine pulpwood on a regional level. Some counties within each region were found to have available pine pulpwood volume. The available pine pulpwood should increase in the Coastal Plain region as rapidly growing pine plantations begin reaching maturity.

HARD-HARDWOOD SAWTIMBER

All four regions within the state have net-available hard-hardwood sawtimber. The area with the largest potential for expansion of wood-based facilities using this resource is in the Ozark region. This region has 57% of the net-available hard-hardwood sawtimber.

SOFT-HARDWOOD SAWTIMBER

Arkansas's four timber regions all have net-available soft-hardwood timber. The area of greatest net-available volume (77 million board feet, a value of \$6 million per year) is in the Delta region. Desha county in the Delta region has the only available soft-hardwood volume exceeding \$1 million in value annually. The surrounding counties of Arkansas and Chicot contribute another \$1 million in annual soft-hardwood sawtimber growth.

HARDWOOD PULPWOOD

Available hardwood pulpwood abounds in the Delta and Ozark regions of Arkansas. These two regions have over \$6 million per year of net-available hardwood pulpwood. These two regions could sustain expansion of wood-based manufacturing facilities requiring hardwood pulpwood.

CONCLUSION

This study has focused on forest resource availability. Areas that could possibly support expansion of wood-based manufacturing facilities have been identified. The location of new or expansion of existing wood-based manufacturing facilities should proceed with a more detailed analysis of species available, the presence of purchasable timber, and available labor supply. Additional study could provide the information not considered in this analysis.

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