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Wood Products Industries in the Texas Economy

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Special
Research
Report

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Wood Products Industries in the Texas Economy [1/]

Forests, and the manufacturing plants which make wood products are widely dispersed over eastern Texas. Their dispersion tends to obscure their economic impact. Two federal agencies, the Forest Service of the Department of Agriculture and the Bureau of Census of the Department of Commerce provide most of the available data on forest resources and the forest industry; isolation of some data is difficult, however, because some census categories combine data for non-wood manufacturing with that for wood products. This paper is an attempt to bring together the most pertinent data on the forest industries of Texas. Hopefully it will afford a basis for evaluating them as a factor in the State's economic structure, and in relation to the forest land and its ability to replace harvested timber by regrowth.

Unlike the early sawmill industry, which had essentially exhausted East Texas' virgin forest by the late 1920's, the modern wood industries produce a variety of primary products, including paper, fiberboard, and plywood as well as lumber. They waste much less wood, and use the smaller trees of managed forests more efficiently. In contrast to the oil, coal and metal industries, which must eventually import raw material, the forest industries have bright prospects for permanent wood supplies from the forest lands of East Texas. As appraisal of an oil industry must consider its reserves and prospective raw material replacements, the forest products industries of Texas must be considered in the light of the future for their wood supplies, as well as their current economic status.

For this analysis, we have considered as wood products industries both the primary manufacture of basic products such as lumber, plywood, fiberboards

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paper and paperboard and also the secondary manufacture of products depending mainly on wood as a raw material. Census data are not completely segregated in this manner. Thus the census classification "SIC 25 - Furniture and fixtures" embraces several subclasses whose use of wood is limited, including "upholstered household furniture," "metal household furniture," "mattresses and bedsprings," "metal office furniture," "metal partitions and fixtures" and "display hardware and blinds and shades". Tabulations in this paper exclude values for these six classes except as noted.

ECONOMIC IMPORTANCE

Value Added

The combined forest products industry of Texas is one of eight manufacturing industries whose "value added" exceeded one billion dollars in 1976 (Table 1). Its total of $1.1 billion was 4.1 percent of the total for all manufacturing in the state. The value of its shipments, another indication of economic importance, was estimated at $2.7 billion or 3.5 percent of all shipments by manufacturers. Its capital expenditures in 1976 were 5.4 percent of those for all manufacturing. Its cost of materials used in production, $1.6 billion, was 3 percent of the state total.

Of the three major categories under which the forest industries are reported by the Bureau of Census, "paper and allied products" was highest in all these measures, slightly exceeding "lumber and wood products," and many times as high as "wood furniture and fixtures." The paper industry group also accounted for $216.9 million of the $257.7 million expended for capital investments in 1976.

In the same year, the combined forest industry ranked eighth among Texas manufacturers in value added through manufacture (Table 2). The eight leading

Table 1. Value Added by Manufacture, Value of Shipments, Capital Expenditures, and Cost of Materials by Industry, Texas, 1976.

Industry	Value added by Manufacture		Value of Shipments		Capital Expenditures		Cost of Materials	
	Million $	Percent	Million $	Percent	Million $	Percent	Million $	Percent
All Manufacturing	27,600.0	100.0	77,120.0	100.0	4,768.1	100.0	49,990.5	100.0
Lumber and Wood Products	503.0	1.8	1,227.6	1.6	39.0	0.8	725.6	1.5
Wood Furniture and Fixtures	35.5	0.1	81.5	1.0	1.8	0.0	43.8	0.1
Paper and Allied Products	597.6	2.2	1,402.9	1.8	216.9	4.5	812.1	1.6
Forest Industry Totals	1,136.1	4.1	2,712.0	3.5	257.7	5.4	1,581.5	3.2

Source: U.S. Bureau of the Census, Annual Survey of Manufacturers, 1976.

Table 2. Texas Manufacturing Industries with $1 Billion or More Value Added, 1976.

Rank	Industry	Value Added by Manufacture	% of all Manufacture
		Million $	
1	Chemicals and allied products	6,186.9	22.4
2	Petroleum and coal products	3,914.7	14.2
3	Machinery, except electrical	3,178.2	11.5
4	Food and kindred products	2,645.7	9.6
5	Transportation equipment	2,003.2	7.3
6	Fabricated metal products	1,836.6	6.7
7	Electric and electronic equipment	1,443.7	5.2
8	Forest industries	1,136.1	4.1

Source: U.S. Bureau of the Census, Annual Survey of Manufacturers, 1976.

industries accounted for 81.0 percent of the value added by all Texas manufacturers. The value added by forest industries was somewhat less than one-fifth that for the first ranking chemical industry, but quite close to that for electric and electronic equipment, a well known Texas industry.

Employment and Payrolls

Among Texas manufacturing industries, forest products manufacture ranked eighth in number of employees and in payrolls, having 51,351 employees who received $507.2 million in payrolls (Table 3). This amounted to 6.0 percent of all manufacturing employment and 4.9 percent of all manufacturing payrolls.

Among the major segments of the forest industry, the "lumber and wood products" group employed the most people and produced the largest payroll, though the "paper products" group was a close second in payroll value (Table 4). Both "logging camps and contractors" and "wood furniture and fixtures" were much lower in both categories; of the two, the former reported higher annual payrolls per employee.

An additional measure of economic importance is the number of production workers. Texas' forest industry ranked fourth among the state's manufacturing industries, with 39,500 such employees (Table 5). In wages paid production workers, it ranked seventh, with a total of $345.6 million. Average wage per hour, $8.74 was lowest of the major industries, reflecting the rural location of major segments of the industry. The "lumber and wood products" segment of the forest industry accounted for more than half of the industry's production workers and nearly half its wages paid such workers.

Location of Forest Industry

Primary wood manufacturing plants, including several in adjacent states, which used wood from Texas in 1977 are identified by symbols on Figure 1.

Table 3. Leading Texas Manufacturing Industries 1976; Number of Employees, Value of Payrolls and Rankings.

Industry	Employment			Payroll		
	Number Employed [1]	% of all Manufacture	Rank	Value ($1000)	% of all Manufacture	Rank
Machinery, except electrical	107,695	12.4	1	1,385,945	13.4	1
Food and kindred products	84,340	9.7	2	861,816	8.3	5
Fabricated metal products	77,626	9.0	3	921,380	8.8	3
Apparel and other textile products	77,196	8.9	4			-- [2]
Electronic and electronic equipment	66,168	7.6	5	757,561	7.3	6
Transportation equipment	66,116	7.6	6	914,381	8.8	4
Chemicals and allied products	61,680	7.1	7	1,057,567	10.2	2
Forest industries [3]	51,351 [4]	6.0	8	507,165	4.9	8
Petroleum and coal products			-- [2]	681,925	6.6	7

Source: U.S. Bureau of the Census, County Business Patterns, Texas, 1976.

[1] Number of employees, payroll period including March 12, 1976.

[2] Not among the highest eight industries.

[3] Does not include "Wood Office Furniture" - data not published.

[4] Estimated as the mean between 51,226 and 51,475.

Table 4. Employment and Annual Payroll by Type of Industry, Texas, 1976.

Industry	Employment[1/]	% of all Manufacture	Payroll (Thousand $)	% of all Manufacture
All Manufacturing	865,044	100.00	10,377,503	100.00
Logging Camps & Contractors	1,891	0.22	16,648	0.16
Lumber and Wood Products	26,294	3.04	228,399	2.20
Wood Furniture & Fixtures	5,345[2/]	0.63	40,018	0.39
Paper & Allied Products	17,821	2.06	222,100	2.14
Forest Industries	51,351[3/]	5.95	507,165	4.89

Source: U.S. Bureau of the Census, County Business Patterns, 1976.

1/ Number employed, payroll period including Mar. 16, 1976.

2/ Estimated as the mean between 5,220 and 5,469.

3/ Estimated as the mean between 51,226 and 51,475.

Table 5. Number of Production Workers and Annual Wages, by Industry, Texas, 1976.

Industry	Production Workers (1000)	% of all Manufacturing	Wages (Million $)	% of all Manufacturing
All Manufacturing	560.3	100.0	5661.1	100.0
Lumber and Wood Products	22.6	4.0	170.0	3.0
Wood Household Furniture	2.5	0.4	16.0	0.3
Paper and Allied Products	14.4	2.6	159.6	2.8
Forest Industries Total	39.5	7.0	345.6	6.1

Source: U.S. Bureau of the Census, Annual Survey of Manufacturers, 1976.

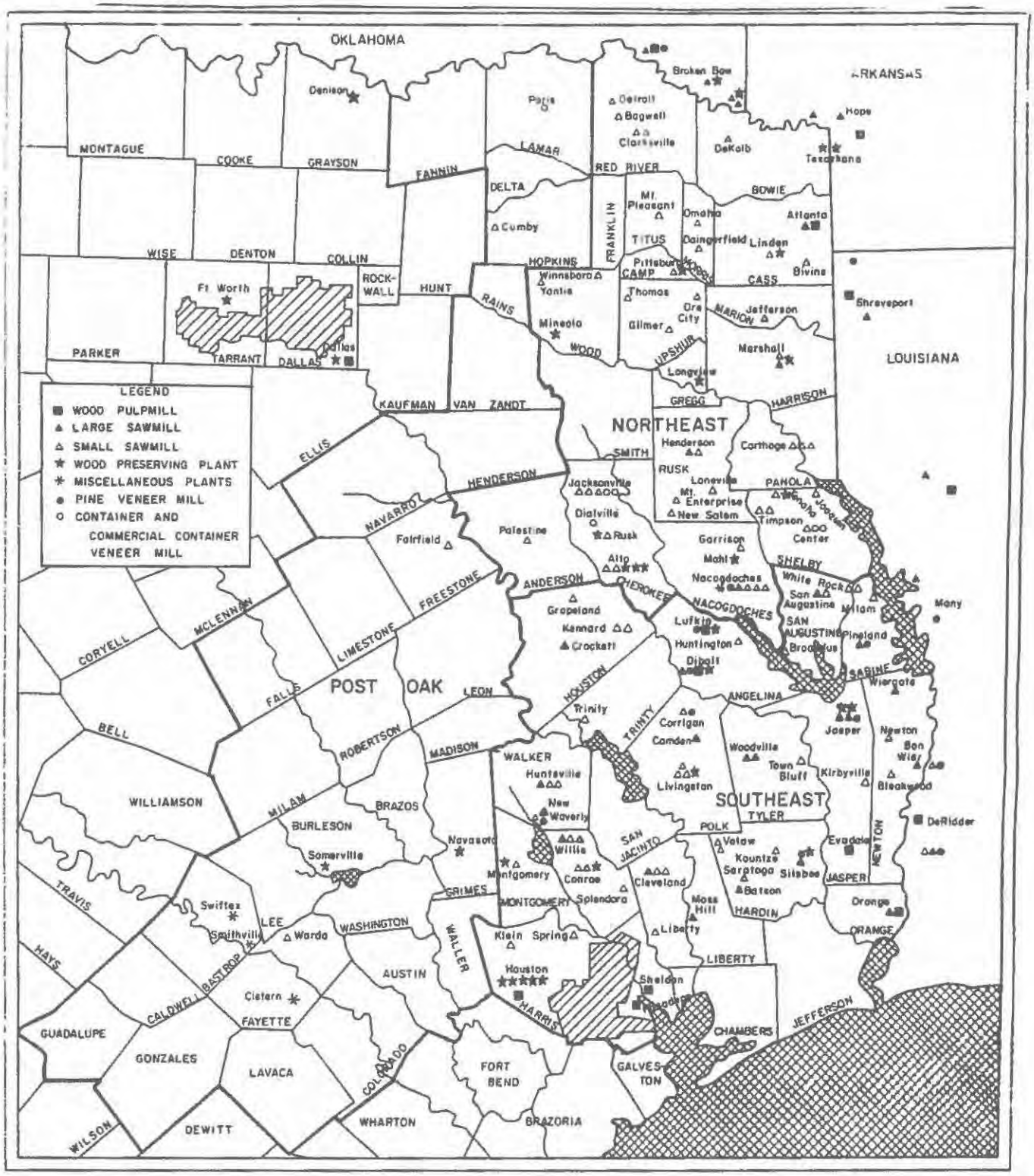

Figure 1. Forest resource regions, Texas and location of primary wood using plants that utilized Texas timber in the regions including those in adjacent states, 1977. Source: Earles, 1976; Braddock, 1978.

With very few exceptions, they are all east of a line separating the counties producing both pine and hardwoods from the Post Oak Region to the west. Their wide dispersion, mainly in the eastern region of prolific wood production reflects the economies of reduced raw material transport inherent in plant locations close to growing forests.

Of the total of over 51,300 people employed in the wood industries of Texas, between 23,500 and 28,100 were employed in the Pine-hardwood Region (Table 6). These people constituted between 8.0 and 9.7 percent of all employees in manufacturing and between 1.9 and 2.3 percent of all employed persons in the region. Forest industry is thus a major factor in the region's industrial and total economy.

Pine-hardwood region employees constituted 67 to 92 percent of all persons in the state employed in logging, 55 to 58 percent of those employed in production of lumber and related products, 42 to 67 percent of those in paper and related products manufacture, and 7 to 17 percent of those employed in production of wood furniture and related products. Thus forest industry employment is not exclusively an asset of the region of wood growth and primary manufacture.

Roughly half the wood-related employment is available in other regions of the state. This is mainly in industries which manufacture furniture, cabinets, moldings, paper bags, boxes, pallets, mobile homes and other consumer products from such standard products as lumber, plywood, fiberboard and paper. The state's widespread secondary wood manufacturing is not entirely dependent on Texas-grown trees, but most such plants benefit from having primary products from local wood available.

Within the state of Texas there were 134 sawmills, 10 wood pulp mills, 18 veneer plants and 35 wood preserving plants in 1977. All except two small

Table 6. Employment[1] by Forest Industries, all Manufacturing, and Total Employment, 1976, in Counties of the Pine-hardwood Region.

County	Forest Industry								
	Logging[2]	Lumber and Wood Products	Wood Furniture and Fixtures[3]	Paper and Allied Products	Total	All Manufacturing	Total Employment	% of all Manufacturing[4]	% of Total Employment[5]
	Number employed								
Anderson	--	20-99	--	--	20-99	1975	5,864	1.0-5.0	1.5-1.7
Angelina	179	2035	--	1000-2499	3035-4534	8408	17,480	36.1-53.9	17.4-25.9
Bowie	--	452	--	--	452	3621	14,043	12.5	3.2
Camp	--	--	20-99	--	20-99	560	1,342	3.6-17.7	1.5-7.4
Cass	--	158	--	500-999	658-1120	1120	4,078	58.8-100.0	16.1-27.5
Chambers	--	--	--	--	--	82	3,087	--	--
Cherokee	20-99	1013	--	--	1013	3092	8,236	32.8	12.3
Franklin	--	--	--	--	--	274	1,458	--	--
Gregg	--	118	--	20-99	138-217	8713	29,207	1.2-2.5	0.5-0.7
Hardin	57	1157	--	--	1157	1661	4,789	69.7	24.2
Harris	--	2547	325-574	4302	7174-7423	178804	911,841	4.0-4.2	0.7-0.8
Harrison	--	250-499	--	--	250-499	6647	12,958	3.8-7.5	1.9-3.9

Table 6. Continued.

County	Forest Industry								
	Logging[2]	Lumber and Wood Products	Wood Furniture and Fixtures[3]	Paper and Allied Products	Total	All Manufacturing	Total Employment	% of all Manufacturing[4]	% of Total Employment[5]
	----------Number Employed----------								
Houston	--	282	20-99	--	302-381	1034	3349	29.2-36.8	9.0-11.4
Jasper	260	1146	--	1000-2499	2146-2694	2694	5736	80-100.0	37.4-47.0
Jefferson	--	117	--	--	117	29,926	88,132	0.4	0.1
Liberty	--	237	--	--	237	721	6843	32.9	3.5
Marion	--	--	20-99	--	20-99	206	828	9.7-48.1	2.4-12.0
Montgomery	--	380	--	--	380	1771	9796	21.5	3.9
Morris	--	51	--	--	51	2500-4999	6582	2.0-1.0	0.8
Nacogdoches	--	704	--	--	704	3481	8946	20.2	7.9
Newton	--	596	--	--	596	616	1156	96.8	51.6
Orange	--	20-99	--	500-999	520-1098	9006	18,089	5.8-12.2	2.9-6.1
Panola	--	100-249	--	--	100-249	286	2395	34.9-87.1	4.2-10.4
Polk	77	1000	--	--	1000	1098	3233	91.1	30.9
Red River	--	100-249	--	--	100-249	765	2480	13.1-32.5	4.0-10.0
Rusk	53	332	--	--	332	1519	6683	21.9	5.0

Table 6. Continued

County	Forest Industry								
	Logging[2]	Lumber and Wood Products	Wood Furniture and Fixtures	Paper and Allied Products[3]	Total	All Manufacturing	Total Employment	% of all Manufacturing[4]	% of Total Employment[5]
	Number Employed								
San Augustine	53	147	--	--	147	224	931	65.6	15.8
San Jacinto	--	--	--	--	--	13	223	--	--
Sabine	53	147	--	--	147	224	1268	65.6	11.6
Shelby	20-99	737	--	--	737	1869	3993	39.4	18.5
Smith	--	100-249	--	250-499	350-748	11,636	35,341	3.0-6.4	1.0-2.1
Titus	--	109	--	--	109	1266	4617	8.6	2.4
Trinity	20-99	74	--	--	74	185	994	40.0	7.4
Tyler	216	362	--	--	362	663	1632	54.6	22.2
Upshur	--	111	--	--	111	614	3188	18.1	3.5
Walker	250-499	892	--	--	892	1117	5042	79.9	17.7
Wood	--	--	--	--	--	594	3921	--	--
TOTAL	1258-1744	15,494-16,348	385-871	7572-11,896	23,451-28,127	288,985-291,484	1,239,781	8.0-9.7	1.9-2.3
STATE TOTAL	1,891	28,185	5220-5469	17,821	51,266-51,475	865,044	3,755,267	5.9-6.0	1.4

Table 6. Continued.

Source: U.S. Bureau of the Census, County Business Patterns, Texas, 1976. In accordance with census practice, only a range of values is shown where exact figures would disclose data for an individual employer. The exact values are included in most state totals. In compiling regional and industry totals, we have added to the sum of all exact values the sum of all range lows to compute the lower limit of a range, and the sum of all range highs to compute its upper limit.

1/ Number of employees for pay period including March 12, 1976.

2/ Values in this column are included under "Lumber and Wood Products".

3/ Excludes from Census item 25 upholstered furniture, metal household furniture, mattresses and bedsprings, metal office furniture, metal partitions and fixtures.

4/ Total divided by all manufacturing.

5/ Total divided by total employment.

sawmills, two pulpmills and five preservative treatment plants were in the pine-hardwood region. The combined forest industry utilized in that year a total of 474.2 million cubic feet of wood. In 1974 (a year for which additional data are available) 68 sawmills each cut more than 3 million board feet; 23 of these cut more than 10 million board feet each. There were 20 veneer plants operating in 1974, nine producing pine plywood, nine making veneer for containers and two producing flat or face veneer. Plywood manufacture in Texas dates from 1964 when the first two plants were constructed; construction of six more plants during 1965 raised this segment of the industry to almost its present proportions. Pulpmill expansion and new plant construction from 1964 to 1974 nearly tripled Texas' pulping capability from 2595 to 7075 tons per day. Individual capacity of the mills ranges from 50 to 1450 tons daily.

Table 6 presents the reported number of employees of wood using industries in 1976 for each of the counties of the Pine-hardwood Region of Texas, together with other comparative values.

For many counties and some segments of forest industry, only ranges are available for certain items; the county, regional and state totals in Table 6 therefore show, in some cases, ranges between which the true values lie.

The primary manufacturing of lumber, plywood and paper is concentrated in the Pine-hardwood Region, especially in its southern part. Except for three paper mills in Harris county, most wood manufacturing plants are located in rural counties. It is in these counties that employment in forest products manufacturing is locally more important. There were 17 counties in the region in which forest industry employment in 1976 exceeded 20 percent of all manufacturing employment; in 9 counties it exceeded 40 percent, in 6 counties 60 percent and in 2 counties 80 percent. In the same year, forest industry

employment exceeded 10 percent of all employment in 11 counties; in 3 counties it exceeded 20 percent and in 1 county 40 percent. Even in Harris County, occupied largely by the city of Houston, forest industry afforded over 4 percent of all manufacturing employment, and over 0.8 percent of total employment.

Trends

Trends of employment, payrolls and value added by manufacture in Texas forest industries are charted in Figure 2. Reflected in these trends are important shifts from labor-intensive to capital-intensive processes, from many small sawmills to fewer, larger and more efficient units, from a concentration on sawn boards to varied end products, including kraft paper, newsprint, fiberboards and plywoods.

Over the 22 year period, employment increased 62.7 percent, or at a compound interest rate of 2.2 percent per year. Most of the increase took place, however, in the last half of the period, after a decline from 1954 through 1958, reflecting in part at least, cumulative declines in the number of small sawmills. The annual rate of increase from 1963 through 1976, was considerably higher (3.8 percent) despite hardly any increases towards the end of the period. Payrolls have increased each reporting year since 1958, at an annual rate of 8.2 percent over the period. The rapid increase in payrolls in comparison with employment reflects in part a general increase of wages over the period, but also higher proportions of skilled employees in the industry. Even greater increases were observed in value added by manufacture which rose 9.4 percent per year over this period, again the combined result of inflation plus higher proportions of intrinsically more valuable products.

Average rates of increase in employment, payrolls and value added for all manufacturing over the 22 year period were 3.4, 8.8, and 9.8 percent

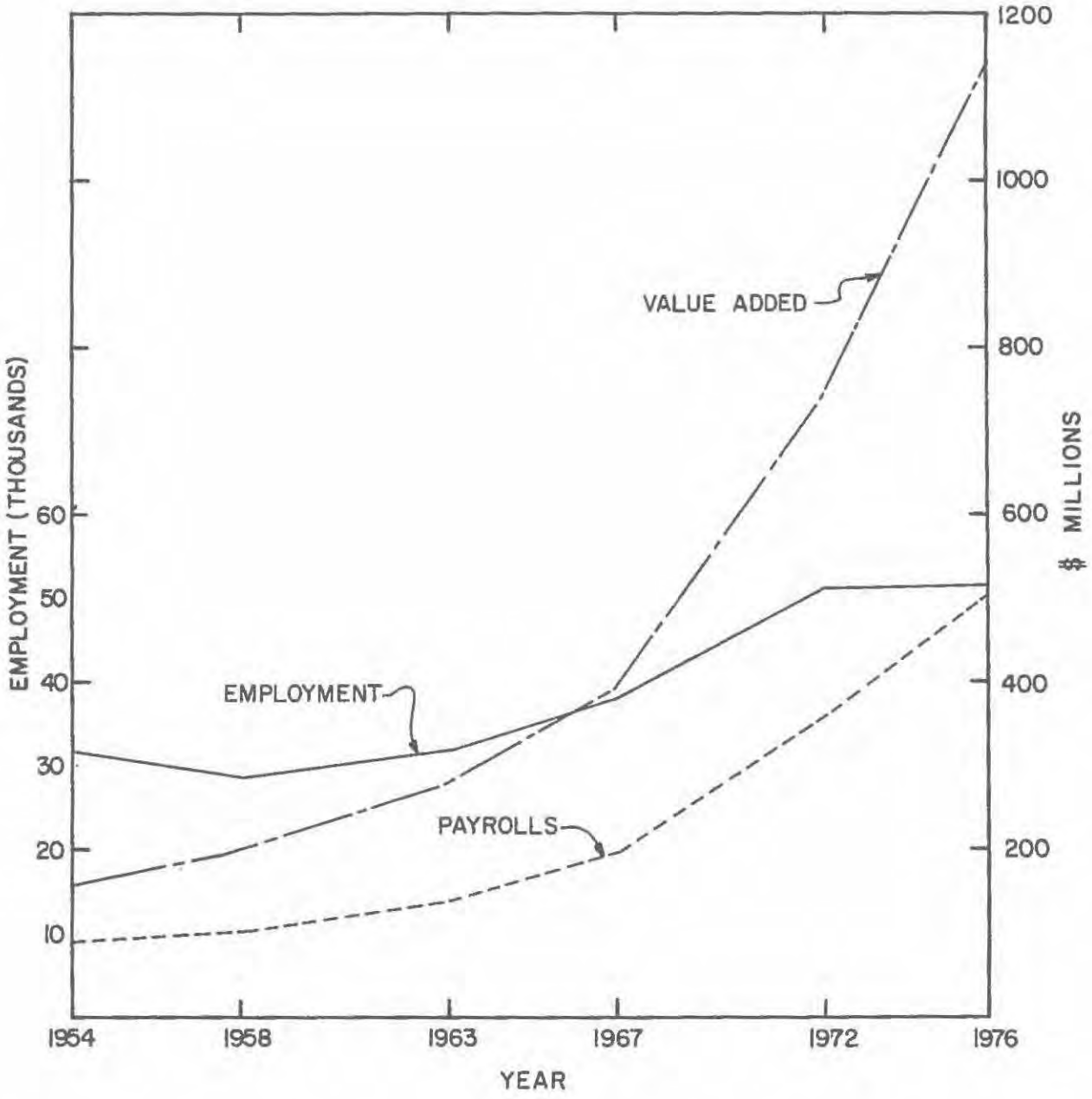

Figure 2. Trends in forest industry employment, payrolls and value added by manufacturers, Texas, 1954-1976. Source: U.S. Bureau of Census of Manufacturers, 1954, 1958, 1963, 1967 and 1972. Due to changes in category definitions, values exclude a small but varying number of plants dependent primarily on wood raw materials. Data for 1976 were taken from U.S. Bureau of Census, Annual Survey of Manufacturers, 1976.

respectively. Thus forest industry's employment has grown less than that of all manufacturing. Its payrolls and value added, however, have increased at only slightly lower rates than those for all manufacturing. Furthermore, during 1963-1976, the period of most rapid industrial growth in Texas, employment in forest industry increased at a 3.8 percent rate, which approaches the rate of 4.1 percent for all manufacturing.

During the 14 years from 1964 through 1977, annual harvests of standing trees rose from 299.2 to 543.0 million cubic feet, an average of 4.3 percent per year. During this period, value added by manufacture for the Texas forest industries increased at an average annual rate of 11.4 percent. The fact that value added has increased faster than the quantities of raw material used further reflects improved plant efficiency and a more valuable product mix, resulting from new plant construction.

FOREST RESOURCES

The early Texas lumber industry which peaked in 1909 had essentially exhausted its supplies of suitable timber by 1930. For this and other reasons, the forest products industry was at a low ebb during the 1930's. After some 40 years of growth, the new diversified industry must consider whether or not it faces eventual exhaustion of its raw material supply as did its predecessor.

Basic to this consideration are the lands capable of producing commercial timber, the current and prospective uses of this land, the species and utility of the growing stock of trees now on the land, the rates of the growth and the relation of current and prospective growth to wood removals including the cut for industrial use.

Land Area

Lands capable of producing commercial forests are confined to 66 counties

of eastern Texas where rainfall and soils favor tree growth (Figure 1). In the eastern portion of this area, classed for forest survey purposes as Northeast and Southeast Texas, both pine and hardwood tree species are abundant. Taken together, these two forest areas, called the Pine-hardwood Region, support most of the Texas primary forest industry. West of it, in the Post Oak Forest Region, hardwoods of small size predominate, growth is slow, there is little wood manufacturing and forests are used primarily for grazing and wildlife production. Although considered capable of producing commercial forest products, including pine pulpwood and sawlogs, few owners have yet made the investment needed for commercial production.

Of the 33+ million acres in the three forested regions, 14.2 million are forested, 12.5 million of which are considered commercial, 1.6 million, mostly in the Post Oak Region, are unproductive and 37.2 thousand acres are productive but reserved from timber harvest (Table 7). The remaining area includes 7.9 million acres of cropland and 11.0 million other non-forest acres which include pasture, range, urban, and industrial lands and 113.8 thousand acres of water surface.

There is a continued shifting of land among these uses, as when land abandoned from agriculture or other use reverts naturally or is planted to forest, or when forest or agricultural land is taken over for rights-of-way, or for urban or industrial use. From 1965 to 1975 the Pine-hardwood Region lost 1.03 million acres of commercial forest, 706.2 thousand to agriculture and 328 thousand to other non-forest uses (Table 8). This was partially offset by gains of 479.9 thousand acres from non-forest uses, for a net loss of 554.3 thousand acres. Thus the effect on the forest resources was not only the loss of all future production from the 554.3 thousand acres of net loss, but also a delayed harvest on the 479.9 thousand acres of new forest land in the initial stages of tree growth which substitutes for lands which

Table 7. Land Classification, Forest Region of Texas, 1975.

Land Classification	Area Thousand Acres	Percent of all land
Commercial	12,512.5	
Productive reserved	37.2	
Unproductive	1,604.2	
Total forest	14,154.0	42.8
Cropland[1/]	7,856.7	
Other[2/]	11,045.7	
Total non-forest	18,902.4	57.2
All land[3/]	33,056.4	

1/ Census of Agriculture

2/ Includes pasture and range, industrial and urban areas, other non-forest land, and 113,800 acres, classed as water by Forest Survey, but defined by the Bureau of the Census as land.

3/ United States Bureau of the Census.

Table 8. Commercial Forest Land 1965 and 1975 by Region.

Region	Commercial Forest (Thousand Acres) 1965	1975	Change Thousand Acres	Percent Change
Southeast	6,590.8	6,345.2	-245.6	-4
Northeast	4,865.0	4,556.2	-308.8	-6
Pine-hardwood	11,455.8	10,901.4	-554.4	
Post Oak	1,627.3*	1,611.0	- 16.3	-1
Total	13,083.1	12,512.4	-570.7	-4

*Estimated

Source: P. A. Murphy, 1976, p. 1.

would have been ready for harvest many years sooner. Net losses in this period were higher in Northeast than in Southeast Texas.

Prior to 1952, the area of commercial forest lands in Texas had increased through abandonment of cropland for several consecutive decades, reaching a peak of 13.171 million acres about 1952. More recently clearing of land for pastures has largely offset abandonment, and diversion of forest land for urban and industrial uses has increased. This trend, combined with pressures for allocation of forest lands to park, wilderness or other uses considered incompatible with timber harvests, suggests that shrinkage of the forest land base will continue in the future.

Forest Land Ownership

Wood processed by Texas forest industries is not supplied exclusively from industry-owned lands; plants typically purchase a sizeable portion of their raw material from other landowners. Thus all commercial forests of the Pine-hardwood Region are potential suppliers of wood to the industry as a whole. Table 9 shows the distribution of commercial forest lands by ownership. Only 6.9 percent of the total is publicly owned, 5.3 percent being in National Forests, under multiple use management, and 1.6 percent owned by other federal, state and local agencies for purposes which usually do not exclude timber production.

The great preponderance of commercial forests, 93.1 percent. are privately owned. Of the 10.1 million acres in private ownership, 3.8 million (37.0 percent) are owned by forest industry, 0.8 million (7.8 percent) by farmers and 5.6 million (55.3 percent) by miscellaneous private owners.

The National Forests have been managed since the late 1930's for production of high quality trees. Sales of stumpage in 1978 were 64.2 million board feet,

Table 9. Area of Commercial Forest Land by Ownership Classes, Pine-hardwood Region, Texas, 1975.

Ownership Class	Area (Thousand acres)
Public	
National Forest	572.7
Other public	180.5
Total public	753.2
Private	
Forest Industry	3,750.6
Farmer	787.2
Misc. private	5,610.5
Total private	10,148.3
All ownerships	10,901.5

Source: Earles, 1976.

for a total value of $6.2 million. Forest industry lands are generally well managed for continued yield, mostly on a short rotation basis which produces relatively small trees at rapid rates of growth. The 6.4 million acres of farmer and miscellaneous private ownership, representing 58.7 percent of the state's commercial forests, are not generally as well managed. Their level of management is a major unknown in the industry's future, and an important key to future timber supplies. These lands now supply a major part of the current timber cut, but foresters doubt their capacity to do so permanently unless their owners take more adequate steps to insure regeneration and adequate growth of desirable species after cutting.

Volume of Growing Stock

The volume of sound trees on the land is a rough measure of the total amount of wood available for harvest at a given time; it is also a factor often considered by foresters in estimating future rates of growth. Generally, over wide areas, low stocking per acre is indicative of low growth rates per acre. Differences in successive estimates of total growing stock for the same area afford the best estimate of net growth (or loss) over the intervening period.

Table 10 presents the 1975 growing stock estimates for the Pine-hardwood and Post Oak regions, by species groups, and the percent changes since 1965. These are net changes resulting from tree growth during the period, over and above withdrawals by harvest and by natural factors such as decay, disease, insects and storms. Thus a high percentage increase may reflect either a high growth rate or a low rate of removals.

Because the growing stock of the Post Oak Region is less than 10 percent of the total and the available timber is of low quality, it is currently of little interest as a source of timber.

Table 10. Growing Stock on Commercial Forest Land, Pine-hardwood Region in 1975, and Change Since 1965.

	Region		
	Northeast	Southeast	Pine-hardwood
All species, 1975, million ft^3	4077.6	7730.7	11,808.3
Change, %	+ 33	+ 12	+ 22
Growing stock per acre, 1975 ft^3	894.9	1218.4	1,083.2
10 yr Growth per acre, ft^3	208.0	127.9	161.3
Softwood, 1975, million ft^3	2334.6	5590.5	7,925.1
Change, %	+ 49	+ 14	+ 22
Growing stock per acre, 1975, ft^3	512.4	881.1	727.0
10 yr Growth per acre, ft^3	158.4	103.9	126.9
Hardwood, 1975, million ft^3	1743.0	2140.2	3,883.2
Change, %	+ 16	+ 8	+ 12
Growing Stock per acre, 1975, ft^3	382.5	337.3	356.2
10 yr Growth per acre, ft^3	49.6	24.0	35.8

Source: Earles, 1976.

In both Northeast and Southeast Texas there were sizeable net increases; percentage gains in softwoods were greater than those for hardwoods in both regions, as were 10-year gains per acre. In 1975 total stocking per acre was higher in the Southeast than in the Northeast, but per acre net gain was greater in the Northeast. This is attributed largely to heavier cutting in the Southeast where industrial harvesting removes a larger percentage of growth. This is true especially of softwoods; despite heavier stocking in the Southeast net softwood gain per acre is about one third less than in the Northeast.

Hardwood stocking per acre is slightly higher in the Northeast, 382.5 ft^3 as against 337.3 ft^3. Net hardwood gain is also higher in the Northeast though much lower in both regions than the net gain of softwoods. The low net gain of hardwoods, despite substantial hardwood growing stocks in both regions is at least in part a reflection of low inherent growth rates in these species.

While total growing stock affords an index of future wood availability, sawtimber volume, which is limited to sound softwoods over 9.0 inches in diameter and sound hardwoods over 11.0 inches, provides a better estimate of what is currently available, especially for sawlogs and veneer logs. In Table 11, the concentration of sawtimber volume in the Southeast is apparent. In 1975, roughly three-fourths of the softwood sawtimber and 56 percent of the hardwoods in Texas were in the Southeast. Despite the active harvesting of trees of these sizes, the inventory of sawtimber increased substantially during the 1965-75 decade. The 27 percent increase in softwood sawlogs and the 12 percent increase in hardwoods reflect growth on unharvested trees of these sizes plus ingrowth of smaller trees in excess of harvests and natural losses. It is to be noted, however, that these are 10 year changes; the

Table 11. Sawtimber Volume, 1975 and Change Since 1965.

Resource Region	All Species Volume	Softwood Volume	Softwood Change	Hardwood Volume	Hardwood Change
	Million bd.ft.	Million bd.ft.	Percent	Million bd.ft.	Percent
Southeast	31,295.5	25,127	+18	6,168.5	+ 9
Northeast	13,535.3	8,825.1	+60	4,710.2	+18
Pine-hardwood Region	44,830.8	33,825.1	+27	10,878.7	+12

Source: Earles, 1976, p. 2.

average yearly increase, one-tenth of these values, suggests a favorable but rather close balance between growth and removals.

Timber Growth and Harvests

In Figure 3 annual timber growth (gross growth less mortality) and harvest in the Texas Pine-hardwood Region are plotted for each year, 1964 through 1977. Softwood growth increased rather consistently until 1973, to a level of 472.5 million ft^3; since then growth appears to have leveled off at about 14 percent above the 1964 level. Hardwood growth, however, appears to have more than doubled in recent years, although this may reflect inaccuracies in estimation. Softwood harvests have increased consistently throughout the period, more than doubling from 199.3 million ft^3 in 1964 to 453.9 million ft^3 in 1977. Hardwood cutting was abnormally high from 1964 to 1966 due to clearing extensive bottomlands for reservoir sites.

Harvests exceeded growth only for hardwoods during the period of reservoir clearing. The sharp rise in annual growth of hardwood in 1973 largely reflects adjustment in estimate of hardwood growing stock. The chart shows however that hardwood harvest has been consistently below annual growth. Increases of softwood harvests have greatly exceeded increases in growth during the period. As a result, annual cuts have increased from about half the annual growth to nearly 100 percent of it.

Imports and Exports

While unmanufactured wood is a bulky raw material that is not economically transported over long distances, there is some interchange of wood with adjacent states. In 1977, Texas imported 39,257 M ft^3 and exported 66,001 M ft^3 of wood. The state was thus a net exporter of 26,744 M ft^3. This is about 5 percent of the state's total wood production of that year.

Table 12 presents some details of the state's interstate trade in raw

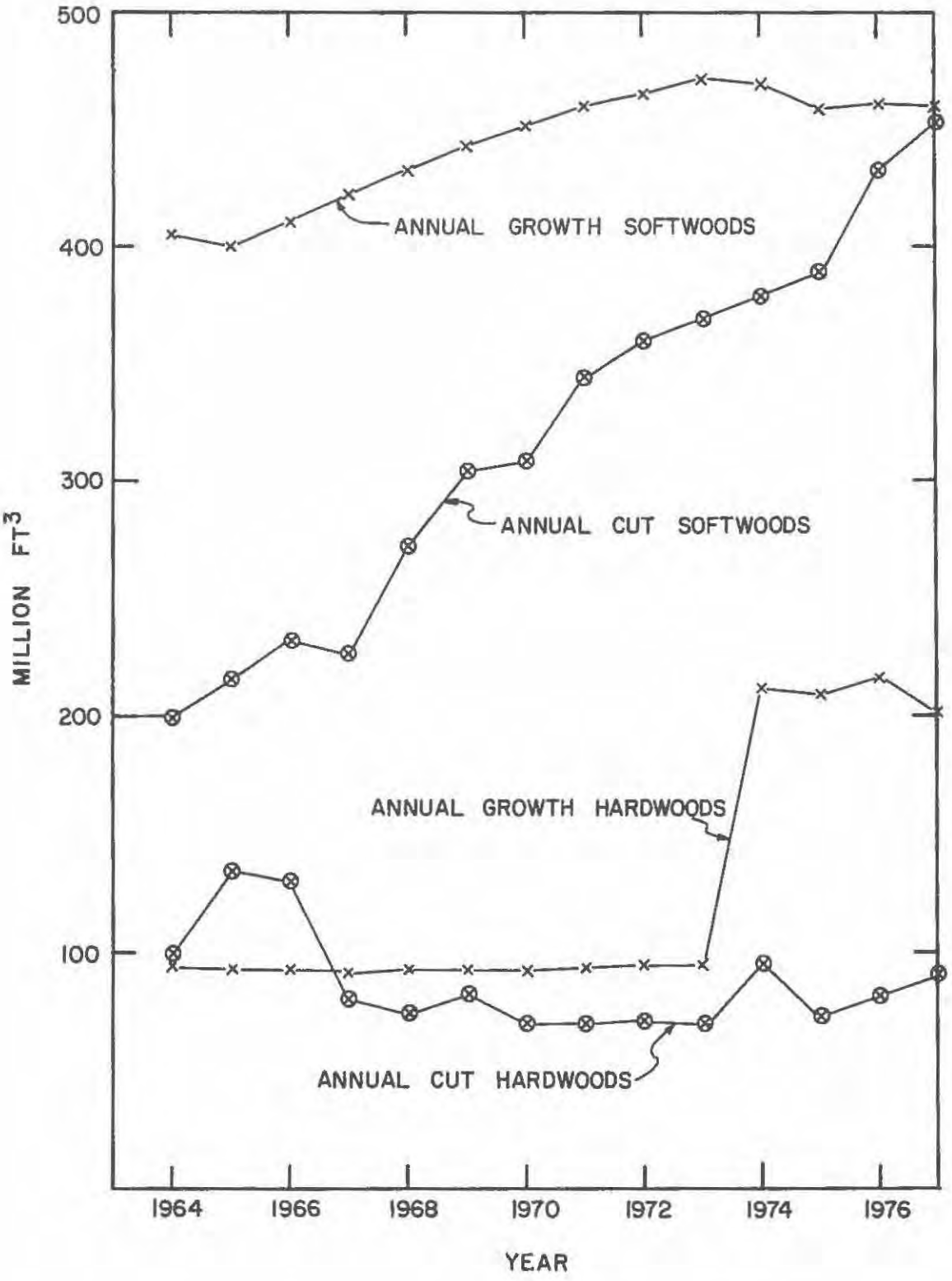

Figure 3. Annual growth and annual cut from growing stock, Pine-hardwood Region, Texas, 1964-1977. Source: Barron, 1973; Braddock, 1978.

Table 12. Texas' Trade Balance in Wood Products, 1977.

Species and direction of trade	All products	Saw logs	Veneer Logs	Pulpwood	Poles, Posts & Piling
	M ft^3	M bd. ft.	M bd.ft.	Cords	M ft^3
All Species					
Exports	66001	65649	47486	589025	9
Imports	39257	39085	96994	175968	2262
Balance	26744	26564	-49508	413057	-2243
Softwoods					
Exports	61077	64402	46611	531772	9
Imports	32429	25447	95608	122114	2262
Balance	28648	38955	-48997	409658	-2253
Hardwoods					
Exports	4924	1247		57253	-
Imports	6828	13638	1386	53854	-
Balance	-1904	-12391	-1386	3399	

Source: Harvest Trends, 1976 & 1977, p. 16.

wood products in 1977. There was in that year a net export of 28,648 M ft^3 of softwoods and a net import of 1904 M ft^3 of hardwoods. Texas was a net importer of both hardwoods and softwood veneer logs, and a net exporter of pulpwood of both species classes. There was a net export of softwood and a net import of hardwood sawlogs.

While sizeable, the scale of this interstate trade in primary forest products is not large enough to greatly affect current raw material availability. Adjacent states resemble Texas in the state of balance between their wood growth and harvest. It is unlikely, therefore that future out-of-state wood supplies or raw material needs will greatly affect the capacity of Texas' forests to sustain its forest industries.

SUMMARY

The wood manufacturing industry of Texas is one of the eight most important in the state. It is essentially the only manufacturing industry whose raw material is potentially self perpetuating. For over 40 years wood harvests have been more than offset by wood growth on the state's commercial forest land. During this period the industry has grown until in 1977 harvests and growth were essentially in balance. Recent trends in demand for wood-based products and in the state's industrial growth suggest further expansion of forest industry in Texas. Highly desirable from the standpoint of economic growth and employment, substantial expansion can only be temporary unless growth of wood on forest lands can be increased in proportion to further increases in wood harvest.

The land base for growing wood is finite, or shrinking. The 1.6 million forest acres in the Post Oak Region, now largely unproductive, could be converted to pine, though at a cost which few landowners have so far considered economic.

If economic factors change to make the conversion feasible, growth of softwoods might be increased by about 14 percent. Under foreseable price levels, however, growth increases are available only through better management of the Pine-hardwood Region's 10.9 million forest acres.

Foresters estimate that usable wood growth on these lands can be appreciably increased. The National Forests of Texas are probably best managed of any ownership class; if their production is to meet southwide projections, however, their growth rate by year 2020 is expected to balance an annual harvest of 56.1 ft^3 per acre, as compared to about 32 ft^3 harvested in 1978. Similarly, growth on the 3.8 million acres of industry-owned land is being steadily increased. Greatest opportunity for growth increase, but most difficult to accomplish, is on the 6.4 million acres of forest land owned by farmers and miscellaneous private owners.

If further expansion of wood using industries is to be sustained, at least the following actions will be necessary:

1) Minimize, wherever possible, the diversion of productive forest lands to uses incompatible with wood harvesting. Potentially, one full time job is lost for each 212 acres so diverted.
2) Continue efforts to accelerate growth on the 572.7 thousand acres of National Forests and the 3.8 million acres of industry-owned land within the state.
3) Greatly intensify efforts to improve management of the 6.4 million acres of privately owned forest land in farmer and miscellaneous ownership in the Pine-hardwood Region.
4) Expand research and field trials by both public agencies and forest industry on technology for increasing pine production in the Post Oak Region.

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