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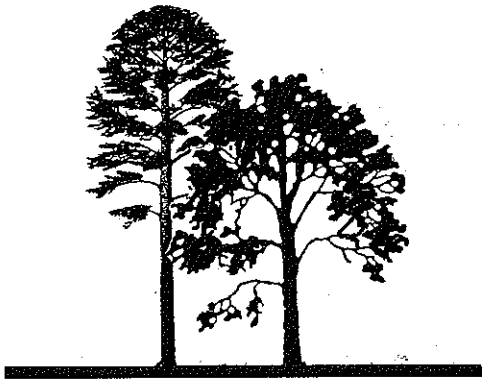
FORESTRY

AND MISSISSIPPI'S FOREST RESOURCES



THEIR ECONOMIC IMPORTANCE

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MISSISSIPPI AGRICULTURAL & FORESTRY EXPERIMENT STATION Verner G. Hurt, Director Mississippi State, MS 39762
Donald W. Zacharias, President Mississippi State University R. Rodney Foil, Vice President

Forestry and Mississippi's Forest Resources — Their Economic Importance

Mark R. Dubois
Research Assistant I
Department of Forestry

Thomas J. Straka
Former Associate Forester and Associate Professor
Department of Forestry

Larry Doolittle
Sociologist
Social Science Research Center

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Forestry and Mississippi's Forest Resources — Their Economic Importance

Introduction and Highlights

This bulletin provides an overview of Mississippi's forest resources and forestry's contribution to the Mississippi economy. Forest resources cover almost 17 million acres of Mississippi, and forestry is a vital component of the state's economy. Everything concerning forestry and forest resources cannot be covered in one publication. However, the breadth of this overview should provide the reader with an appreciation for the vast range of benefits derived from Mississippi's extensive forest resource.

Mississippi's Forest Industry

Mississippi's forest industry is one of the driving forces of the state's economy. Raw materials from the state's timberlands support the production of lumber, plywood, wood pulp, paper, furniture and many other semi-finished and finished forest products. Some examples of the industry's importance in Mississippi's economy include the following:

- Forest industries own or control 20 percent—3.2 million acres—of Mississippi's timberland.
- Almost 1.9 billion board feet of sawtimber and more than 7.2 million cords of pulpwood were harvested from Mississippi's timberland in 1989.
- The value of Mississippi's forest products at first delivery point totaled $717 million in 1989, and exceeded that of any single agricultural crop.
- In 1988, approximately 57,000 Mississippians earned over one-billion dollars in wages while employed by the forest industry. Furthermore, almost one of every four manufacturing jobs and dollars of wages paid are provided by the forest industry.
- In 1986, more than $1.8 billion of processing value was added by Mississippi's forest industry.
- The value of Mississippi's forest products exported to foreign markets totaled $565 million in 1986, and accounted for almost 13 percent of all of the state's forest industry shipments.
- During 1988, Mississippi was a net exporter of pulpwood to neighboring states for wood pulp processing and further paper manufacturing. Using economic multipliers, net pulpwood exports of 3.1 million cords in 1988 would have supported an additional $2.1 billion of output, $361 million in annual income, and 16,364 more jobs in Mississippi's total economy. Furthermore, an additional $43 million would have been generated for the state's government revenues through increased economic activity.

Forestry and the Mississippi Economy

Economic multipliers of Mississippi's forest industry demonstrate a strong relationship to the state's economy. The strength of the relationship results from forest industry's close ties to other state industries and Mississippi's vast timberlands. The following are examples of economic impacts resulting from Mississippi's forest industry:

- A $1.00 increase in output from Mississippi's forest industry will stimulate $1.06 of production and sales in other state industries.
- A $1.00 increase in income in Mississippi's forest industry will result in $0.96 of additional household income in the state's total economy.
- For each additional job created in Mississippi's forest industry, 1.23 jobs will be created in other state industries.
- Evaluation of a weighted-Type II economic multiplier indicates that the forest industry has the greatest impact on Mississippi's economy of any manufacturing industry in the state.

Mississippi's Forest Resources

Forests cover 56 percent of the state's land and are well-distributed throughout Mississippi except in the Delta. In the last 30 years, Mississippi's commercial timberland acreage has remained relatively stable, although changes have occurred from region to region within the state. The following are some of the highlights of Mississippi's forest resources.

- Forests occupy 56 percent—17 million acres—of Mississippi's land area.
- Almost 70 percent—11.7 million acres—of Mississip-

pi's timberlands are in nonindustrial private ownership.

- Current growth of Mississippi's timberlands is only 46 percent of the potential for fully-stocked natural stands.
- Forest industry ownerships account for 53 percent—1.2 million acres—of the pine and oak-pine plantations in Mississippi.
- Since 1957, timber volumes on the state's timberlands have almost doubled. However, in 1987, timber volumes for Mississippi's softwood growing stock were essentially unchanged from 1977, while hardwood growing stock continued to increase.
- Mississippi's softwood timber growth approximately equals softwood timber removals, while hardwood timber growth is approximately twice that of hardwood timber removals.

Nonindustrial Private Forest Landowners

Ownership patterns have shaped the characteristics of the state's timberland resource. Thus, the future of Mississippi's timberland resource largely depends on the management practiced on the 11.7 million acres of timberland controlled by nonindustrial private forest (NIPF) landowners. Characteristics of these landowners influence the level of timber management practiced, which, in turn, affects the future supply of forest products. Some characteristics of these landowners and the impact they provide include the following:

- NIPF landowners control nearly 70 percent—11.7 million acres—of Mississippi's timberland.
- More than 70 percent of NIPF land is held by owners who control 100 acres or more.
- The more timberland a NIPF landowner controls, the more apt he is to sell timber.
- Nearly 70 percent of NIPF land in Mississippi is owned by individuals or individuals and their spouses.
- Well over one-half of Mississippi's NIPF land is owned by persons aged 55 or older.
- More than 70 percent of NIPF timberland belongs to owners primarily interested in either current or future income.
- Only 18 percent of NIPF land in Mississippi is covered by a written management plan.

Mississippi's Public Forest Resources

Mississippi's public forest resources are well-distributed throughout the state. These resources are managed by various government agencies to fulfill a diverse set of objectives. Many of the public forest resources provide opportunities for outdoor recreation and wildlife management, along with the production of forest products. Some of the highlights of Mississippi's public forest resources include the following:

- Forest resources administered by the USDA Forest Service, U.S. Army Corps of Engineers, USDI Fish and Wildlife Service, and the Mississippi Department of Wildlife , Fisheries, and Parks account for approximately 1.4 of the estimated 1.9 million acres of public timberlands in Mississippi.
- Approximately 25 million visitor-days of recreational activities were enjoyed on Mississippi's public forests and their associated water facilities in 1988.
- Wildlife objectives are the primary management emphasis for several of Mississippi's public forest resources and play an integral role in the remainder of the state's public forests.
- In 1988, more than 7 million man-days were spent in hunting activities; an additional 1.5 million man-days are spent in non-consumptive wildlife activities each year in Mississippi on both public and private lands.

Mississippi's Forest Industry

Utilization of Mississippi's forest resources began with early settlement. In 1840, almost 120,000 cords of fuelwood were sold primarily to steamboats operating on the Mississippi River (Williams, 1980). More than 300 sawmills were operating in Mississippi in 1840, and forest industry continued to expand through the 1800's as settlement of the state progressed.

An explosive expansion began shortly after the turn of the century, and by 1925, the state's peak year for lumber production, almost 40,000 workers were employed in forest industries (James 1951). Today, the industry continues to be a major component of Mississippi's economy.

Forest Industry Timberland Ownership

Mississippi's forests possess and grow the raw material required by the state's forest industry. This industry owns or controls approximately 3.2 million acres of Mississippi's timberland. The forest industry consists of almost 800 primary and secondary processing facilities dispersed throughout the state. However, the industry's timberland ownership is highly concentrated. Six companies account for almost 86 percent of the estimated forest industry timberland ownership (Table 1). Additionally, forest industry timberland ownership is most heavily concentrated in the southern one-third and the east-central areas of Mississippi (Figure 1).

Forest Products and Production

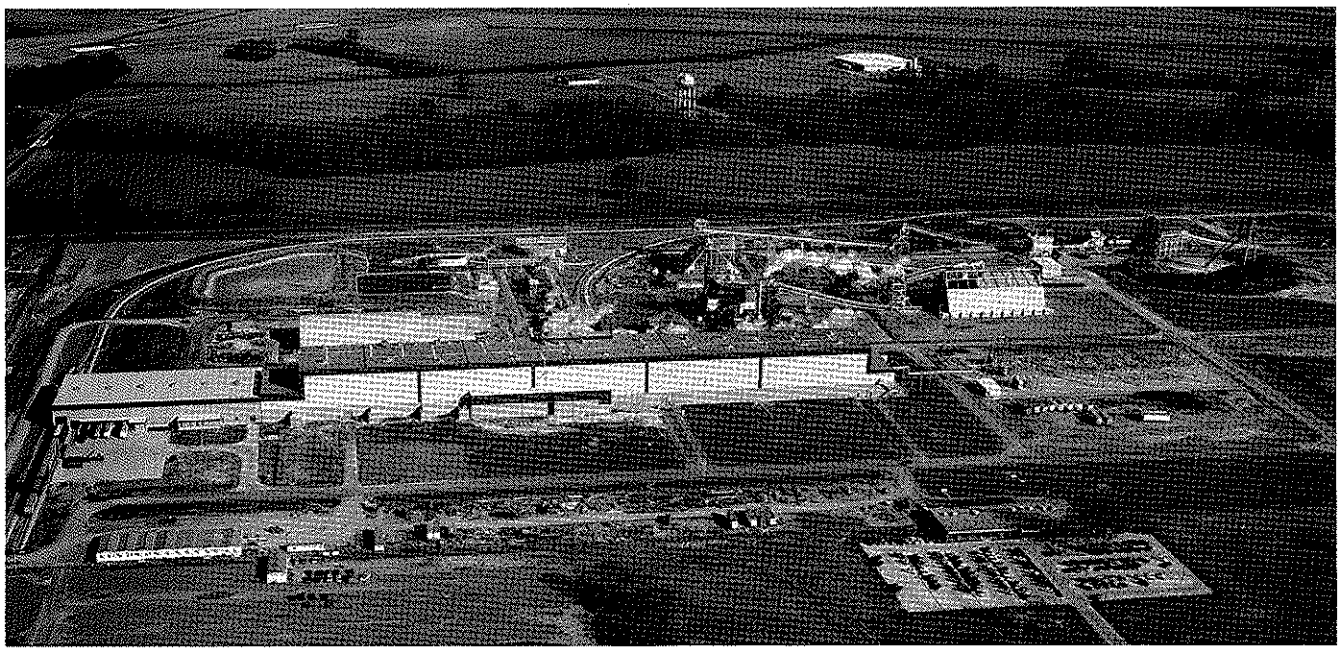
Raw materials from Mississippi's forests are produced in various forms for various uses. Total production of pine and hardwood sawtimber in the form of sawlogs, plywood logs, poles, piling, veneer logs, and crossties harvested from the state's forests increased from approximately 1 billion board feet in 1982, to almost 1.9 billion board feet in 1989 (Figure 2)[1]. In 1989, combined pine and hardwood sawtimber pro-

[1] When appropriate, supporting tables for figures can be found in Appendix A.

Table 1. Area of timberland owned in simple fee or controlled through long-term lease agreements by forest industries, Mississippi, 1989.[1]

Industry Name	Area of timberland
	(acres)
Georgia-Pacific Corporation	940,000
International Paper Company	902,000
Weyerhauser Company	402,000
Cavenham Forest Industries Inc.	289,000
Scott Paper Company	195,000
Packaging Corporation of America	134,000

[1] Based on an informal survey of forestry managers conducted by the authors. Actual figures may vary at any point in time based on each firm's timberland acquisition and disposal activities. Georgia-Pacific's timberland area includes that acquired from Leaf River Forest Products in 1990.



The Newsprint South, Inc. mill, located in Grenada, Mississippi, opened in September 1989. The mill, which employs 220 people, produces high quality newsprint from southern pine timber grown in northeastern Mississippi.

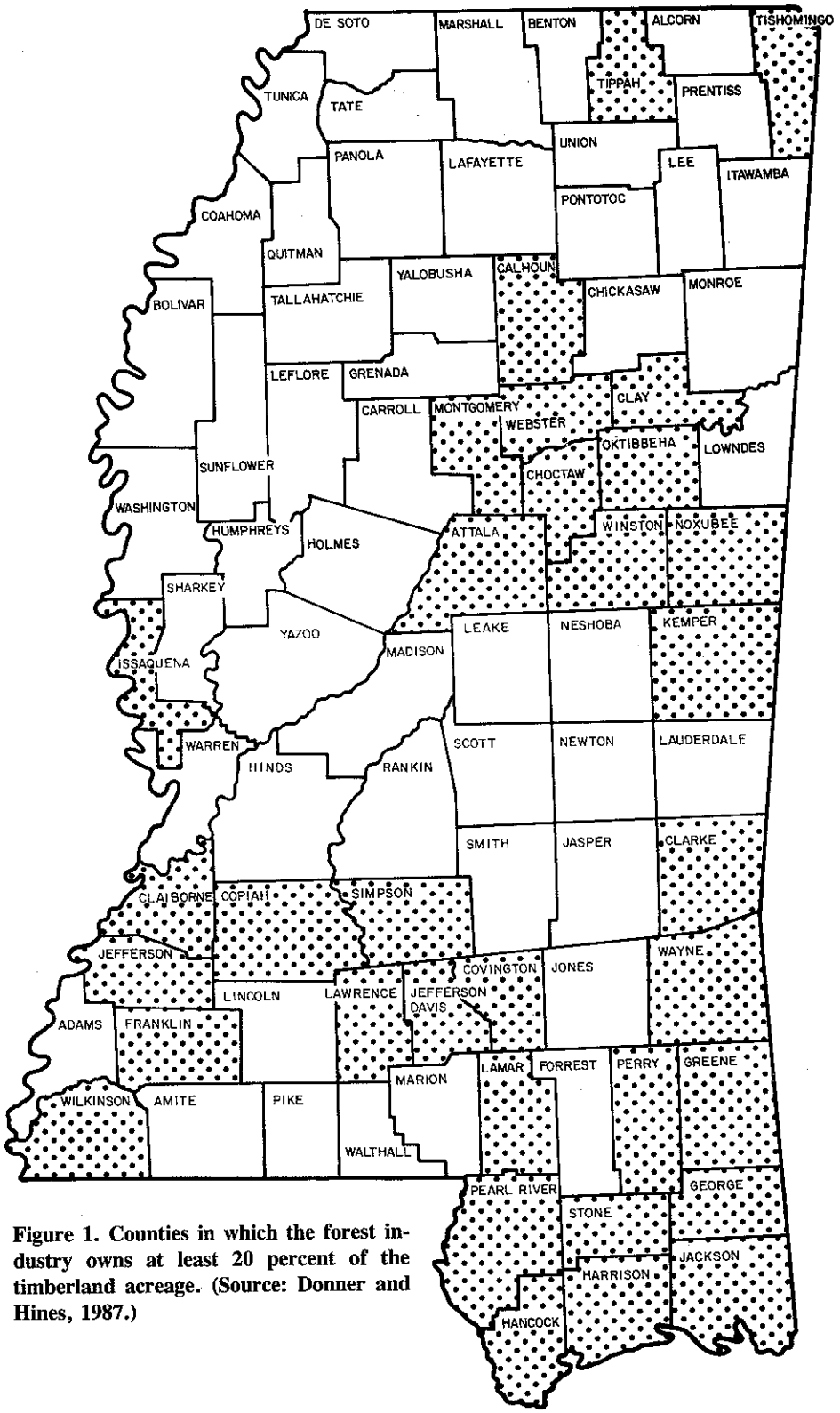


Figure 1. Counties in which the forest industry owns at least 20 percent of the timberland acreage. (Source: Donner and Hines, 1987.)

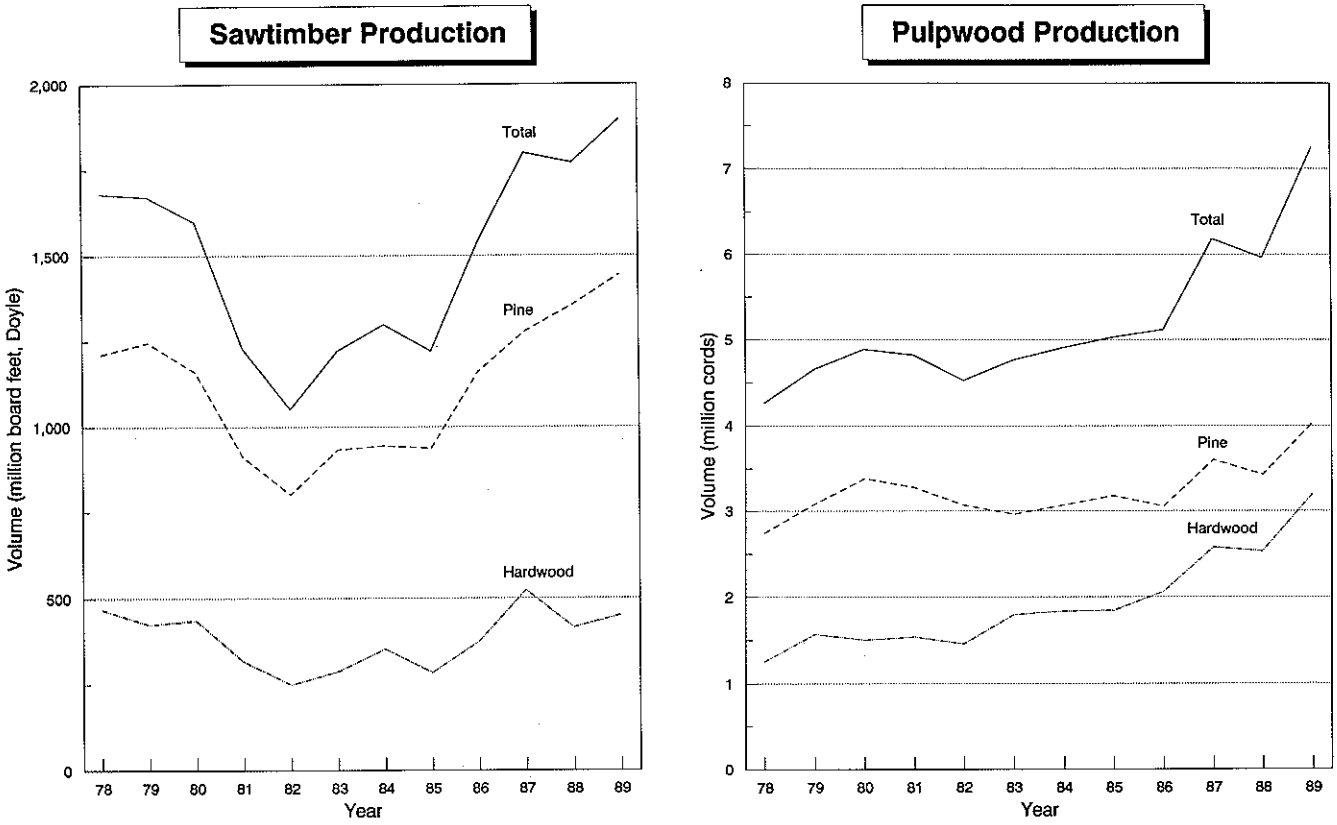


Figure 2. Forest production in Mississippi by product class and species group, 1978-1989. (Source: Mississippi Cooperative Extension Service—Annual.)

duction was 7 percent more than it was in 1988, with pine sawtimber comprising 76 percent of all sawtimber production.

Combined production of pine and hardwood pulpwood harvested from the state's forests for the manufacture of wood pulp, chip-n-saw, and other uses increased from 4.5 million cords in 1982 to more than 7.2 million cords in 1989 (Figure 2). Between 1988 and 1989, total pulpwood production increased almost 1.3 million cords—22 percent—as both pine and hardwood production increased.

The hardwood component of total pulpwood production increased from 31 percent in 1980 to 44 percent in 1989. New technological processes now allow hardwood usage in panel products such as oriented strand board. These products are consumed, in some instances, as substitutes for softwood plywood. Technological and product line changes in the pulp and paper industry have also increased hardwood usage. Furthermore, emergence of foreign markets for hardwood chips has increased demand for hardwood pulpwood. For these reasons, Mississippi's hardwood resource will become an increasingly important source of fiber.

Pulpwood Production and Consumption

Pulpwood production, in the form of roundwood and wood chips harvested from Mississippi's forests, and wood chips from wood-using industry residues, are consumed by pulp mills located in Mississippi and surrounding states for the manufacture of wood pulp. Pulpwood production data are reported annually (USDA Forest Service — Annual) as are data for Mississippi's consumption of pulpwood for wood pulp and energy (American Pulpwood Association — Annual).

The American Pulpwood Association (APA) uses the term *"wood fiber"* to describe pulpwood in its reports. In this report, the term *"pulpwood"* is used to be consistent with other data sources. APA data consolidate pulpwood consumed domestically for the manufacture of wood pulp and energy, however, energy components of pulpwood consumption are not available each year because of disclosure restrictions. Nevertheless, 618,000 cords of pulpwood were consumed for energy in Mississippi during 1988. Differences between Mississippi's pulpwood production and consumption, using USDA Forest Service and APA data, are therefore a close proxy in the determination of whether Mississippi is a net exporter or importer of pulpwood destined for domestic wood pulp production.

It is apparent from Figure 3 that Mississippi is a net exporter of pulpwood. From 1977 to 1988, annual production and consumption of pulpwood have fluctuated, but annual differences have varied around the 2 million cord level. Moreover, differences between pulpwood production and consumption for the manufacture of wood pulp are actually greater than indicated in Figure 3 since energy components

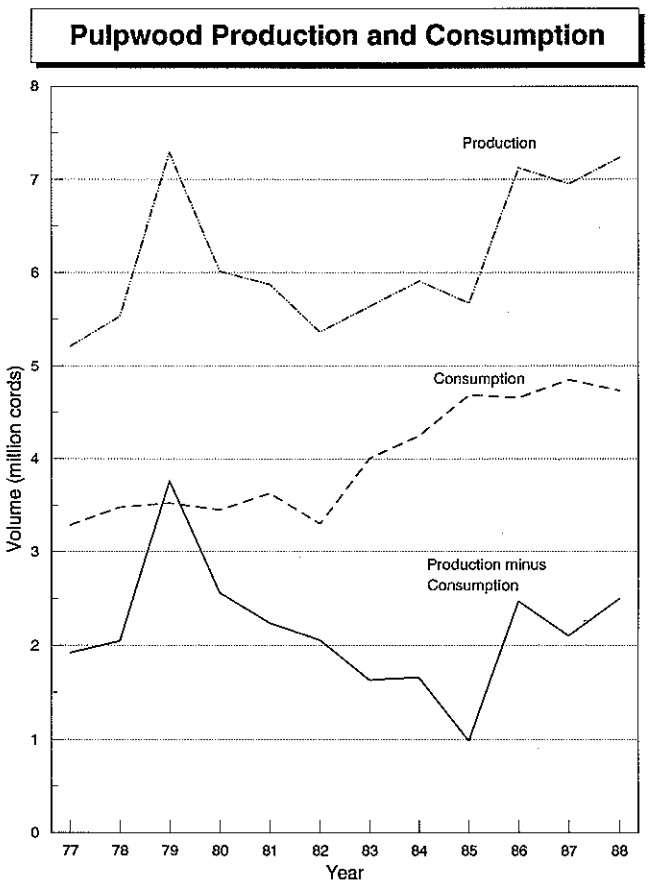


Figure 3. Mississippi pulpwood production and consumption, 1977-1988. (Sources: USDA Forest Service—Annual; American Pulpwood Association—Annual.)

of consumption cannot consistently be separated from totals. Additionally, pulpwood production data do not include roundwood and wood chips harvested from Mississippi's forests and exported to foreign markets.

In 1988, 7.2 million cords of pulpwood were produced and 4.7 million cords of pulpwood were consumed in Mississippi. Of the 4.7 million cords consumed, 618,000 were for the manufacture of energy. Thus, 4.1 million cords of pulpwood were consumed in the state for the manufacture of wood pulp during 1988. Therefore, approximately 3.1 million cords of pulpwood were apparently exported to Mississippi's domestic neighbors for the manufacture of wood pulp in 1988.

Mississippi's annual pulpwood consumption was relatively constant from 1977 to 1982. However, it increased from 1982 to 1988. Although Mississippi's annual consumption has been increasing, the 2 million cord differential between production and consumption is still being maintained. New pulp mill construction and expansions will continue to increase wood pulping capacity within the state, resulting in increased pulpwood production and consumption.

Value of Agricultural Crops and Forest Products

The $717 million value of forestry harvests in 1989 is the largest ever recorded in the state and exceeds that of any single agricultural crop (Figure 4). Almost every forestry product harvested in Mississippi increased in value from 1988 to 1989. Furthermore, of the $717 million of total value, landowners received $410 million as payments for stumpage, or 57 percent of the value of forestry products harvested. The remaining 43 percent represented the value of harvesting and transporting material to the point of first delivery.

The value of forest products at first delivery point underestimates the impact of forestry on Mississippi's economy. Indeed, forest-based manufacturing facilities are attracted to the state because sawlogs and pulpwood are relatively heavy and, thereby, costly to transport. These manufacturing facilities further increase the impact of forestry through additional employment and wages. Conversely, commodities such as cotton and soybeans are predominately exported from the state for processing, thus effectively reducing their additional value to Mississippi.

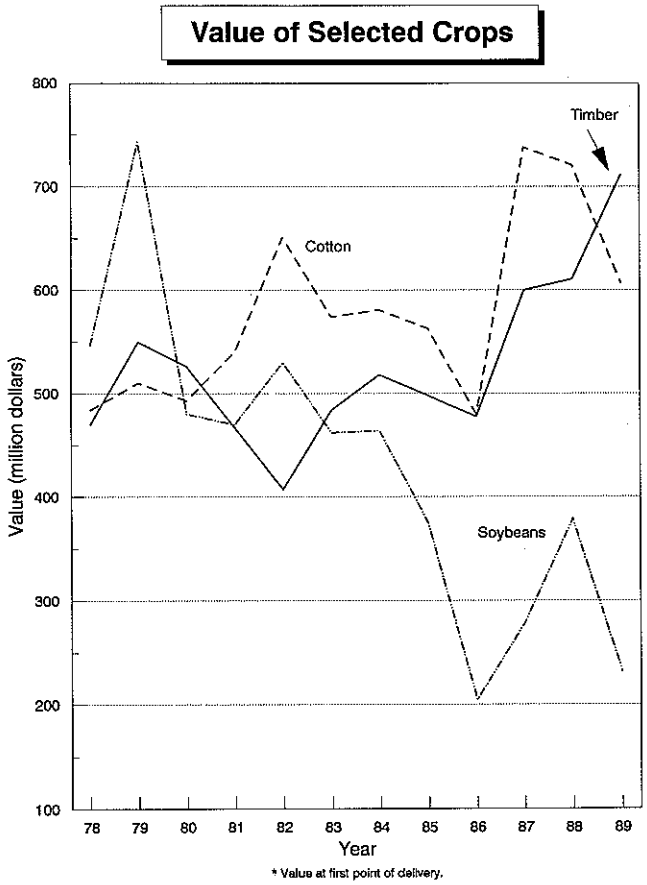


Figure 4. Value of selected crop in Mississippi, 1978-1989. (Sources: Mississippi Cooperative Extension Service—Annual; Mississippi Cooperative Extension Service, 1990.)

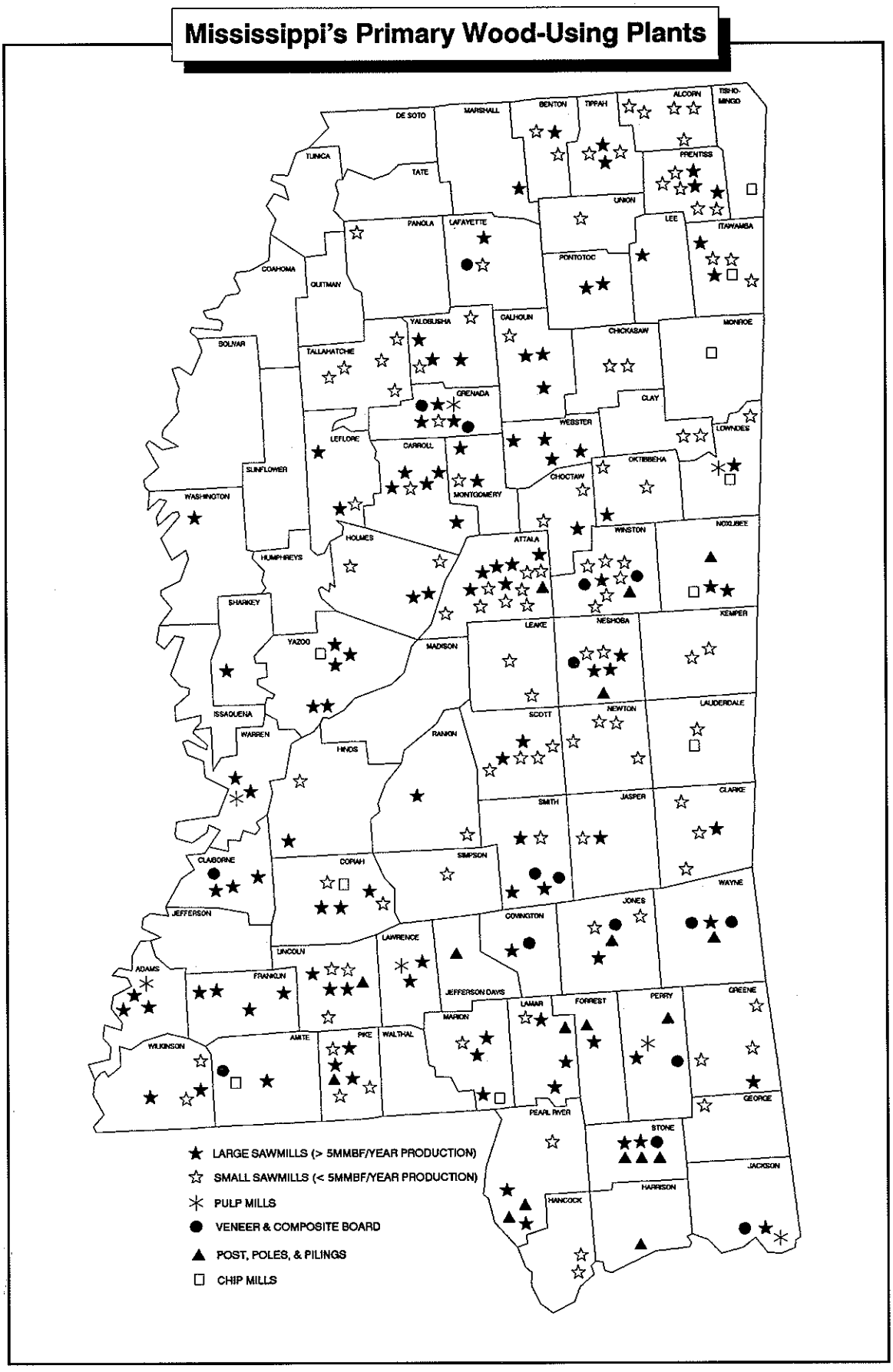


Figure 5. Primary wood-using plants in Mississippi. (Source: Mississippi Forestry Commission, 1990.)

Manufacturing Industries

Utilization of raw materials produced from Mississippi's vast forest resource base is an important component of the state's economy. The forest products industry in Mississippi consists of both primary and secondary manufacturing. Primary manufacturing industries are well distributed throughout Mississippi and encompass those involved in cutting, transporting, and processing raw wood (Figure 5). These industries include logging contractors; sawmills; planing mills; plywood mills; structural panel facilities including veneer, particleboard, waferboard, and oriented strand board mills; pulp mills; chip mills; and posts, poles, and pilings industries.

Secondary manufacturing industries include those involved in the remanufacture of lumber, plywood, veneer, pulp, paper, and other wood products into semi-finished or finished products. Secondary industries in Mississippi include the furniture and fixtures industries, paper mills, millwork producers, wood preserving plants, pallet mills, hardwood dimension and flooring plants, and other lumber and wood product conversion facilities. (For additional information on Mississippi's furniture industry see: Steven H. Bullard, Brian A. Doherty, and Paul H. Short, 1988, *The Mississippi Furniture Industry and Its Use of Wood-Based Materials,* Research Report 13, Mississippi Forest Products Utilization Laboratory, Mississippi State, MS, 20 p.)

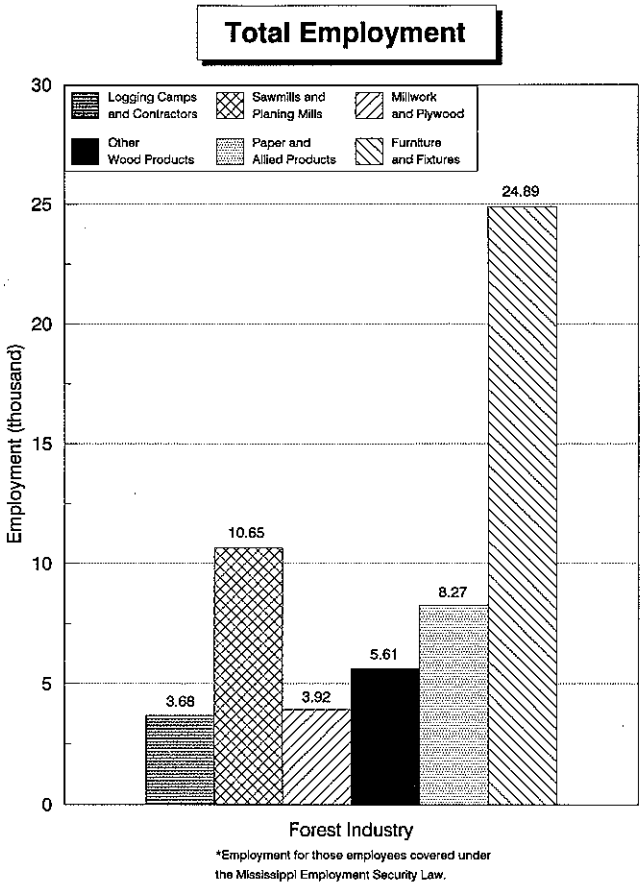


Figure 6a. Total employment by forest industry, Mississippi, 1988. (Source: Mississippi Employment Security Commission, 1989.)

Employment and Earnings

In 1988, approximately 57,000 Mississippians were employed by forest manufacturing industries (Figure 6a). Almost one in every four manufacturing jobs in the state is attributed to the forest industry. Within the industry, the furniture and fixtures sector accounts for 44 percent of total employment. Sawmills and planing mills, and paper and allied products account for 19 and 14 percent of the industry's employment, respectively. The remaining 23 percent of employment is in the logging contractors, millwork and plywood, and other wood product sectors of the industry.

In 1988, forest industry provided over $1 billion in wages for its employees (Figure 6b). Wages earned by forest industry employees accounted for almost 24 percent of all wages earned by all manufacturing employees in the state. Paper and allied products' employees received 23 percent of the total annual wages paid to all forest industry employees, although they represent only 14 percent of all forest industry employees. Furniture and fixtures, and sawmills and planing mills industry employees received 39 and 17 percent of total annual wages, respectively. The remaining 21 percent of total annual wages were paid to remaining forest industry employees.

Forest industry employees earned an average annual wage of $18,208 in 1988, compared to $18,341 for all manufacturing employees (Figure 6b). Paperworkers' annual average wage of $29,402 was 161 percent of the forest industry average and was the highest of all forest industries. Sawmills and planing mills, and furniture and fixtures employees' annual average wages were 91 and 89 percent of the forest industry average, respectively.

Value Added and Value of Shipments

Value added by manufacturing is the difference between the value of shipments and the cost of materials, parts, and services purchased in production. Value added represents the income available for workers and business owners. It is considered the best measure available for comparing the relative importance of manufacturing among industries (USDC Bureau of the Census, 1988).

In 1986, value added amounted to $1.8 billion for forest industries in Mississippi (Table 2). This figure represents 21 percent of the value added by all Mississippi manufacturing industries. Of the industry's total value added, lumber and wood products provided 37 percent, paper and allied products 34 percent, and furniture and fixtures 29 percent.

Value added, expressed as a percentage of value of shipments is an indication of the general performance of an industry because it represents the ability of an industry to

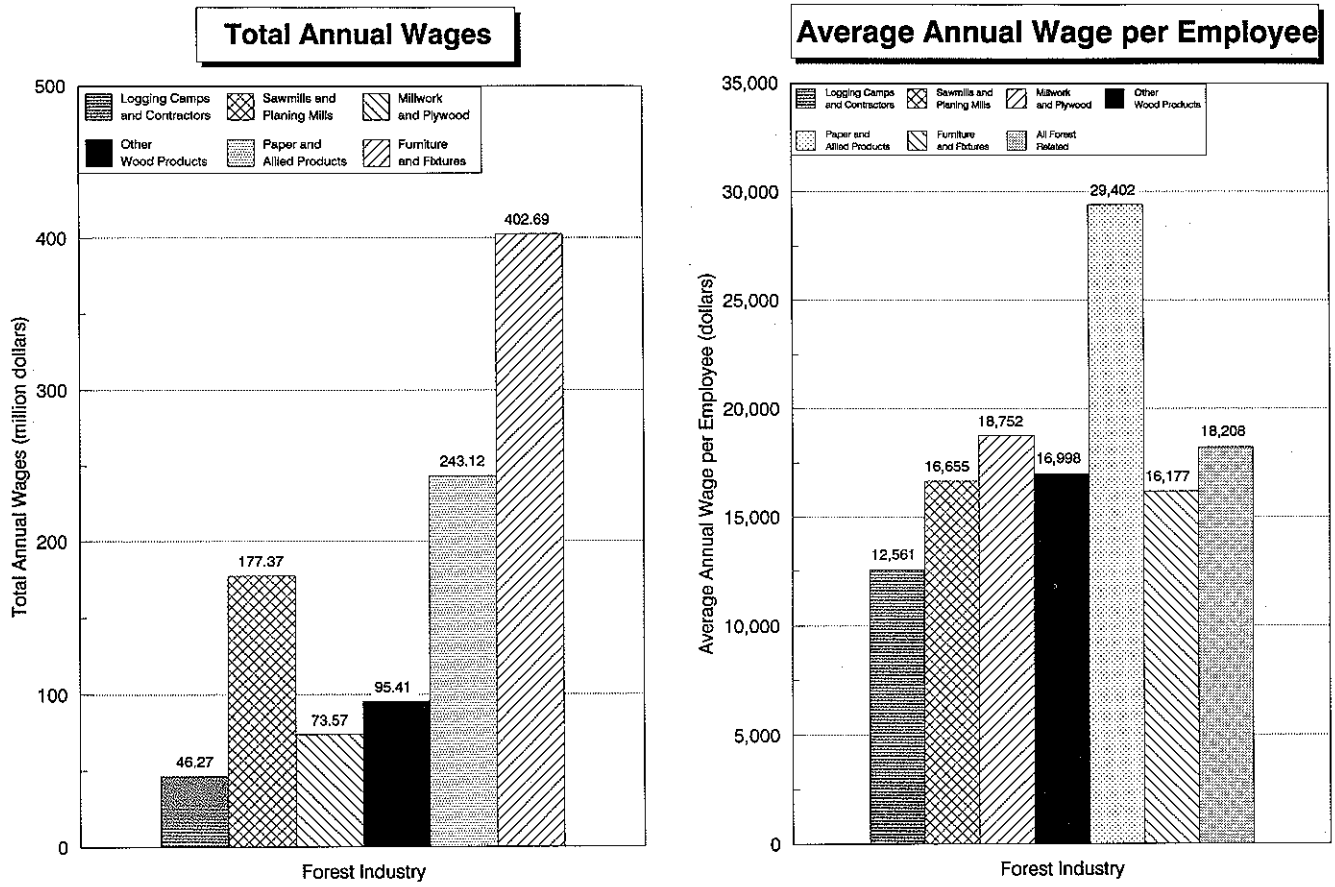
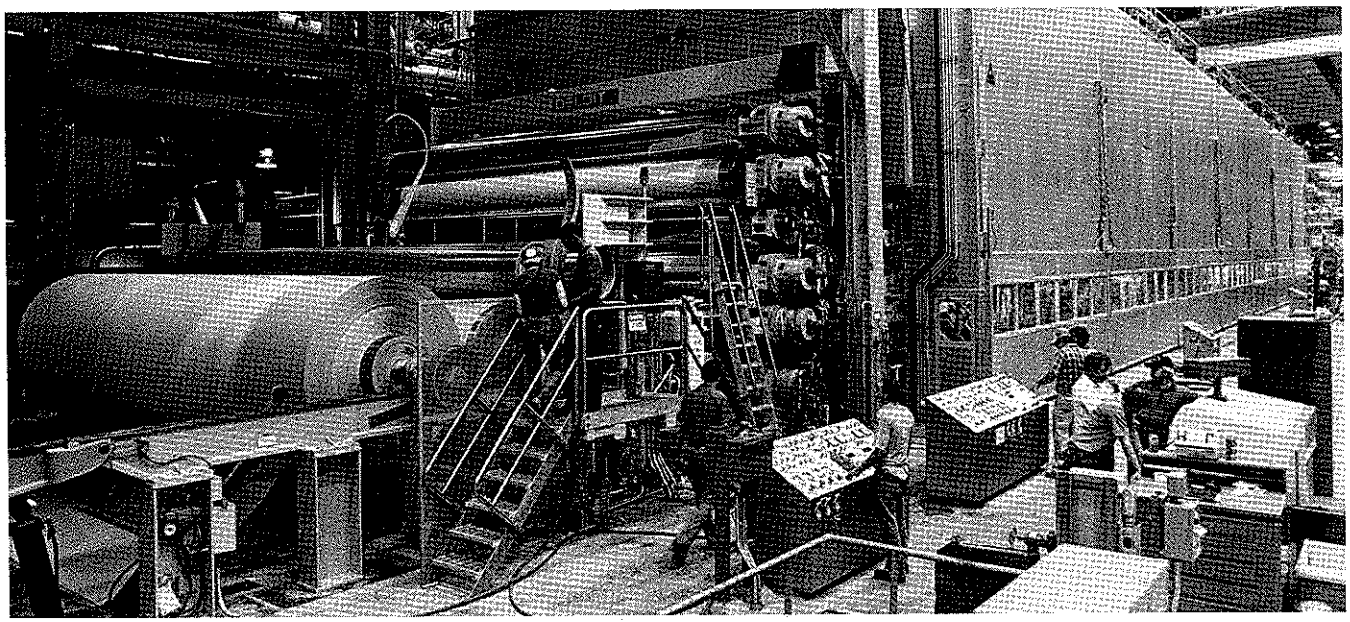


Figure 6b. Total annual wages and average annual wage per employee by forest industry, Mississippi, 1988. (Source: Mississippi Employment Security Commission, 1989.)



Production at the Weyerhauser Paper Company's Columbus, Mississippi lightweight coated papermill contributed to the $1.8 billion in value added by manufacturing for the state's forest industry in 1986. With the opening of the new kraft pulp mill in May 1990, employment at the Weyerhauser complex has grown to 700.

Table 2. Value added, value of shipments, and value added as a percentage of shipments for forest-based industries, Mississippi, 1986.[1]

Industry	SIC code	Value added	Value of shipment	Value added as % of shipment
		($ million)		(percent)
Lumber and Wood Products	24	681.7	1,810.6	37.7
Furniture and Fixtures	25	536.6	1,181.8	45.4
Paper and Allied Products	26	623.3	1,427.5	43.7
All Forest Related Manufacturing		1,841.6	4,419.9	41.7
All Manufacturing		8,973.5	21,719.1	41.3

[1] Source: USDC Bureau of the Census, 1988.

pay wages and profits. Value added as a percentage of value of shipments ranged from 37.7 to 45.4 percent for sectors of the forest industry and averages 41.7 percent (Table 2). All Mississippi manufacturing averaged 41.3 percent.

Forest Products Exports

Exports of forest products are an important component of Mississippi's forest economy. The Mississippi River system and the Tennessee-Tombigbee Waterway facilitate the movement of Mississippi's forest products to deep-water ports in New Orleans and Mobile. Forest products are also exported through Mississippi's ports at Pascagoula and Gulfport.

Wood pulp is the major forest product exported from Pascagoula, while linerboard is the major forest product exported from Gulfport. Wood pulp, lumber, and veneer dominate forest product exports from Mobile. Wood pulp, paper, paperboard, and lumber are the major forest products exported from New Orleans. Additionally, hardwood chips from northeast Mississippi, transported down the Tennessee-Tombigbee Waterway for export from Mobile, have increased substantially within the last 2 years.

In 1986, $565 million worth of forest products, or almost 13 percent of the total value of forest product shipments, were exported (Table 3). The value of forest product exports almost doubled between 1983 and 1986. Paper and allied products accounted for 70 percent of all exports of Mississippi's forest industry in 1986. Furthermore, almost 28 percent of all paper and allied products shipments were exported in 1986.

In 1983, 2,600 Mississippi forest industry employees were involved in the manufacturing of forest product exports (Table 3). By 1986, this figure had increased to 3,300 and represented 7.6 percent of forest industry manufacturing employment. During the same period, export-related employment in the lumber and wood products sector remained at around 1,300, while employment in the paper and allied products sector rose from 900 to 1,600. In 1986, export-related employment in the paper and allied product sector represented 21 percent of its total work force.

Table 3. Shipments and employment related to forest industry exports, Mississippi, 1983-1986.[1]

Forest industry	SIC code	Year	Shipments		Employment	
			Export related	Export as percent of total	Export related	Export as percent of total
			($ mil.)	(%)	(thousand)	(%)
Lumber and Wood Products	24	1983	112.2	6.9	1.4	6.6
		1984	113.1	6.4	1.2	5.6
		1985	114.6	6.7	1.2	5.8
		1986	142.9	7.9	1.4	6.8
Furniture and Fixtures	25	1983	16.8	1.9	0.3	2.1
		1984	18.4	1.9	0.3	2.0
		1985	21.0	2.0	0.2	1.2
		1986	26.5	2.2	0.3	1.8
Paper and Allied Products	26	1983	177.5	17.3	0.9	13.6
		1984	216.3	16.9	1.1	15.1
		1985	267.0	20.5	1.5	19.0
		1986	395.6	27.7	1.6	21.0
All Forest Industry		1983	306.5	8.7	2.6	6.1
		1984	347.8	8.6	2.6	5.9
		1985	402.6	9.9	2.9	6.4
		1986	565.0	12.8	3.3	7.6

[1] Sources: USDC Bureau of the Census, 1987; and USDC Bureau of the Census, 1989.

Mississippi's Pulp and Paper Industry

A common perception is that historically, much of Mississippi's pulpwood has been exported to neighboring states for conversion to wood pulp and subsequent conversion to paper products. Through the years, several forest products firms have located pulp mills in adjacent states close to Mississippi's borders. These mills have drawn pulpwood from Mississippi for the manufacture of wood pulp and paper products. Consequently, Mississippi's neighbors have reaped economic benefits associated with additional output, income, and employment generated in their economy.

In 1988, Mississippi's total pulpwood production (roundwood and wood chips harvested from the state's forests, and wood chips from mill residues, less energy chips) exceeded consumption by 3.1 million cords. This excess, 43 percent of the state's total production, represents the net amount of pulpwood exported to neighboring states for the manufacture of wood pulp and further paper processing. Furthermore, the 3.1 million cords of exported pulpwood are equivalent to 76 percent of Mississippi's pulpwood consumption for the manufacture of wood pulp.

If some out-of-state pulp mills had been located in Mississippi, additional output, income, and employment in the pulp and paper industry and their related secondary industries would have resulted. Assuming that effects on output, income, and employment in the paper and allied industry sector of the state's economy would be directly proportional to increased pulpwood consumption, the foregone opportunities on Mississippi's total economy can be evaluated using Type II output, income, and employment multipliers.

If indeed Mississippi had captured 3.1 million cords of exported pulpwood in 1988, total annual output from Mississippi's economy would have increased by $2.1 billion, while annual incomes would have increased by $361 million, and annual employment would have increased by 16,346 (Table 4). Furthermore, the $361 million of additional personal income would have generated sufficient economic activity to result in an additional $43.4 million of state government revenues in 1988. (State government revenue generated is based on analysis provided by Dr. Daniel K. Lee, Director, Department of Economics, Mississippi Institutions of Higher Learning, Jackson, Mississippi.).

Table 4. Effects on Mississippi's economy of capturing excess pulpwood production.

	Year of data	Units	Paper and allied products		Type II multiplier	Total increases in Mississippi's economy[1]
			Actual	Potential		
Output	1986	($ mil.)	1,427.5	2,508.6	1.98	2,140.6
Income	1988	($ mil.)	243.1	427.2	1.96	360.8
Employment	1988	(No.)	8,269	14,532	2.61	16,346

[1] Values were derived by taking the differences between potential and actual output, income, and employment values and multiplying the differences by the appropriate Type II multiplier.

Forestry and the Mississippi Economy

When growth occurs in one of Mississippi's industries, many other industries are affected. For example, when consumers purchase more wood furniture, the furniture industry must purchase more lumber, adhesives, and other materials used in furniture production. These purchases are termed *direct effects* of the increased consumption. All industries that support the wood furniture industry must then produce more, and must increase purchases from their suppliers. For example, sawmills must purchase more logs to produce more lumber. These purchases are termed *indirect effects* of the consumption. This process continues throughout the economy to the point where many industries have increased production as the result of consumers' furniture purchases. Increased production implies more income and employment for the region's total economy. The effects of expansion or contraction of an individual industry on an economy can be evaluated by the use of an input-output model.

Economic Multipliers

Output, income, and employment multipliers derived from input-output models are used to estimate effects of changes in output, income, and employment. An industry's multipliers are directly related to the proportion of its purchases that are made within the state. The more an industry purchases from in-state suppliers, the larger will be its multipliers (Flick and Teeter, 1988). Type I and Type II multipliers are computed from input-output models. Type I multipliers reflect only the direct effects of changes in economic activity. Type II multipliers reflect direct, indirect, and induced effects of a change in economic activity. Induced effects result from additional household income leading to increased consumer spending in the economy.

Table 5 provides Type I and Type II multipliers for various industries in Mississippi's economy. Table 5 was adapted from a 92-industry input-output model developed by Lee (1986). Although it is the most current model available, it is admittedly dated since it is based on Mississippi's 1977 economy. Therefore, interpretation of results should be viewed with caution. A new input-output model for the state's economy is currently under construction and when completed, can be used to corroborate the conclusions presented here.

The discussion that follows is limited to Type II multipliers because they more fully reflect impacts of changing economic

Table 5. Output, income, and employment multipliers, Mississippi, 1977.[1]

Sector	Type I				Type II		
	Output	Income	Employment		Output	Income	Employment
1 Livestock	1.70	1.49	1.43		2.61	1.88	1.78
2 Other agriculture	1.55	1.32	1.21		2.45	1.67	1.57
3 Mining	1.27	1.37	1.53		1.59	1.71	2.14
4 Construction	1.62	1.42	1.38		2.23	1.78	1.79
5 Food and kindred	1.76	2.90	2.95		2.75	3.65	3.75
6 Textiles	1.37	1.46	1.51		1.75	1.84	2.00
7 Apparel	1.46	1.33	1.26		2.10	1.67	1.54
8 Logging camps	1.43	2.19	2.49		1.86	2.75	3.21
9 Sawmills	1.55	1.49	1.46		2.10	1.87	1.88
10 Millwork and plywood	1.78	1.83	2.04		2.35	2.31	2.73
11 Other wood products	1.44	1.46	1.43		1.89	1.84	1.83
12 Furniture and fixtures	1.57	1.37	1.37		2.27	1.73	1.79
13 Paper and allied	1.53	1.57	1.84		1.98	1.96	2.61
14 Chemical and allied	1.38	1.66	1.84		1.59	2.07	2.57
15 Rubber and plastics	1.34	1.33	1.32		1.67	1.68	1.77
16 Primary metals	1.47	1.86	1.87		1.73	2.34	2.50
17 Fabricated metals	1.41	1.51	1.60		1.78	1.90	2.15
18 Machinery and electric	1.38	1.34	1.38		1.68	1.67	1.79
19 Transportation equipment	1.41	1.24	1.30		2.10	1.56	1.82
20 Miscellaneous manufacturing	1.50	1.73	1.94		1.84	1.96	2.61
21 Wholesale and retail	1.35	1.25	1.21		2.25	1.58	1.52
22 Services	1.46	1.33	1.28		2.40	1.65	1.61
23 Finance, insurance, and real estate	1.40	1.36	1.39		2.35	1.71	1.85
24 Transportation	1.48	1.32	1.35		2.34	1.66	1.84
25 Communications and utilities	1.41	1.45	1.54		1.99	1.83	2.17
Forest industries average	1.53	1.58	1.68		2.06	1.98	2.23
Other manufacturing average	1.48	1.73	1.82		1.95	2.12	2.41
All economy average	1.48	1.56	1.62		2.08	1.94	2.13

MANUFACTURING; Forest Industry (Type I: 8 Logging camps, 9 Sawmills, 10 Millwork and plywood, 11 Other wood products, 12 Furniture and fixtures, 13 Paper and allied; Type II: 8 Logging camps, 9 Sawmills, 10 Millwork and plywood, 11 Other wood products, 12 Furniture and fixtures, 13 Paper and allied)

[1] Source: Adapted from Lee, 1986.

activity. Output multipliers relate demand to output. For example, if demand for paper increases by $1.00, the output for the economy will increase by more than $1.00. Mississippi's paper and allied industry has a Type II output multiplier of 1.98 (Table 5). Thus, a $1.00 increase in output for Mississippi's paper industry will stimulate an additional $0.98 of production and sales in other industries.

Income multipliers show changes in household income that occur throughout the economy per unit income change in any industry. Mississippi's paper and allied industries have a Type II income multiplier of 1.96 (Table 5). This indicates that a $0.96 increase in household income will occur in the total state economy when paper industry incomes increase by $1.00.

Employment multipliers indicate changes in employment in the economy per unit employment change in a specific industry. For example, Mississippi's paper and allied industries have a Type II employment multiplier of 2.61 (Table 5). This indicates that 1.61 jobs will be created in other industries of the economy for each job created in the paper industry.

Combined Weighted Type II Multiplier

Type II multipliers for manufacturing industries were weighted and combined to provide a composite multiplier in order to evaluate an industry's relative importance to the state's economy. Weighting was based on each manufacturing industry's relative contribution to output, income, and employment in Mississippi's economy. Weights were then applied to each Type II multiplier. The three weighted Type II multipliers for each manufacturing industry were then summed to provide a combined weighted Type II multiplier.

Combined weighted Type II multipliers ranged from .07 for the textile industry to 1.41 for the forest industry (Table 6). Forest industry's combined weighted Type II multiplier of 1.41 placed it first in importance of all manufacturing industries in Mississippi.

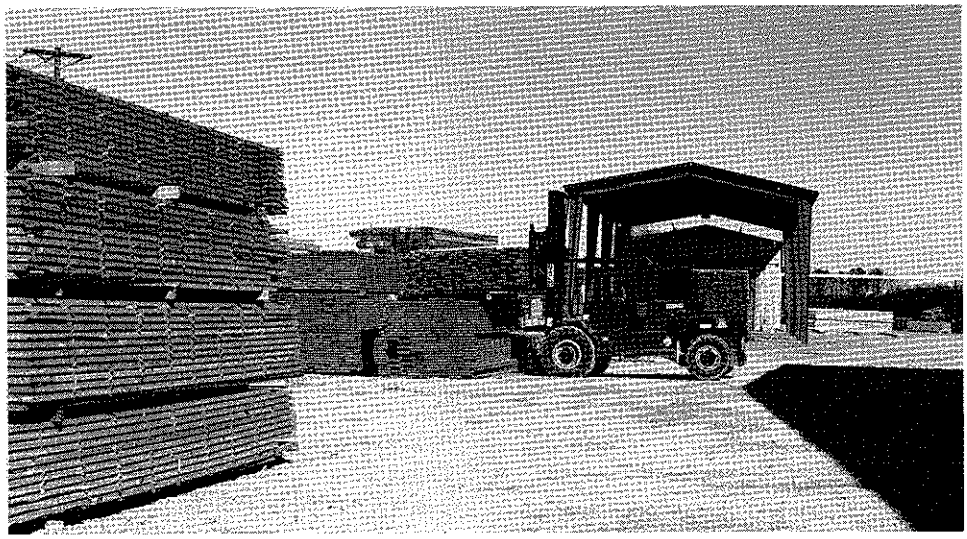
In summary, the economic multipliers for Mississippi's forest industry indicate a strong relationship to the state's economy. This strength of this relationship is based on forest industry's close ties to other industries and to Mississippi's substantial forest resource base.

Table 6. Ranking of combined weighted output, income, and employment Type II multipliers for manufacturing industries, Mississippi.[1]

Industry	Combined Weighted Multiplier[2]
Forest industries	1.41
Food and kindred	1.29
Machinery and electric	0.81
Apparel	0.68
Transportation equipment	0.61
Miscellaneous manufacturing	0.47
Fabricated metals	0.33
Chemical and allied	0.33
Rubber and plastics	0.21
Primary metals	0.15
Textiles	0.07

[1] Sources: Data derived from Lee, 1986; Mississippi Employment Security Commission, 1988; USDC Bureau of the Census, 1985; and USDL Bureau of Labor Statistics, 1988.

[2] Each industry Type II multiplier (output, income, and employment) was weighted by the industry's relative contribution to total value of shipments (1982), income (1987), and employment (1987) for each manufacturing industry. All weighted multipliers for each manufacturing industry were summed to yield a combined weighted multiplier for each industry.



Barge Forest Products Company's new sawmill in Macon, MS, began operation in September 1990, adding 59 people to Mississippi's forest industry payroll. As a result of the new sawmill, an additional 52 jobs were created in the state's economy, according to Type II employment multipliers for sawmills.

Mississippi's Forest Resources

The land area within Mississippi's current state boundaries was heavily timbered when settlers first arrived. Portions of the Black Prairie in northeastern Mississippi and the Jackson Prairie in east-central Mississippi were the only significant nonforested lands. The cotton boom, which started around 1800, greatly increased the rate of settlement and land clearing. By 1860, more than 5 million acres of forest land had been cleared for cultivation and pasture (James, 1951). Clearing of forest land for agricultural uses continued into the 1900's as the state's population and settlement continued to expand. In recent history, Mississippi's total forest land area has remained fairly stable. Considerable changes have occurred within specific regions of the state, however.

Much of the information on Mississippi's forest resources comes from periodic forest surveys conducted at 10-year intervals by the USDA Forest Service. This information is classified by geographic units called "forest survey regions".[2] Figure 7 outlines the forest survey regions of Mississippi. (For additional information concerning Mississippi's forest resources see J. F. Kelly and Mike Sims, 1989, *Forest Resources of Mississippi,* Resource Bulletin SO-147, USDA Forest Service, New Orleans, LA 63 p.)

Pine and oak-pine plantations account for 2.3 million acres of Mississippi's timberlands; almost two-thirds of the plantations are less than 20 years old.

Timberland Area

Since 1957, commercial timberland acreage has remained relatively stable at 55 to 57 percent of Mississippi's total land area, although changes have occurred from region to region (Figure 8). By 1973, for example, timberland in the Delta region had decreased to 1,307,000 acres due to land clearing for soybeans in the 1960's and early 1970's (Porterfield et al., 1978). However, by 1977, an equivalent amount of land had been reclaimed by trees in the Delta region. Furthermore, the Conservation Reserve Program (CRP) of the Food and Security Act of 1985 has added acreage to the state's timberland base. Through 1989, 424,905 acres of Mississippi's highly erodible agricultural lands have been planted or established in trees (USDA Agricultural Stabilization and Conservation Service 1990).

Timberland Ownership

Mississippi's timberlands today are a vast resource covering 17 million acres—56 percent of the state's total area. Ownership of timberland is grouped into four forest land ownership classifications: (1) National Forests, (2) other public, (3) forest industry (including lands leased to forest industry), and (4) nonindustrial private forests (NIPF). Almost 70 percent of Mississippi's timberlands are in NIPF ownerships (owned by farmers,individuals, and small corporations). Another 20 percent are owned or leased by the forest industry. National Forests account for 7 percent of the state's timberland area, and the remaining 3 percent is in other public ownerships (Figure 9, page 17). Other public ownerships include miscellaneous federal, state, county, and municipal timberlands.

Forest Types

Timberlands in Mississippi can be classified into various forest types based on the most common or combination of tree species found in a stand of timber. Stands can be further classified by stand origination — natural or planted. Most

[2] Data presented in this section are from estimates based on periodic surveys, and therefore may be affected by estimating and sampling errors.

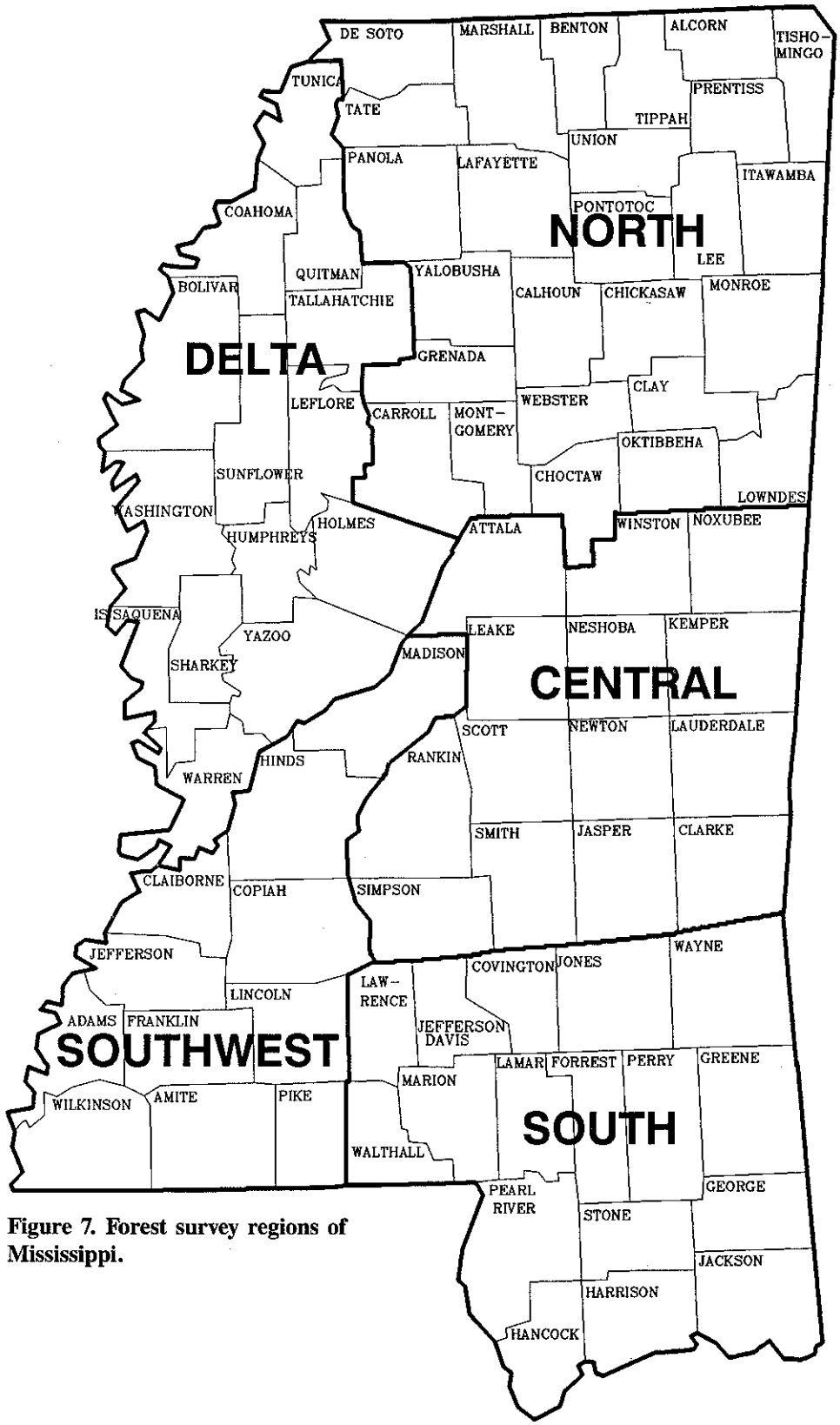


Figure 7. Forest survey regions of Mississippi.

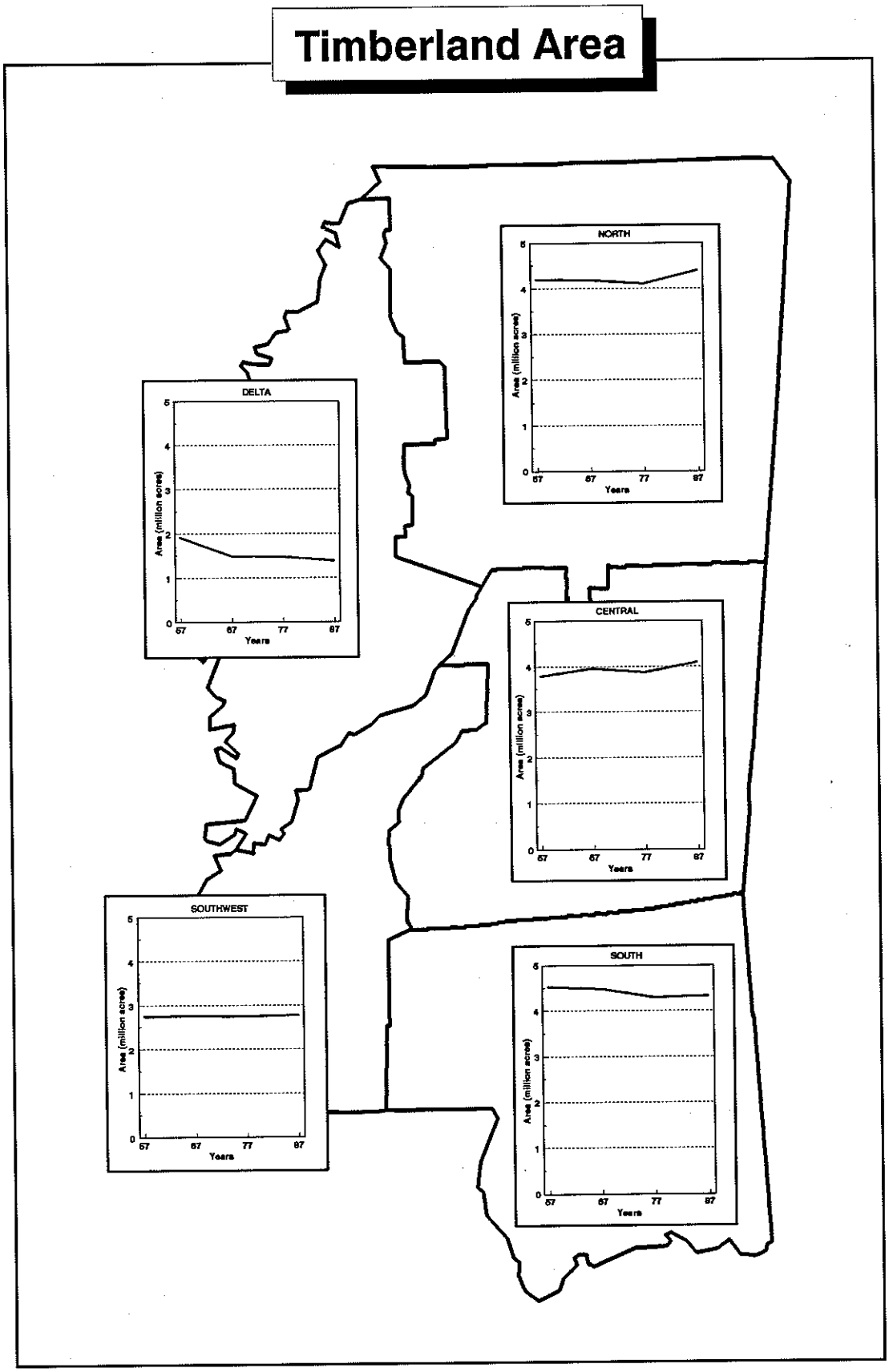


Figure 8. Timberland area by survey region in Mississippi for 1957, 1967, 1977, and 1987. (Source: Kelly and Sims, 1989.)

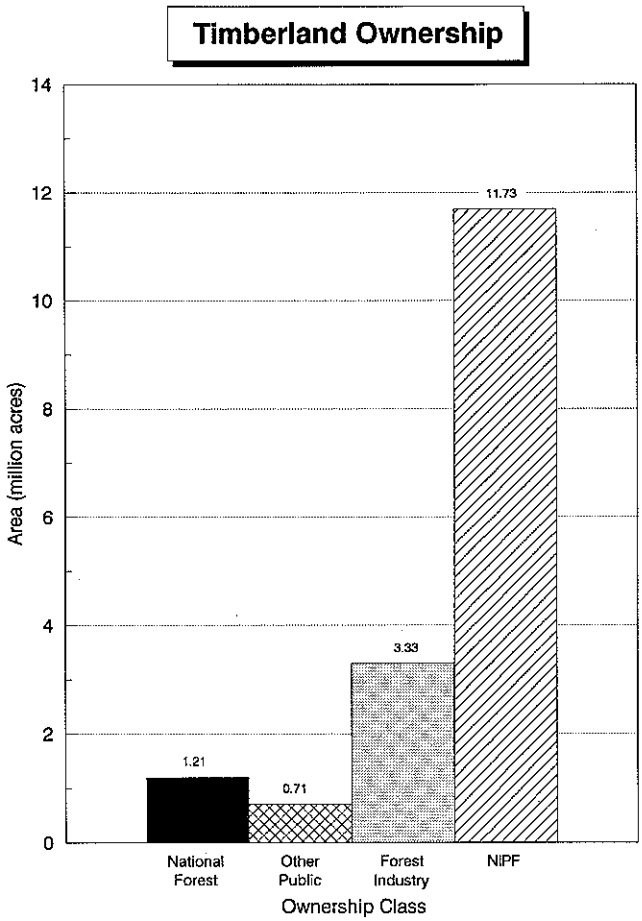


Figure 9. Mississippi's timberland area by ownership class, 1987. (Source: adapted from Donner and Hines, 1987.)

plantations in the state have been planted with pine, and thus are classed as pine or oak-pine forest types. Oak-pine plantations result from the system of classifying forest types. Many young plantations contain sufficient numbers of hardwood stems to be classified as oak-pine, however, many of these stands will evolve into pine type plantations as they mature.

Some forest types are more common on certain ownership classes (Figure 10). For example, forest industry owns or controls 29 percent of the state's pine forest type acreage, while accounting for only 20 percent of all timberland ownerships. NIPF ownership account for 69 percent of all timberlands, but only 57 percent of the pine forest type. Additionally, 79 percent of all oak-hickory forest type acreage is in NIPF ownership. National Forests control approximately 10 percent of the pine and oak-pine forest type acreage but account for only 7 percent of all timberland ownerships.

Plantations

Fifty-three percent of Mississippi's pine and oak-pine forest type plantations are in forest industry ownerships, and 39 percent are in NIPF ownerships; only 8 percent are in National Forests and other public ownerships. Furthermore, plantations account for approximately 50 percent of forest industry's pine and oak-pine forest type acreage, while plantations account for less than 20 percent of those forest types in NIPF ownerships.

Fifty-six percent of the pine and oak-pine plantations in forest industry ownerships are less than 10 years old (Figure 11). Additionally, only 3 percent of forest industry plantation acreage is 31 years or older. On NIPF ownerships, 43 percent of the pine and oak-pine plantations are aged 10 years or younger, and 19 percent of the plantations are over 30 years of age.

Manufacturing facilities, including sawmills, pulp mills, and plywood mills, which rely on **pine** raw materials, are a significant component of Mississippi's forest industry. Consequently, these industries manage their timberland holdings to produce pine forest types. Furthermore, forest industry timber management activities, such as pine plantation establishment, generally favor the perpetuation of pine forest types in order to provide future sources of raw materials.

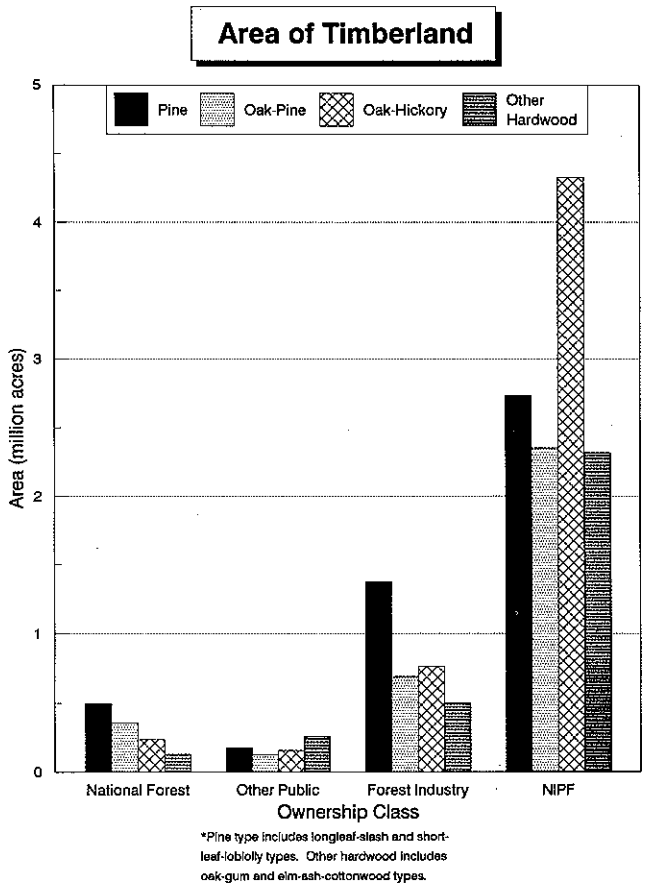


Figure 10. Mississippi's timberland area by ownership class and forest type, 1987. (Source: adapted from Donner and Hines, 1987; and USDA Forest Service, 1989.)

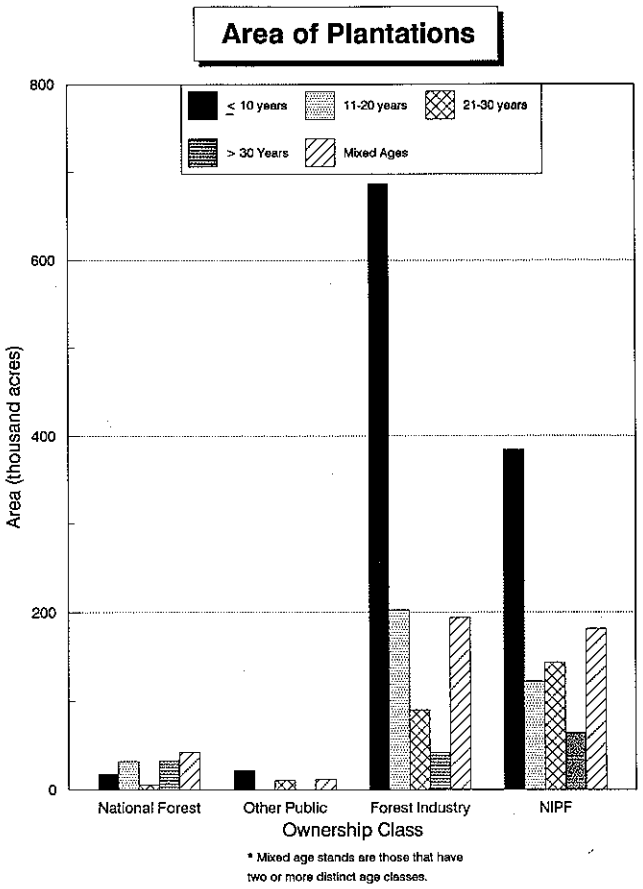


Figure 11. Mississipi's pine and oak-pine type plantation area by ownership class and age class, 1987. (Source: USDA Forest Service, 1989.)

Timberland Productivity

Productivity of timberland is an estimate of the natural capability of the land to grow crops of industrial wood based on fully-stocked natural stands. Productivity is measured in units of cubic feet of wood per acre per year.

The productive potential of fully-stocked natural stands on Mississippi's timberlands averages about 122 cubic feet of wood per acre per year — approximately 1.5 cords (Figure 12). Actual net growth however, is only 56 cubic feet of wood per acre per year, representing only 46 percent of potential net growth. However, Mississippi's average productive potential and actual net growth are comparable to those of neighboring states. With the exception of other public ownerships, actual net growth does not vary substantially between ownership classes (Figure 12).

Considerable proportions of forest industry ownerships are in young stands. This is especially true in pine and oak-pine plantations. As these young stands become established and as they mature, average productivity on forest industry lands should improve as trees grow into merchantable sizes.

Growing Stock Volumes

All live trees of commercial species, excluding rough and rotten cull trees, comprise the growing stock of Mississippi's timberland. Growing stock volume includes the sound wood portion of trees at least 5.0 inches diameter at breast height (d.b.h.) to a top diameter 4.0 inches outside bark (or where the main stem otherwise terminates).

The total volume of softwood growing stock more than doubled from 1957 to 1987 (Figure 13)[3]. However, the rate of increase of softwood growing stock volume has declined every 10 year period since 1957. Mississippi's total volume of hardwood growing stock almost doubled from 1957 to 1987. Furthermore, hardwood growing stock has demonstrated steady increases in volumes, although the rate of increase from 1977 to 1987 declined compared to the previous 10 year period.

Average volumes of softwood and hardwood growing stock are presented by ownership class and forest type in Figure

[3] Minor changes in survey procedures have occurred between 1957 and 1987 that may affect compatibility of data. These changes may limit very detailed analyses between survey intervals, however, general trends and comparisons can be made.

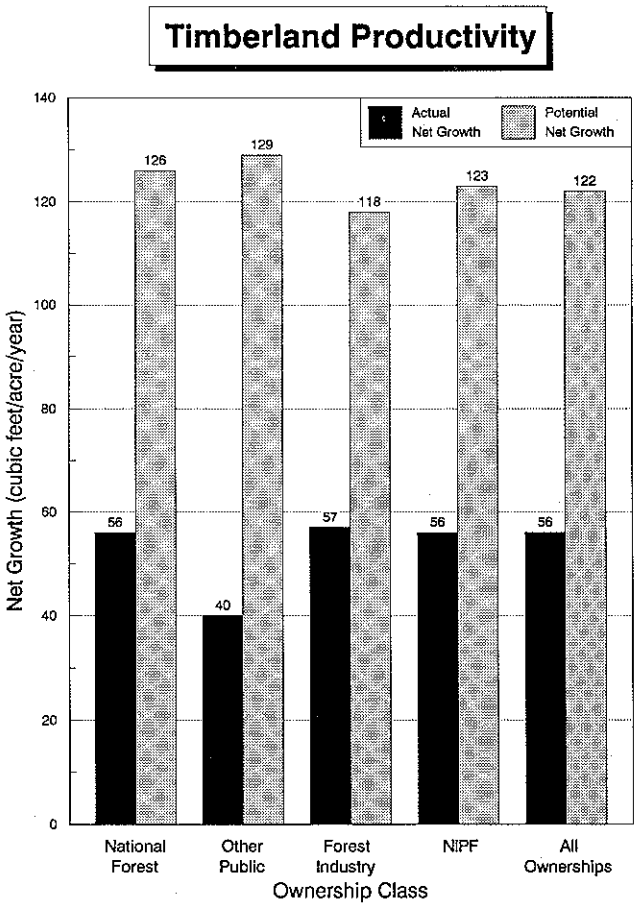


Figure 12. Productivity of Mississippi's timberland by ownership class, 1987. (Source: USDA Forest Service, 1989.)

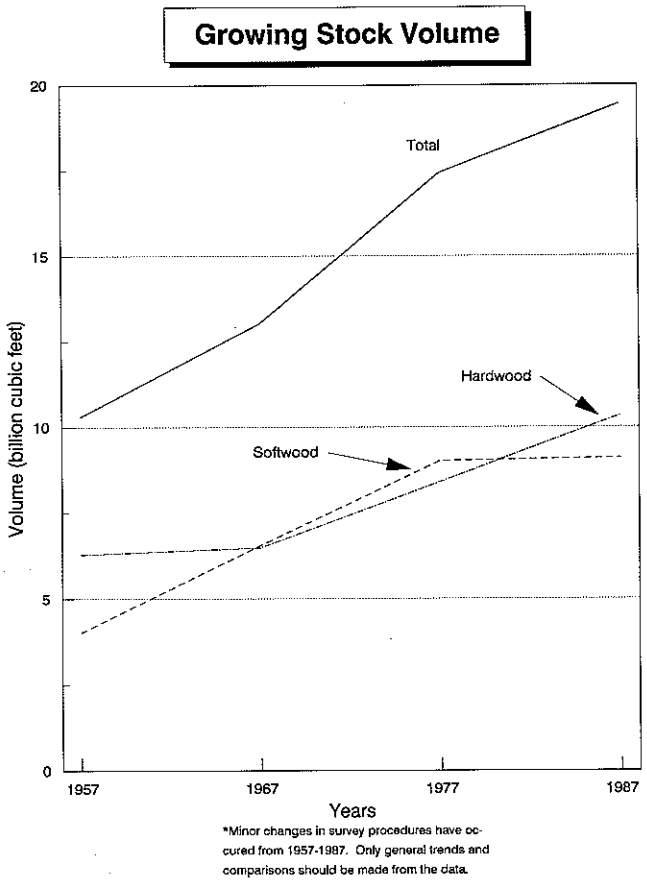


Figure 13. Growing stock volume of Mississippi's timberland by species group, 1957-87. (Sources: Van Sickle and Van Hooser, 1969; Donner and Hines, 1987; Table 17 (adapted); and USDA Forest Service, 1989a.)

14, page 20. Public ownerships have the highest average volumes per acre of softwood and hardwood growing stock for each of the forest types. The average volumes of softwood and hardwood on forest industry lands are very similar to NIPF averages, but almost without exception, average volumes for the private landowners classes are lower than those of public ownerships. However, average volumes per acre of softwood growing stock on forest industry ownerships should increase as their abundant young plantations mature.

Sawtimber Volumes

Public ownerships have the highest average volumes per acre of softwood and hardwood sawtimber for all forest types (Figure 15, page 21). Forest industry ownerships have greater average volumes per acre of softwood sawtimber than NIPF ownerships for the natural pine and oak-pine forest types. However, NIPF ownerships' pine and oak-pine plantation average volumes per acre of softwood are higher than forest industries' because their plantations are proportionally older. Average volumes per acre of hardwood sawtimber for forest types are generally greater for NIPF ownerships than the forest industry ownership class. Lower volumes per acre of growing stock and sawtimber on forest industry and NIPF ownerships as compared to public ownerships reflect the reliance of forest industries on Mississippi's private timberland resource for raw materials.

Growth and Removals

Net annual growth is the net increase in the volume of trees during a specified year. Net annual growth includes the incremental growth in net volume of trees at the beginning of a specific year, plus the net volume of trees reaching the minimum size class during the year, minus the volume of trees that die and those trees that become rough and rotten. Net annual removals are the net volume of growing stock or sawtimber trees removed from inventory by harvesting, cultural operations, such as timber stand improvement, land clearings, or changes in land use (Murphy, 1978).

The relationship between average net annual growth and average net annual removals (growth-removal ratios) can provide a general indication of under-utilization or over-utilization of a forest resource. Continuation of a growth-removal ratio of less than 1.0 indicates that removals exceed growth, while a ratio greater than 1.0 indicates that growth exceeds removals. These ratios reflect only general utilization of the forest resource and are not a reflection of Mississippi's current timber supply situation. A growth-removal ratio of less than 1.0 indicates an eventual depletion of the forest resource. A growth-removal ratio greater than 1.0 indicates a maturing forest resource in which net growth eventually approaches zero.

Growth and Removals by Forest Survey Region

Growth-removal ratios for growing stock and sawtimber are presented by forest survey region for the 1978-1987 period in Table 7. These ratios represent average net annual growth and removals for the 10-year interval.

Average net annual growth of softwood growing stock and sawtimber approximately equaled average net annual removals from 1978 to 1987 in the central, south and southwest survey regions of Mississippi, while softwood growth exceeded

Table 7. Ratio of average net annual growth to average net annual removals for growing stock and sawtimber by survey region, Mississippi, 1978-1987.[1]

	Growth-Removal Ratio			
	Growing Stock		Sawtimber	
Survey Regions	Softwood	Hardwood	Softwood	Hardwood
Delta	1.25	2.47	1.68	2.39
North	1.11	1.59	1.40	1.97
Central	0.88	1.45	1.12	1.67
South	1.00	1.82	1.08	1.72
Southwest	0.96	2.38	1.17	2.66
All Regions	0.98	1.81	1.18	2.05

[1] Sources: Adapted from Donner and Hines, 1987; and Kelly and Hines, 1987a-e, Tables 23 and 24.

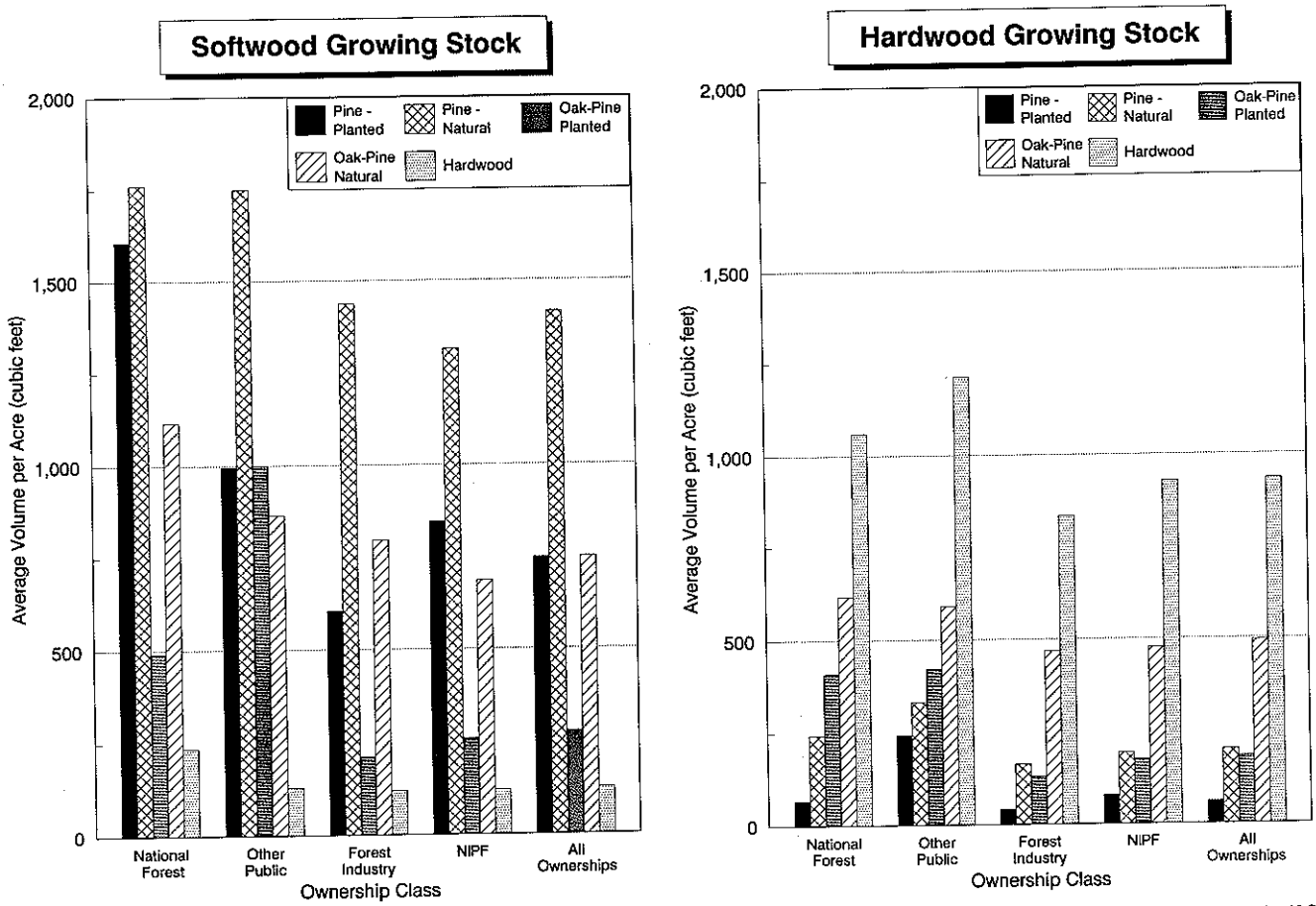


Figure 14. Average volume per acre of softwood and hardwood growing stock by ownership class and forest type, Mississippi, 1987. (Source: USDA Forest Service, 1989.)

removals for the Delta and north survey regions. Greater softwood removals in the southern portion of the state relative to other areas in the state results from a higher concentration of forest industry timberland ownerships and pine-utilizing mills.

Hardwood growth exceeds removals for both growing stock and sawtimber in all survey regions. However, there is concern among industry personnel that growth-removal ratios do not completely reflect Mississippi's hardwood timber situation. In recent years, strong hardwood markets for high-quality hardwood logs have existed. Therefore, while net hardwood growth may be occurring, the overall quality of the hardwood stands may be declining. Indeed, Kelly and Sims (1987) reported that the harvest of high-quality timber, lack of regenerating harvested stands, and maturing timber stands, has resulted in an overall lowering of tree grade from 1978 to 1987.

Growth and Removals by Ownership Class

Growth-removal ratios for growing stock and sawtimber are presented by ownership class for the 1968-1977 and 1978-1987 periods in Table 8. Again, these ratios reflect average net annual growth and removals for the 10-year intervals.

Growth-removal ratios for both softwood growing stock and sawtimber within the all ownership class declined between the 1968-1977 and 1978-1987 time periods. From 1978 to 1987, softwood growing stock and sawtimber growth approximately equaled removals, while growth exceeded removals by approximately 50 percent during the previous 10-year period within this class. All of the ownership classes, except other public, demonstrated similar declines in growth-removal ratios for softwood growing stock and sawtimber from 1978 to 1987.

For hardwood growing stock and sawtimber, from 1978 to 1987 average net annual growth was approximately twice that of removals for the all ownerships class, and was essentially unchanged from the 1968-1977 period. The other public and NIPF ownerships had growth-removal ratios similar to the all ownership class for hardwood growing stock and sawtimber. Hardwood growing stock and sawtimber growth has exceeded removals by a multiple of five during both time periods on National Forest ownerships. Growth-removal ratios

Table 8. Ratios of average net annual growth to average net annual removals for growing stock and sawtimber by ownership class and species group, Mississippi, 1968-77 and 1978-87.[1]

		Growth Removal Ratio			
		Growing Stock		Sawtimber	
Ownership Class	Interval	Softwood	Hardwood	Softwood	Hardwood
	(years)				
National Forest	1978-87	0.86	4.78	0.95	5.45
	1968-77	2.54	5.93	2.72	6.08
Other Public	1978-87	1.93	1.65	2.68	2.27
	1968-77	2.02	1.53	2.34	1.84
Forest Industry	1978-87	0.80	0.92	0.85	0.97
	1968-77	1.27	1.60	1.13	1.63
NIPF	1978-87	1.09	2.12	1.35	2.43
	1968-77	1.57	1.73	1.71	1.78
All Ownerships	1978-87	0.98	1.81	1.18	2.05
	1968-77	1.56	1.78	1.62	1.82

[1] Sources: Adapted from Donner and Hines, 1987, Tables 23 and 24; and USDA Forest Service, 1989.

on forest industry land, meanwhile, have declined for both hardwood growing stock and sawtimber—average annual growth approximately equaled removals during the 1978-1987 period.

Growth and Removals—Summary

The overall forest resource situation for Mississippi between 1978 and 1987 indicates that softwood growth approximates removals, while hardwood growth is approximately twice that of removals. However, removals may exceed growth for certain species in select regions of the state (Table 7). With the introduction of new markets, such as the hardwood chip export market served by northeast Mississippi, certain regions of the state could experience declining growth-removal ratios in the near future. Additionally, growth-removal ratios for softwoods might have been greater for the 1978-1987 period, but timber mortality has more than doubled in the last decade, primarily as a result of southern pine beetle epidemics. NIPF ownerships, with large timberland acreage and growth-to-removal ratios greater than 1.0, contribute markedly to the net annual growth that is occurring.

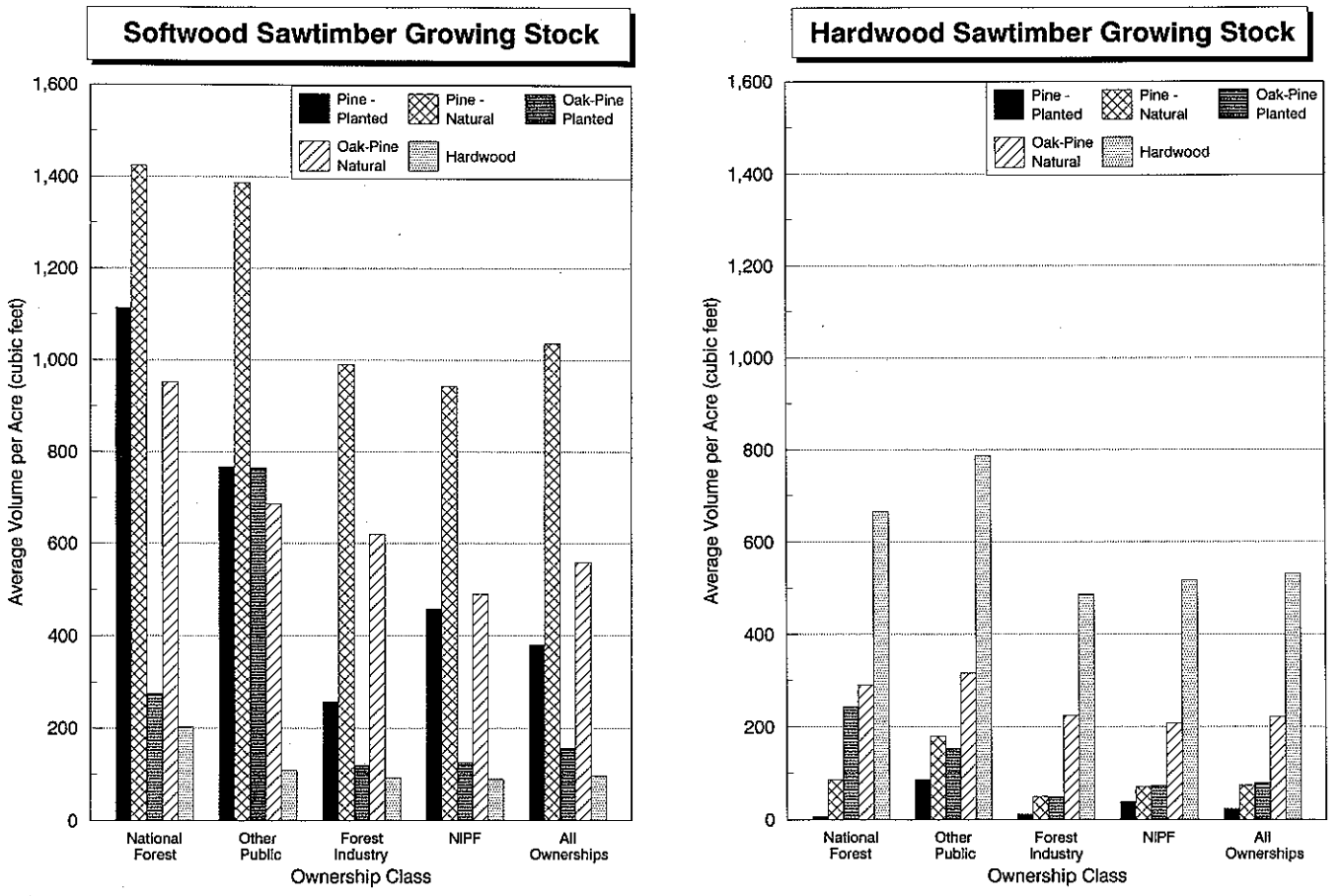


Figure 15. Average volume per acre of softwood and hardwood sawtimber growing stock by ownership class and forest type, Mississippi, 1987. (Source: USDA Forest Service, 1989.)

Nonindustrial Private Forest Landowners

The future of Mississippi's forest resource will be determined largely by the management practiced on the 11.7 million acres of timberland controlled by nonindustrial private forest (NIPF) landowners. NIPF landowners own nearly 70 percent of Mississippi's forest land. Characteristics of these landowners will influence the level of forest management, and thus the yield of forest products, expected on this land. Who owns Mississippi's NIPF lands? What are their timber selling plans? The USDA Forest Service completed a survey of 655 Mississippi NIPF landowners in 1988 (Baird and Doolittle, 1988). Results of this survey, summarized in the tables that follow, are expressed in terms of the number of NIPF acres affected by each response.

Size of Forest Holding and Merchantable Timber

NIPF landowner investments in forestry (level of forest management intensity) are determined by the acreage and volume of merchantable timber owned (Straka, 1985). Several explanations for the positive relationship between timber production on NIPF's and tract size have been proposed (Straka et al., 1984). First, larger tract sizes allow for greater economies of scale. On a per acre basis, larger tracts cost less to manage, so higher expected returns encourage investment in forest management. Second, NIPF landowners who are not primarily interested in timber production (i.e., those interested in recreation, aesthetics, or other benefits), can satisfy their needs from a relatively small acreage. Landowners interested in timber production are more likely to invest in larger acreages. Third, owners of larger tracts tend to have higher incomes and higher net worths than owners of smaller tracts. Thus, owners of larger tracts are more likely to invest in forest management.

Table 9. Timber land tract size and number of tracts owned or managed by Mississippi nonindustrial private forest landowners, by acreage owned, 1988.[1]

Tract Size	Timberland Acreage Owned
(acres)	(percent)
<10	2
10 - 49	13
50 - 99	14
100 - 499	37
500 - 999	12
1,000 +	22
Number of Tracts Owned By A Single NIPF Landowner	
(No.)	
one	49
two	20
three	10
four +	21

[1] Source: Baird and Doolittle, 1988.

Most of Mississippi's NIPF land belongs to owners who control fairly large acreages; more than 70 percent is held by owners who control 100 acres or more (Table 9). This suggests that Mississippi's NIPF land has a significant advantage for attracting forest management investment. Nearly half of Mississippi's NIPF timberland is held in single tracts (Table 9).

Most NIPF landowners sell timber because the timber is merchantable (responses included "timber was mature," "grow different species," "improve growth," and "salvage timber"). Table 10 suggests that this is the case in Mississippi. Generally, as timber becomes merchantable, the forest landowner realizes he is holding an economic asset and harvests the timber.

Nevertheless, survey responses indicate that only 68 percent of Mississippi's NIPF owners plan to harvest their timber in the future (Table 10). Does this mean that 32 percent of NIPF land in Mississippi will be unavailable for timber harvest? Stone (1970) first addressed this question in Michigan. Most NIPF landowner studies estimate that almost one-third of respondents do not plan to harvest timber. Over time, however, most NIPF land becomes available for timber harvesting. Ownership of tracts changes and owner attitudes towards harvesting change. Over time, economic opportunities tend to persuade reluctant landowners to convert mature timber to cash (Stone, 1970). Carpenter (1985) stated that "while the proportion of owners favoring or opposing timber harvest is reasonably consistent at any particular time, it is not the same timber tracts for which owners hold a particular view. New owners hold different attitudes or the same owners have changed their attitude as their circumstances or percept ions change." Thus, Table 10 does not present trends that are likely to impact the long-run timber supply situation in Mississippi.

The strong positive relationship between "acres of timberland owned" and "plans to sell" timber is amply illustrated in Table 10. The more timberland an NIPF owner controls, the more apt he is to sell timber.

NIPF Landowner Characteristics

Nearly 70 percent of NIPF land in Mississippi is owned by individuals, or individuals and their spouses (Table 11). Partnerships with relatives account for another 13 percent of these lands.

One of the most distinctive characteristics of NIPF landowners is their occupation. Table 11 presents data on this for

Mississippi. Those in the "retired" occupation category own the most acreage. Owners in this category are least likely to sell timber, while the "farmer-rancher" owner is most likely to sell based upon current plans.

Timber selling plans by "major source of income" are comparable to those by "occupational category" (Table 10). Owners who rely primarily upon farming and forestry for income are more likely to sell timber than owners in the other income categories. Pensioners are least likely to sell timber. Owners on salary/wages, in business, or living on interest, reported selling intentions representative of the overall population of owners.

More than half of NIPF land in Mississippi is owned by persons aged 55 or older. Indeed, more than one-third is owned by persons above the "official" retirement age of 65 (Table 11). Conversely, only about 13 percent of NIPF land

Table 10. Reasons affecting decision to sell timber and characteristics of NIPF landowners and NIPF land with future timber selling plans, by acreage owned in Mississippi, 1988.[1]

Most Important Reason To Sell	Timberland acreage owned
	(percent)
Timber was Merchantable	47
Needed Money	21
Good Price	17
To Clear Land	10
Scheduled by Plan/Forester	5
Future Plans to Sell	
Yes	68
No	32
Timberland Owned	**Plans to Sell**
(acres)	(percent of timberland owned)
1 - 9	18
10 - 49	43
50 - 99	60
100 - 499	71
500 - 999	68
1,000 - 4,999	83
5,000 - 9,999	95
10,000 +	97
TOTAL	68
Selling Plans by Major Source of Income	
Salary/Wages	68
Farming	78
Business	69
Pension	56
Interest	68
Timber	88
TOTAL	68
Major Species Composition	
Mostly Pine	78
Mostly Hardwood	63
Half and Half	55
TOTAL	68

[1] Source: Bard and Doolittle, 1988.

Table 11. Characteristics of Mississippi's NIPF landowners, by acreage owned, 1988.[1]

Characteristics	Timberland Acreage Owned
Ownership Category	(percent)
Individual-Spouse	69
Partnership (Relatives)	13
Partnership (Non-Relatives)	1
Undivided Estate	7
Other	10
Occupation	
Farmer-Rancher	12
White Collar-Professional	23
Blue Collar-Technical	22
Retired	43
Age (years)	
<35	3
35-44	10
45-54	22
55-64	27
>65	38
Education (No. years)	
0-8	7
9-11	6
12 (High School Diploma)	30
13-15	15
16 (College Degree)	25
>17	16
No Response	1
Place of Residence	
Farm	33
Rural but not a farm	27
Town (<2500)	7
Town (2,500 - 100,000)	26
City (>100,000)	7
Distance residence from timberland (miles)	
0 (lives on land)	43
1-9	25
10-19	12
20-29	4
30-39	2
40-49	1
50-100	5
>100	8
Primary benefit of owning timberland	
Timber Production/Sales	47
Investment/Future Income	14
Recreation/Hunting	12
Income	11
"Ownership"	4
Firewood	3
Beauty/Land Appreciation	2
Livestock Grazing	2
Home for Wildlife	2
Other	3

[1] Source: Baird and Doolittle, 1988.

belongs to owners younger than 44. It appears that the median age of owners (57 years in Mississippi) is increasing. Although age is not a major factor affecting an owner's timber selling plans, the level of education attained does make a difference. Generally, as the level of education attained by owners increases, the proportion of land on which timber sales are planned also increases. Of the NIPF landowners who responded to the question on education, nearly 40 percent were college graduates (Table 11). The survey found that land owned by a college graduate was nearly twice as likely to support a timber sale as land whose owners have less than a high school education.

Where do Mississippi's NIPF landowners live? Table 11 indicates that most landowners live in rural areas; about one-third live on farms and approximately another one-fourth live in other rural areas. More than two-thirds of these owners live less than 10 miles from their timberland (Table 11). Landowners who live more distant from their timberland are more likely to sell timber.

Of the applicable respondents to the survey, 79 percent were male and 21 percent were female. Ninety-six percent were white and 4 percent were black. Approximately 13 percent of Mississippi's NIPF land is leased to someone else. Of the leased NIPF land, 42 percent is under a hunting lease, 16 percent is under a mineral lease, 15 percent is under a timber lease, 14 percent is under an agricultural lease, 9 percent is under a grazing lease, and 4 percent is under another type of lease.

What is the primary benefit that NIPF owners receive from the timberland they own or manage? The primary benefit is mainly timber production and income (Table 11). More than 70 percent of the land belongs to owners who are primarily interested in income, either currently or in the future. Twelve percent of the land is owned primarily for recreation or hunting. Owners of the land held mainly for timber production and income are much more likely to make future timber sales.

Only about 18 percent of NIPF land in Mississippi is covered by a written management plan. As expected, most (85 percent) of this NIPF land belongs to owners who plan to sell timber in the next 10 years. In contrast, 64 percent of the land belonging to owners with no management plan is not scheduled for a timber sale in the next 10 years.

According to NIPF owners, 47 percent of their land contains "mostly pine," about 24 percent contains "mostly hardwood," and nearly 29 percent is "half-and-half." Interestingly, these estimates of species composition are strikingly different from the 1987 Mississippi forest survey results. The USDA Forest Service (Donner and Hines, 1987) found that only 23 percent of NIPF land is in pine types (longleaf-slash or loblolly-shortleaf), 20 percent is mixed (oak-pine), and 57 percent is hardwood (oak-hickory, oak-gum-cypress, or elm-ash-cottonwood). It appears that owners perceive that their land contains more pine than is actually the case. It is conceivable that a large portion of the "oak-pine" type in the USDA Forest Service survey is perceived as "mostly pine" by owners.

While NIPF landowners may own less pine than they think, the "mostly pine" owners are significantly more likely to plan timber sales (Table 10). In fact, the relative marketability of the major species types are matched by the order of planned selling among owners: "mostly pine," first; "mostly hardwood," second; and "half-and-half" last.

Mississippi Forestry Commission

The Mississippi Forestry Commission (MFC) was established as a state agency in March 1926. Its primary mission was initially to prevent and suppress wildfires and to encourage the reforestation of cut-over and eroding acres on NIPF land. The MFC now provides numerous services to NIPF landowners in Mississippi.

Protection of the state's forests from wildfire is still a major function of the MFC. Other functions include application of modern forest resource management practices to NIPF lands and advocacy of stewardship of forests for a wider range of forest benefits. Practices to enhance aesthetics, to improve wildlife habitat, and to prevent erosion have become major objectives of many NIPF landowners. The services of the MFC include these practices as well as the continuance of a long-term effort to increase overall forest productivity. (The MFC section presented here is based on annual reports and information from the MFC State Forester's Office, Jackson, MS.)

Fire Prevention and Protection

Mississippi Forestry Commission fire prevention and suppression efforts, supported by effective public education programs carried out by the entire public and private forestry community, have succeeded in reducing the area burned annually by wildfires from an estimated 10 million acres in 1926 to approximately 57,000 acres in fiscal year 1989 (FY89). The number of wildfires occurring annually has also declined. Only 3,886 wildfires were suppressed during the FY89 fire season, the lowest number since 1960 (Table 12).

The MFC participates in the Rural Community Fire Protection Program. Since 1975 more than 400 rural volunteer fire departments have received Federal matching funds for firefighting equipment through small federal grants administered by the MFC. A law was enacted in FY89 to increase the tax on timbered and noncultivatable land from 2

Table 12. Forest acres burned and number of forest fires suppressed by the Mississippi Forestry Commission, 1983-1989.[1]

Date	Acres burned	Number of fires
1983-84	86,948	6,781
1984-85	71,248	6,122
1985-86	140,827	9,408
1986-87	60,312	4,562
1987-88	218,777	12,429
1988-89	56,625	3,886

[1] Source: Mississippi Forestry Commission.

Table 13. Record of management assistance provided by the Mississippi Forestry Commission, by service provided, 1986-1989.[1]

Item	1986-87	1987-88	1988-89
Reconnaissance or diagnosis cruise:			
(no. of cases)	15,469	15,036	15,728
Management plans:			
Number	4,267	4,356	3,852
Acres	288,646	249,111	210,564

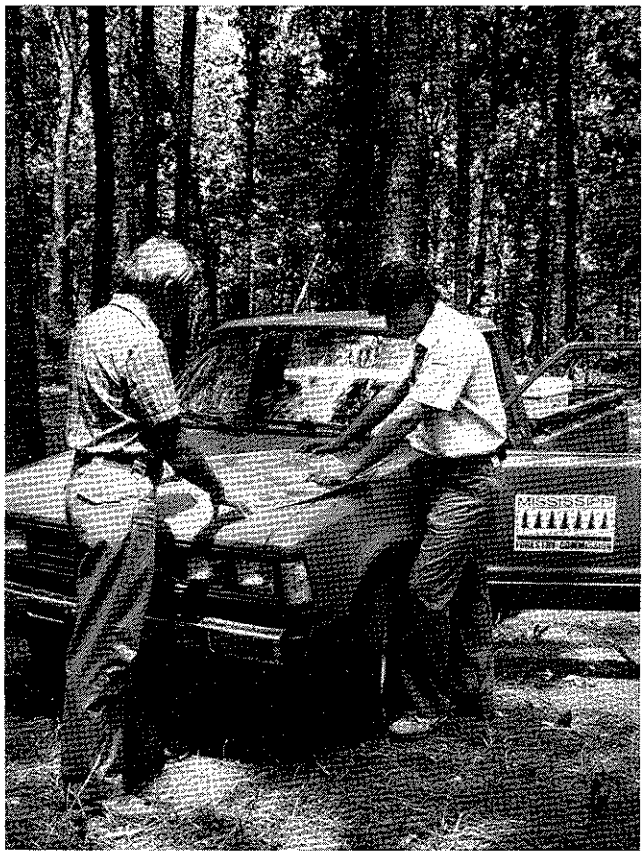
[1] Source: Mississippi Forestry Commission.

cents ($.02) to 9 cents ($.09) per acre by 1992. These tax revenues are dedicated to the fire control program of the MFC.

Forest Resource Management

The Mississippi Forestry Commission provides limited professional forestry advice and assistance for private forest owners, processors of primary and secondary wood products, and public land agencies. Services include preparing forest management plans, including timber sales, and supplying quality seedlings for reforestation projects (Table 13).

On July 1, 1986, the MFC became responsible for prescribing management and harvesting practices on approximately 380,000 acres of 16th Section school timberlands. The MFC is to bring all 16th Section timberlands to maximum productivity by 1995. Through 1989, the MFC had regenerated more than 28,000 acres of 16th Section timberland and performed release treatments on an additional 6,540 acres. Most timber sales administered by the MFC in FY89 were for 16th Section timberlands, and sales receipts totalled almost $8 million.



Personnel of Mississippi Forestry Commission provide limited professional forestry advice and assistance to Mississippi's nonindustrial forest landowners who control nearly 70 percent of the state's timberland.

Table 14. Numbers of applications, acreage of forest land improved, and funds approved for programs authorized by the Mississippi Forest Resources Development Act (FRDP) and the Forest Incentives Program (FIP), Mississippi, 1987-88 and 1988-89.[1]

Item	Program	Year 1987-88	Year 1988-89
Applications (no.)	FRDP	1,027	920
	FIP	256	372
Planted or Seeded (acres)	FRDP	48,333	45,598
	FIP	14,796	20,292
Released or Site			
Prepared for Natural	FRDP	4,840	4,202
Regeneration (acres)	FIP	18	327
Cost Share Approved for	FRDP	2,580,484	3,555,940
Above Work (dollars)	FIP	795,424	1,383,470
Fire Breaks (feet)	FRDP	----------	142,705
Cost Share (dollars)	FRDP	----------	7,792

[1] Source: Mississippi Forestry Commission.

In 1974, Mississippi became the second state to enact a Forest Resource Development Program (FRDP). Funding for the cost-share program is derived from the Timber Severance Tax. Up to 65 percent of the cost of reforestation practices has been paid to qualified landowners through the FRDP. Beginning July 1, 1990, the FRDP cost-share will be 50 percent. In FY89, FRDP provided $3,555,940 for cost-sharing to private landowners and for development of 16th Section school timberlands (Table 14).

The federal Forestry Incentives Program (FIP) has also provided a major impetus to the regeneration of Mississippi's forest lands. Table 14 summarizes FIP and FRDP activity. The Agricultural Conservation Reserve Program was used by a small number of landowners to improve 8,199 acres of forested acreage in 1989. Furthermore, the CRP has supported the conversion of 424,905 acres of Mississippi's highly erodible and eroding croplands to forest plantations through 1989.

The MFC performs firelane construction and prescribed burning, with more than 3,900 miles of firelanes built or

Table 15. Miles of firelanes constructed and acres of prescribed burning by the Mississippi Forestry Commission and number of owners receiving the services, 1983-1989.[1]

	Firelane Construction		Prescribed Burning	
Date	Miles of firelanes	Number of owners	Acres burned	Number of owners
1983-84	2,749	2,405	68,292	1,056
1984-85	2,661	2,183	74,705	1,212
1985-86	2,625	2,197	61,623	1,098
1986-87	2,519	1,993	47,443	640
1987-88	2,589	2,016	63,705	896
1988-89	3,901	1,499	54,100	781

[1] Source: Mississippi Forestry Commission.

refurbished, and 54,100 acres prescribed burned in FY89 (Table 15). Another service is the provision of vendor lists for forestry services such as tree planting, mechanical site preparation, and cull tree removal to private landowners. Surveillance flights to detect insect and disease damage to forests are also conducted annually. MFC foresters provide urban forestry assistance for individual landowners, builders, developers, and city officials, as well. Information and education programs for civic clubs and school programs are available from local MFC offices.

Mississippi's Consulting Foresters

According to the 1990 roster of registered foresters, approximately 105 individuals in Mississippi, with various qualifications and specializations, have the title of consulting or self-employed forester. These foresters provide a wide array of forestry services to Mississippi's timberland owners. While the NIPF landowner may be the typical client of most consulting foresters, many also provide forestry services to industrial and public timberland owners. The Mississippi Forestry Commission refers landowners to private forestry consultants and provides directories of consultants.

The Mississippi Association of Consulting Foresters (MACF), an organization of professional consulting foresters who practice in Mississippi, was established as a chapter of the Association of Consulting Foresters of America (ACF) in 1971. Not all of Mississippi's forestry consultants are members of the MACF. Membership in the MACF is limited to those full-time professional foresters who hold professional forestry degrees, have 5 years of practical forestry experience, complete regular continuing education requirements, and have no association in a timber purchasing or procurement entity wherein a potential conflict of interest may exist. Members of the MACF average 27 years of forestry experience, of which 15 years is as a consultant. Furthermore, MACF members manage approximately 1.5 million acres of Mississippi's timberlands on a full-time basis.

The typical client of most forestry consultants is an NIPF landowner owning fewer than 500 acres of timberland. Timber production through the development and maintainance of a productive and profitable forest is usually the primary goal of a forestry consultant's clientele, though wildlife, recreation, and aesthetics are also important. As professional forestry and the needs of NIPF landowners have grown, there has been increased specialization among forestry consultants. Moreover, a critical value of professional forestry consultants continues to be their ability to adapt forest management programs to fulfill a client's goals and objectives, as well to encourage keeping Mississippi's timberlands a productive entity.

Mississippi's Public Forest Resources

National Forests

The USDA Forest Service administers 1.1 million acres of public land in six national forests in Mississippi; the Bienville, Delta, DeSoto, Holly Springs, Homochitto, and Tombigbee (Figure 16). National forests are managed to provide a sustained flow of natural resources, including outdoor recreation, forage, wood, water, wilderness, wildlife, and fish, in combinations that best meet the needs of society now and in the future. Acquired 50 years ago, these once cutover and eroded lands now produce more commodities than any other national forest in the eastern two-thirds of the nation.

National forests in Mississippi yielded 244 million board feet of timber, valued at almost $21 million, in 1988. Revenues exceeded operating expenses by more than $11 million. Mississippi's national forests include the Southern Region tree nursery, where 30 million seedlings are raised annually for forests in nine southern states. More than 13,000 acres were reforested in Mississippi's national forests in 1988.

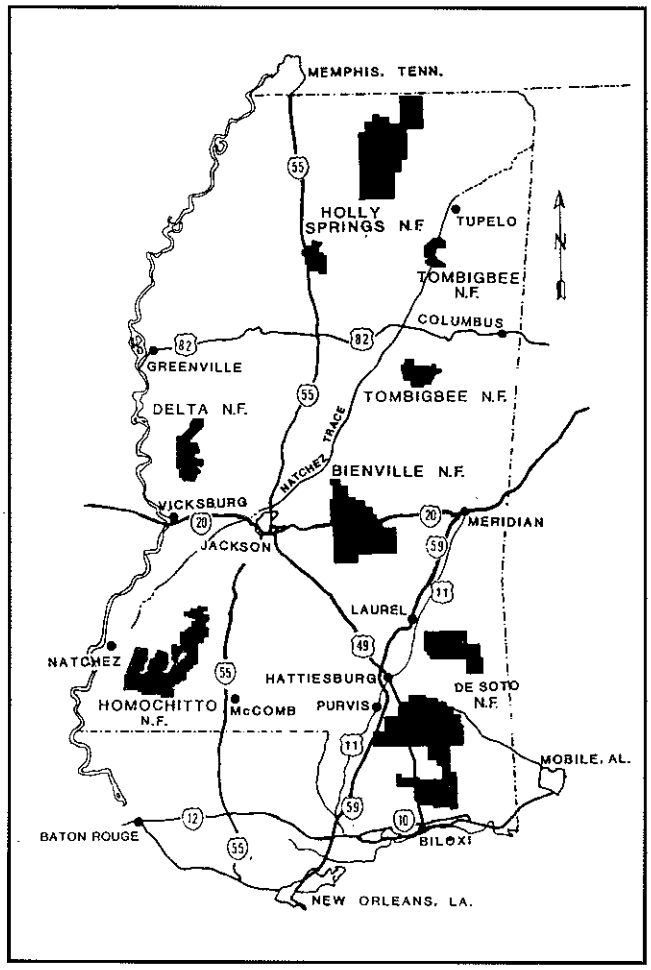


Figure 16. Map shows the locations of the USDA National Forests in Mississippi.

Fire management is used extensively in the management of National Forests. More acres are prescribed burned in the national forests of Mississippi than any other national forest in the nation. In 1988, almost 150,000 acres were treated with prescribed burns to reduce wildfire hazard, improve wildlife habitat, and improve range resources.

More than 1.2 million recreation visitor-days on Mississippi's National Forests were enjoyed by the public in 1988. Recreational activities include hunting, fishing, floating the only segment of a wild and scenic river in the state, hiking, camping in one of two wildernesses or at one of the many developed campsites, picnicking, and swimming. In recent years, recreational use of national forests in Mississippi has been increasing by approximately 6 percent annually.

Economic contributions by Mississippi's national forests are significant. About 2,000 jobs and an estimated $49 million were generated in 1988 for local communities as a result of timber sales from the national forests. In 1988, shared returns amounting to more than $5 million made significant contributions to counties containing national forest land for use in their public schools and for roads.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers has six projects in Mississippi that contain significant forest resources. These projects are divided between two administrative areas, the Vicksburg District and the Mobile District. Arkabutla, Enid, Grenada, and Sardis Lakes, in north-central Mississippi, are part of the Vicksburg District, while Okatibbee Lake, in east-central Mississippi, and the Tennessee-Tombigbee Waterway, in the northeast, are part of the Mobile District.

All five Corps of Engineer lakes have a primary purpose of flood control, although it was realized that land under the Corps' jurisdiction had potential for multiple resource management; i.e. outdoor recreation, wildlife, fisheries, and forest management. Consequently, provisions have been made for multiple use of the natural resources to the maximum extent compatible with the lakes' primary function of flood control. Various public laws guide the Corps in their management.

Forests associated with the five lakes cover approximately 143,000 acres of land. These forests and lakes provide many varied opportunities for outdoor recreation, including sightseeing, fishing, boating, picnicking, camping, swimming, and hunting. More than 12.8 million visitor-days were enjoyed on the lakes and surrounding lands in 1988.

The Mississippi Department of Wildlife, Fisheries, and Parks (MDWFP) has the primary responsibility for wildlife

Backpacking in the DeSoto National Forest's Black Creek Wilderness Area is just one of many outdoor activities available to Mississippi's recreationists. Approximately 25 million visitor-days of recreational activities were enjoyed in the state's public forest resources and associated waterways in 1988.

and fisheries management at the lakes. This is supplemented by Corps management activities. Wildlife management activities are aimed at maintaining and improving wildlife habitat and populations.

Forests are managed in a manner that is compatible with and enhances other uses of forest land. Management activities include prescribed burning and fire lane construction to reduce wildfire hazard and to improve wildlife habitat. Timber harvesting activities are undertaken in order to keep stands of trees growing vigorously, reducing the chances of disease and insect attacks. Reforestation efforts include the planting of 500,000 bald cypress and 300,000 pine seedlings annually.

The 234-mile Tennessee-Tombigbee Waterway officially opened in 1985. It joins the Tennessee River near the Mississippi-Alabama-Tennessee border with the Black Warrior Waterway located in Alabama. Approximately 140 miles of the Waterway are located in Mississippi. Providing navigation for commerce, recreational opportunities, and wildlife management are the principal goals and objectives of the Waterway.

Approximately 59,000 acres of forest land and 32,000 acres of water associated with the Waterway are located in eastern Mississippi. Forest management objectives are targeted at maximizing wildlife and recreational values and opportunities. Recreational activities center around public recreational facilities that have been established to include hunting, fishing, camping, water skiing, and swimming. Additional recreation facilities are incorporated in future development plans. In 1988, approximately 6.1 million visitor-days of recreation were reported on the Waterway.

USDI Fish and Wildlife Service

The USDI Fish and Wildlife Service manages seven national wildlife refuges in Mississippi. The primary objective of a national wildlife refuge is to provide habitat for the conservation and protection of all species of wildlife. Specific management objectives for individual refuges depend on enabling legislation for the establishment of the refuge.

The Mississippi Sand Hill Crane National Wildlife Refuge comprises approximately 17,000 acres in the coastal region of southeastern Mississippi. Restoration and protection of crane habitat is the principal management objective of the refuge. Prescribed burning is used as a management tool for the improvement of habitat. Limited amounts of timber harvesting occur as part of the management program. Public use and access to the refuge are restricted for the protection of the crane.

The Noxubee National Wildlife Refuge, in east-central Mississippi, consists of approximately 47,000 acres, of which 91 percent are forested. The refuge also contains two lakes and three green-timber reservoirs. The primary management

objective of the refuge is to provide wintering habitat for migratory waterfowl. Other objectives include providing habitat for the endangered red-cockaded woodpecker and for the variety of wildlife species native to east-central Mississippi. Approximately 6,000 acres a year are treated with prescribed burning in order to improve wildlife habitat, reduce wildfire hazards, and to visually enhance certain forest stands. Various types of harvesting activities on approximately 2,000 acres annually allow refuge managers to provide and maintain a diversity of habitat. More than 100,000 visitors a year enjoy fishing, hunting, camping, hiking, wildlife photography, and wildlife observation on the refuge's lands.

The Hillside, Mathews Brake, Morgan Brake, Panther Swamp, and Yazoo National Wildlife Refuges comprise the Yazoo National Wildlife Refuge Complex in the Delta region of west-central Mississippi. This complex consists of almost 61,000 acres, 39,000 acres of which are forested. The principal management objective of the refuge is to provide wintering habitat for migratory waterfowl in the Mississippi flyway including provision of wood duck nesting and rearing habitat. Silvicultural activities such as limited timber harvests, cull-tree removal, and regeneration of disturbed sites help fulfill the overall refuge management objective. Approximately 32,000 visitors a year enjoy such activities as hunting, fishing, and wildlife observation on the Yazoo National Wildlife Complex.

Mississippi Department of Wildlife, Fisheries, and Parks

In July of 1989, the Mississippi Department of Wildlife Conservation merged with the Bureau of Parks to become the Department of Wildlife, Fisheries, and Parks (MDWFP). Management, conservation, development, and protection of the state's wildlife and marine resources and their habitats are the main emphasis of the Department's mission. The MDWFP manages eight state-owned wildlife management areas (WMA) totaling 87,000 acres. An additional 800,000 acres of WMA are managed in cooperation with various industry owners and governmental agencies. Each year, approximately 400,000 resident licensed sportsmen and 125,000 non-resident licensed sportsmen participate in hunting, fishing, and trapping activities on Mississippi's public and private lands. Of the more than 7 million man-days spent pursuing hunting activities in Mississippi each year, more than 160,000 occur on the state's WMA's. In addition, more than 1.5 million Mississippians annually participate in nonconsumptive wildlife activities such as nature photography or observation, many of which take place on the WMA's.

Forest management goals and activities are determined by the needs of the wildlife community of specific WMA's. Silvicultural activities, such as prescribed burning and timber harvesting, are used to meet specific wildlife management objectives. The MDWFP has a memorandum of understanding with the Mississippi Forestry Commission to assist with forest management and fire detection and suppression.

The Parks and Recreation Division of the MDWFP administers 27 parks throughout the state. These parks encompass approximately 20,000 acres of state-owned or leased lands. The goal of the Parks and Recreation Division is to provide high-quality recreational opportunities through well-managed park lands, water, facilities, programs and visitor services. In 1988, approximately 500,000 overnight visitors and 4 million day visitors enjoyed recreational activities in Mississippi's state parks.

Summary and Concluding Comments

Mississippi's forest industry is an important component of the state's economy. Indeed, more than 57,000 Mississippians were employed by forest industry in 1988. Additionally, economic multipliers indicate that the forest industry, as compared to other manufacturing industries, has the greatest overall impact on the state's economic output, income, and employment.

Recent forest industry developments, such as the construction of a new pulp mill at Grenada and a major pulp mill expansion at Columbus, demonstrate the potential for forest industry expansion in Mississippi. Furthermore, the furniture industry in northeastern Mississippi has grown impressively over the last decade. In recent years, timber markets have been extremely competitive in the southern half of the state, indicative of a situation in which the forest industry is closely utilizing current regional timber production capacity. However, opportunities for forest industry expansion exist in the southern half of Mississippi, especially in secondary manufacturing.

Timberland ownership patterns have influenced the characteristic of the state's timberland resource, and will continue to do so in the future. Nonindustrial private forest landowners (NIPF) own nearly 70 percent—11.7 million acres—of Mississippi's 17 million acres timberland. Another 20 percent—3.3 million acres—of the timberland resource is owned or controlled by forest industry. Forest management activities of these two sets of landowners will largely dictate the yield of forest products from Mississippi's timberlands.

Forest industry's forest management objectives focus primarily on the supply of raw materials for their manufacturing facilities, while NIPF landowners may have multiple land-owning objectives which often include timber harvesting. Recent survey results of Mississippi's NIPF landowners indicate that more than 70 percent of the timberland belongs to owners who are primarily interested in current or future income, and that 68 percent of NIPF timberland will be harvested in the future (Baird and Doolittle, 1988). Other research suggests that nearly 100 percent of NIPF timberland will be harvested in the future because landowners' objectives change as timber matures (Stone, 1970).

Increasing recreational use of public forest resources, along with developing environmental activism and constraints, may result in fewer acres available for commercial timber production. Perhaps the greatest potential for increasing forest productivity is enhanced forest management activities on the state's timberlands, which are producing only 46 percent of potential for fully-stocked natural stands. Forest management treatments, such as timber stand improvement of overstocked stands and reforesting poorly-stocked stands, can greatly increase Mississippi's timberland productivity. However, many management activities that increase productivity require financial investments by landowners.

Nonindustrial private landowners are the key targets to ensuring Mississippi's long-term timber supply. Traditionally, these landowners have been reluctant to invest heavily in timber production. Perhaps this reluctance is justified. Teeguarden (1985) identified seven potential barriers to investment in private forestry based on previous studies regarding the effects of public policy on private forestry investment. These barriers include: *(1)* the perception of low rates of return relative to other investments; *(2)* lack of investment capital; *(3)* lack of liquidity and long payback periods; *(4)* income, property, and estate taxes; *(5)* lack of knowledge about benefits of forest investments, technical assistance, future markets, and price trends; *(6)* high risk and uncertainty about forest investment payoffs; and (7) diseconomies of scale, placing the small landowner at a disadvantage in production costs, marketing, and cost of capital.

From 1952 to 1984, softwood net annual growth exceeded timber removals, and softwood inventory had been increasing in Mississippi. In the future this may no longer be the case; softwood inventory is expected to decrease over the next 30 years. Hardwood supply projections are even more grim. Hardwood inventory is expected to decrease by a third by the year 2030 (USDA Forest Service, 1988).

Limited timber supply has the potential to curtail further economic development of Mississippi's forest industries. Teeguarden (1985) identified public policy tools that have been developed to lower investment barriers and stimulate forestry investments. Public policy tools currently having positive impacts on forestry investment in Mississippi include the state's Forest Resource Development Program; the federal Forestry Incentives Program; tax credits and rapid amortization of reforestation costs; technical assistance to timberland owners; fire, insect, and disease detection and control; annual income payments for those enrolled in the federal Conservation Reserve Program; price reporting and marketing services; public research and development; cooperative extension services; and university training of professional forestry managers. These public policy tools are making a difference in how NIPF land is being managed. A continued public policy emphasis encouraging intensive and environmentally sound forest management is needed. Many of the trees that will be harvested in 2020 will be planted today.

Mississippi's economy has a vital stake in its forest products industry. Nonindustrial private forest landowners will largely determine the long-term supply of raw material to that industry. Federal and state public policy tools encourage the wise management of forest resources, and if Mississippi's forests are to meet the state's timber and nontimber demands, public policy will need to address continued encouragement and intensification of environmentally sound forest management practices in Mississippi. It is a challenge that must be accepted if one of the key factors in the Mississippi economy is to continue to expand.

GLOSSARY[4]

commercial species — Tree species currently or prospectively suitable for industrial wood products. Excluded are non-commercial species.

cord — A stack of wood measuring 4 feet by 4 feet by 8 feet long; 128 cubic feet (wood, bark, and air).

cubic feet — Volume unit of measurement; 1 foot by 1 foot by 1 foot = 1 cubic foot.

d.b.h. — Diameter at breast height; diameter of a tree, outside bark, at 4.5 feet above ground.

forest types — A classification of forest land based upon those tree species forming a plurality of live-tree stocking. Mixed types that in combination contain a majority of hardwood stocking are hardwood types.

forest land — Land at least 16.7 percent stocked by forest trees of any size, or formerly having such tree cover and not currently developed for non-forest use.

forest land ownership classifications —
National Forest — Federal lands legally designated as national forests or purchase units, and other lands under the administration of the USDA Forest Service.

Other Public — Other federal lands, including Indian reservations; state, county, and municipal forest lands.

Forest Industry — Lands owned by individuals or business organizations operating wood-using plants. Includes lands leased to forest industry.

Non-industrial private forests (NIPF) — Other private lands including farmer, corporate (other than forest industry), and individual forest lands.

growing stock trees — Live trees of commercial species excluding rough and rotten cull trees. Includes sawtimber trees, poletimber trees, and saplings. Rough and rotten trees are excluded. Growing stock volume is for those growing stock trees at least 5.0-inches in d.b.h. to a 4.0-inch top.

growth-removal ratios — Average net annual growth of timber volume divided by average net annual removal. Ratios greater than 1.0, equal to 1.0 and less than 1.0 indicate growth in excess of removal, growth equals removal, and growth less than removals, respectively.

hardwoods — Usually broadleaf trees that lose their leaves in the fall. A conventional term for the timber of broadleaved trees, and the trees themselves.

input-output model — An input-output model is an economic analytical tool based on the interrelationships of industry sectors that compromise the total regional economy.

multipliers — Multipliers derived from input-output models measure economic effects resulting from introducing new industries or changing existing industries of a region's economy.

natural stand — Stands with no evidence of artificial regeneration (planting). Includes those stands established by seed tree regeneration methods.

plantations — A man-made forest; a crop or stand raised artificially, either by sowing or planting.

poletimber trees — Live trees of commercial species 5.0 to 8.9 inches d.b.h. for softwoods and 5.0 to 10.9 inches for hardwoods.

productivity — Productivity of timberland is an estimate of the inherent capability of the land to grow crops of industrial wood based on fully-stocked natural stands. Productivity is measured in units of cubic feet of wood per acre per year.

pulpwood — Wood that is cut for manufacture into paper products, which must first be converted to wood pulp during primary manufacture. Certain roundwood products destined for chip-n-saw, waferboard, oriented strand board, and other uses of small diameter trees are often bought and sold in units of cords and thus are reported as pulpwood in severance tax records.

roundwood — Logs, bolts or other round sections cut from trees for industrial or consumer uses. Wood is unprocessed in this form.

sawtimber trees — Growing-stock trees that contain at least a 12-foot saw log in the butt 16 feet and meet regional specifications for freedom of defect. Softwoods must be at least 9.0-inches in d.b.h. and hardwoods at least 11.0- inches in d.b.h.

SIC (Standard Industrial Classification) — A system of classifying establishments into industries, based on considerations such as similarity of manufacturing processes, types of materials used, types of customers, etc. SIC codes related to forestry include:

SIC 24 - Lumber and wood products, except furniture. Includes establishments primarily engaged in cutting timber and pulpwood; merchant sawmills, lath mills, cooperage stock mills, planing mills, and plywood mills and veneer mills engaged in producing lumber and wood basic materials; and establishments engaged in manufacturing finished articles made entirely or mainly of wood or related materials.

SIC 25 - Furniture and fixtures. Includes establishments primarily engaged in manufacturing household, office, public building, and restaurant furniture; and office and store fixtures.

[4] Glossary is based in part on definitions found in Donner and Hines, 1987; Kelly and Sims, 1989; Murphy, 1978; O'Laughlin and Williams, undated; Porterfield et al, 1979; and Smith, 1962.

SIC 26 - Paper and allied products. Includes establishments primarily engaged in the manufacture of pulps from wood and other cellulose fibers, and from rags; the manufacture of paper and paperboard; and the manufacture of paper and paperboard into converted paper products.

softwoods — Coniferous trees, usually evergreen, with needle or scale-like leaves.

stands - A community of trees possessing sufficient uniformity in relation to species, age, and spatial arrangement, or condition to be distinguishable from adjacent communities.

stumpage - The value of timber as it stands uncut.

timber stand improvement - Those treatments of stands that have as their objective the improvement of the existing stand, regulation of growth, and provision of early financial returns, without any effort directed at regeneration.

timberland - Forest land that is producing, or capable of producing, crops of industrial wood and not withdrawn from timber utilization.

value added - Value of shipments less the cost of materials, parts, supplies, fuel, goods purchased for resale, energy, and contract work used in production. Value added represents the income available for workers and business owners.

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APPENDIX A

Table A1. Forest production by product class and species group, Mississippi, 1978-1989.[1]

Year	Sawtimber[2]			Pulpwood[3]		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	(million board-feet)			(thousand cords)		
1989	1,444	452	1,896	4,037	3,212	7,249
1988	1,355	416	1,771	3,431	2,532	5,963
1987	1,277	523	1,800	3,604	2,576	6,180
1986	1,161	375	1,536	3,055	2,063	5,118
1985	937	284	1,221	3,181	1,847	5,028
1984	945	353	1,298	3,071	1,837	4,908
1983	933	288	1,221	2,965	1,799	4,764
1982	802	250	1,052	3,070	1,460	4,530
1981	913	317	1,230	3,280	1,542	4,822
1980	1,161	437	1,598	3,384	1,504	4,888
1979	1,246	425	1,671	3,084	1,574	4,658
1978	1,212	468	1,680	2,742	1,526	4,268

[1] Source: Mississippi Cooperative Extension Service —Annual.

[2] Pine sawtimber includes poles, piling, and plywood logs. Hardwood sawtimber includes veneer logs and crossties.

[3] Pulpwood includes roundwood destined for wood pulp, chip-n-saw, oriented stand board, waferboard, and other uses of smaller diameter trees.

Table A2. Mississippi pulpwood production consumption, 1977-1988.[1]

Year	Pulpwood[2]		
	Production	Consumption	Production less Consumption
	(thousand cords)		
1988	7,235	4,735	2,500
1987	6,955	4,850	2,105
1986	7,129	4,656	2,473
1985	5,674	4,687	987
1984	5,910	4,249	1,661
1983	5,634	4,004	1,630
1982	5,362	3,304	2,058
1981	5,873	3,632	2,241
1980	6,014	3,453	2,561
1979	7,287	3,524	3,763
1978	5,530	3,482	2,048
1977	5,212	3,289	1,923

[1] Sources: Production: USDA Forest Service—Annual; Consumption: American Pulpwood Association—Annual.

[2] Production figures include softwood and hardwood roundwood and chips harvested from Mississippi's forests, and wood chips from mill residues destined for the manufacture of wood pulp in which Mississippi was the state of origination for the raw material. Consumption figures include softwood and hardwood roundwood, wood chips, and mill residues utilized by mills in Mississippi for the manufacture of wood pulp and wood chips used for energy production.

Table A3. Value of selected crops in Mississippi, 1978-1989.[1]

Year	Timber	Cotton	Soybeans
		($ million)[2]	
1989	711	607	232
1988	611	721	379
1987	600	738	279
1986	478	480	205
1985	498	563	375
1984	518	581	464
1983	484	574	462
1982	407	651	530
1981	467	540	470
1980	526	493	480
1979	550	510	743
1978	470	484	547

[1] Sources: Mississippi Cooperative Extension Service—Annual, and Mississippi Cooperative Extension Service, 1990.

[2] Value at first point of delivery.

Table A4. Total employment, total annual wages, and average annual wages of forest products industry employees with comparisons, Mississippi, 1988.[1]

Industry	Employment[2]	Total Annual Wages	Average Annual Wage Per Employee
	(No.)	($ thousand)	($)
Logging Camps and Contractors	3,684	46,273	12,561
Sawmills and Planing Mills	10,650	177,371	16,655
Millwork and Plywood	3,923	73,566	18,752
Other Wood Products	5,613	95,412	16,998
Furniture and Fixtures	24,893	402,691	16,177
Paper and Allied Products	8,269	243,123	29,402
All Forest Related Manufacturing	57,032	1,038,436	18,208
All Mississippi Manufacturing	239,324	4,389,521	18,341

[1] Source: Mississippi Employment Security Commission 1989.
[2] Average monthly employment for those employers covered under the Mississippi Employment Security Law.

Table A5. Timberland area by survey region in Mississippi, 1957, 1967, 1977, and 1987.[1]

Survey Region	Survey Year			
	1957	1967	1977	1987
	(thousand acres)			
Delta	1,917.1	1,493.8	1,476.6	1,388.3
North	4,204.0	4,194.8	4,251.4	4,401.2
Central	3,792.4	3,959.5	3,879.3	4,097.0
South	4,533.4	4,489.1	4,320.7	4,329.0
Southwest	2,746.7	2,754.7	2,756.8	2,766.0
Total	17,193.6	16,891.9	16,684.7	16,981.5
Percent of Total Area	57	56	55	56

[1] Source: Kelly and Sims, 1989.

Table A6. Mississippi's timberland area by ownership class, 1987.[1]

Ownership Class	Area	Percent of Total Timberland	Percent of All Land
	(thousand acres)	(%)	(%)
National Forest	1,212.1	7.1	4.0
Other Public	707.2	4.2	2.3
Forest Industry	3,332.8	19.6	11.0
NIPF	11,729.4	69.1	38.9
All Ownerships	16,981.5	100.0	56.3
All Mississippi[2]	30,176.0		

[1] Source: Adapted from Donner and Hines, 1987, Table 7.
[2] Source: USDA Forest Service, 1988, Appendix 1, Table 1.1.

Table A7. Mississippi's timberland area by ownership class and forest type, 1987.[1]

Ownership Class	Total Area	Forest Type[2]					
		Pine		Oak-Pine		Oak-Hickory	Other Hardwood
		Planted	Natural	Planted	Natural		
	(thousand acres)						
National Forest	1,212	62	432	74	283	233	128
Other Public	707	23	149	21	103	155	256
Forest Industry	3,325	839	535	377	313	763	498
NIPF	11,729	615	2,117	281	2,071	4,326	2,319
All Ownerships	16,973	1,539	3,233	753	2,770	5,477	3,201

[1] Sources: Adapted from Donner and Hines, 1987, Table 7; and USDA Forest Service, 1989.

[2] Pine forest type includes longleaf-slash and loblolly-shortleaf types. Other hardwood forest type includes oak-gum and elm-ash-cypress types. Area does not include approximately 8,000 acres of open land classified as timberland.

Table A8. Mississippi's pine and oak-pine plantation area by ownership class and age class, 1987.[1]

Ownership Class	Forest Type	Age Class[2]							
		(years)							
		5	15	25	35	45	55	Mixed	Total
		(thousand acres)							
National Forest	Pine	4.3	26.4	5.0	13.5	12.4	—	—	61.6
	Oak-Pine	13.1	11.7	—	—	6.8	—	42.3	73.9
Other Public	Pine	11.9	—	4.8	—	—	—	5.8	22.5
	Oak-Pine	9.5	—	5.4	—	—	—	5.7	20.6
Forest Industry	Pine	457.1	145.3	84.0	26.0	6.7	—	119.8	838.9
	Oak-Pine	229.5	57.6	6.1	4.8	—	5.0	74.0	377.0
NIPF	Pine	242.5	102.6	125.0	40.2	11.7	—	92.9	614.9
	Oak-Pine	142.1	19.5	18.5	12.5	—	—	88.5	281.1
All	Pine	715.8	274.3	218.8	79.7	30.8	—	218.5	1,537.9
Ownerships	Oak-Pine	394.2	88.8	30.0	17.3	6.8	5.0	210.5	752.6
	Total	1,110.0	363.1	248.8	97.0	37.6	5.0	429.0	2,290.5

[1] Source: USDA Forest Service, 1989.

[2] Age classes are mid-point values of 10 year ranges. The 5-year age class includes those stands recently harvested and not yet regenerated. Mixed age classes include those planted stands that contain stand components with at least two distinct age classes.

Table A9. Productivity of Mississippi's timberland by ownership class, 1987.[1]

Ownership Class	Actual net growth	Potential net growth	Actual as percent of potential
	(ft^3/A/yr)	(ft^3/A/yr)	(%)
National Forest	56	126	44
Other Public	40	129	31
Forest Industry	57	118	48
NIPF	56	123	46
All Ownerships	56	122	46

[1] Source: USDA Forest Service, 1989.

Table A10. Growing stock volume of Mississippi's timberland by species group, 1957-1987.[1]

Year[2]	Softwood	Hardwood	Total
	----------	(million ft³) ----------	
1957	4,021	6,291	10,312
1967	6,555	6,480	13,035
1977	9,013	8,414	17,427
1987	9,087	10,339	19,426

[1] Sources: Van Sickle and Van Hooser 1969; Donner and Hines 1987, Table 17 (adapted); and USDA Forest Service, 1989.

[2] Minor changes in survey procedures have occurred from 1957 to 1987 that may affect compatibility of data. Although these changes may limit very detailed analyses between survey intervals, general trends and comparisons can be made.

Table A11. Average volume per acre of softwood and hardwood growing stock by ownership class and forest type, Mississippi, 1987.[1]

			Forest Type[2]				
			Pine		Oak-Pine		
Ownership Class		Units	Planted	Natural	Planted	Natural	Hardwood
National Forest	Softwood	ft³/A	1,607	1,761	490	1,117	235
	Hardwood	ft³/A	65	242	409	617	1,060
Other Public	Softwood	ft³/A	996	1,749	1,000	863	128
	Hardwood	ft³/A	242	332	421	589	1,213
Forest Industry	Softwood	ft³/A	604	1,438	210	795	119
	Hardwood	ft³/A	41	162	129	468	832
NIPF	Softwood	ft³/A	845	1,314	259	684	120
	Hardwood	ft³/A	76	192	174	477	927
All	Softwood	ft³/A	746	1,414	277	748	125
Ownerships	Hardwood	ft³/A	59	200	181	495	932

[1] Source: USDA Forest Service 1989.

[2] Pine forest type includes longleaf-slash and loblolly-shortleaf types. Hardwood forest type includes oak-hickory, oak-gum, and elm-ash-cypress types.

Table A12. Average volume per acre of softwood and hardwood growing stock in the sawlog portion of sawtimber by ownership class and forest type, Mississippi, 1987.[1]

			Forest Type[2]				
			Pine		Oak-Pine		
Ownership Class		Units	Planted	Natural	Planted	Natural	Hardwood
National Forest	Softwood	ft³/A	1,114	1,424	275	953	202
	Hardwood	ft³/A	7	85	243	291	666
Other Public	Softwood	ft³/A	766	1,387	765	685	109
	Hardwood	ft³/A	85	180	153	316	787
Forest Industry	Softwood	ft³/A	258	991	119	619	92
	Hardwood	ft³/A	11	50	48	225	486
NIPF	Softwood	ft³/A	458	943	126	490	89
	Hardwood	ft³/A	38	70	73	207	517
All	Softwood	ft³/A	380	1,036	155	559	95
Ownerships	Hardwood	ft³/A	23	74	79	222	531

[1] Source: USDA Forest Service 1989.

[2] Pine forest type includes longleaf-slash and loblolly-shortleaf types. Hardwood forest type includes oak-hickory, oak-gum, and elm-ash-cypress types.

APPENDIX B

Composition of Input-Output Model Sectors[5]

1. **Livestock and Livestock Products** (SIC 013, 025, 021, 0241, 027) — Cotton and cottonseed; poultry and eggs; meat animals; other livestock (milk).
2. **Other Agricultural Products** (SIC 011, 0116, 018, 0191, 081-4, 091, 097) — Food and feed grains; soybeans and peanuts; other crops; forestry and fisheries products; agricultural, forestry, and fisheries services; catfish farming.
3. **Mining** (SIC 13, 14) — Crude petroleum and natural gas; stone and clay mining and quarrying.
4. **Construction** (SIC 15-7) — Construction.
5. **Food and kindred** (SIC 20) — Meat packing, poultry processing, dairy products, food and feed grains processing, bakery products, cottonseed oil mills, soybean oil mills, beverages, miscellaneous food and kindred products, catfish processing.
6. **Textiles** (SIC 22, except 225) — Textile mill products except knitting.
7. **Apparel** (SIC 225, 23) — Knitting mills; apparel, miscellaneous fabricated textile products.
8. **Logging Camps** (SIC 2411) — Logging camps and contractors.
9. **Sawmills** (SIC 2421, 2426) — Sawmills and planing mills; hardwood dimension and flooring mills.
10. **Millwork and Plywood** (SIC 2431, 2435-6) — Millwork; hardwood veneer and plywood; softwood veneer and plywood.
11. **Other Wood Products** (SIC 2434, 2439, 2441, 2448, 2449, 2452, 2491, 2492) — Wood kitchen cabinets; structural wood members; nailed wood boxes and shook; wood pallets and skids; wood containers; prefabricated wood buildings; wood preserving; particle board.
12. **Furniture and Fixtures** (SIC 25) — Household, office, public building, and restaurant furniture; office and store fixtures.
13. **Paper and Allied** (SIC 26) — Pulp, paper, and paperboard mills; miscellaneous paper products.
14. **Chemical and Allied** (SIC 28) — Chemicals and selected chemical products; plastics and synthetic materials; drugs, cleaning, and toilet preparations; paints and allied products.
15. **Rubber and Plastics** (SIC 30) — Rubber and miscellaneous plastic products.
16. **Primary Metals** (SIC 33) — Primary iron and steel manufacturing; primary nonferrous metals manufacturing.
17. **Fabricated metals** (SIC 34) — Metal containers; heating, plumbing, and fabricated structural metal products; screw machine products and stampings; other fabricated metal products.
18. **Machinery and Electric** (SIC 35, 36) — Farm, garden, construction, metal working, special industry, general industrial, and miscellaneous machinery and equipment; office, computing, accounting, and service industry machines; electrical transmission and distribution equipment and industrial apparatus; household appliances; electric lighting and wiring equipment; radio, TV, and communication equipment; electronic components and accessories; miscellaneous electrical machinery, equipment, and supplies.
19. **Transportation Equipment** (SIC 37, 2451) — Motor vehicles and equipment; ship and boat building and equipment; other transportation and equipment; mobile homes.
20. **Miscellaneous Manufacturing** (SIC 27, 29, 31, 32, 38, 39) — Printing and publishing; petroleum refining and related industries; leather and leather products; glass, stone, and clay products; watches, clocks, medical instruments, optical instruments and lenses; miscellaneous manufacturing and supplies.
21. **Wholesale and Retail** (SIC 50, 52, 58) — Wholesale trade; retail trade; eating and drinking places.
22. **Services** (SIC 70, 72, 73, 75, 76, 78-84, 86, 89) — Hotel and lodging places; personal care and repair services; business services; automobile repair and services; amusement; health services; professional services; educational services; social and non-profit organizations.
23. **Finance, Insurance, and Real Estate** (SIC 60, 65, 67) — Finance and insurance; real estate and rental.
24. **Transportation** (SIC 41, 44) — Transportation and warehousing.
25. **Communication and Utilities** (SIC 48, 49) — Communication, electrical, gas, water, sanitary services and supplies.

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[5] Adapted from Lee, 1986.

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