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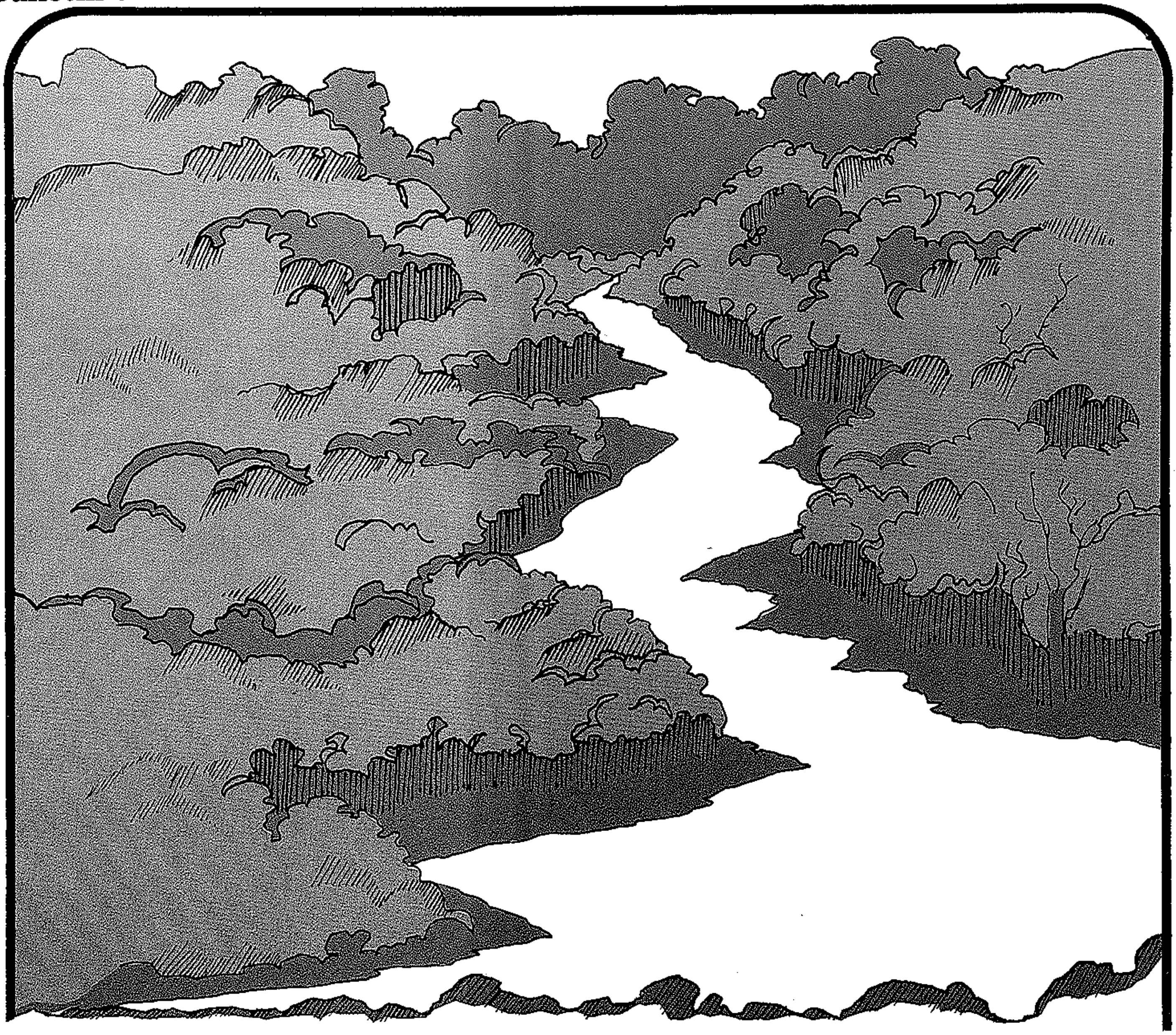

Stand-Age Analysis of Timber on Mississippi's Private, Nonindustrial Forests

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Summary & Conclusions

Most of the current pine timber acreage in Mississippi developed through the reversion of large acreages of agricultural cropland to forestry. Now that cropland retirement has ceased, management practices must provide for pine regeneration on existing forest lands. Harvesting practices that remove higher-valued pine timber from private, nonindustrial pine lands have created large acreages of poorly stocked, low quality hardwood stands.

Effective provision for softwood regeneration at the time of final harvest is essential to the future of the State's forest economy. Present rates of pine regeneration will not sustain present softwood production in Mississippi beyond the next 20 years.

There will be enough pine timber to satisfy the industrial wood requirements in Mississippi, at current consumption levels, through the year 2000 A. D. Private, nonindustrial landowners must contribute a large portion of this raw material requirement. Industrial expansion appears to be most attractive in the North Region where much more softwood is being grown than is being cut. Any sustained increases in the State's short-run softwood consumption, however, must result from increased production per acre through improved technology, management and utilization.

Poor regeneration on private, nonindustrial lands cut in the last 20 years may constrain softwood consumption by about the year 2000 A. D. Constrained future availability of pine timber and the forest industry's continued dependence on private, nonindustrial timber supplies provide a favorable outlook for today's forestry investments. Individuals often reject forestry investments because of the long time period, high time preference for money and uncertain stumpage prices. Landowners with pine stands less than 30 years old need to be encouraged to invest in cultural practices that will help produce more sawtimber at the turn of the century. Private, nonindustrial forests, as a productive resource, are vital to Mississippi's economy, and the outlook is bright for individuals with the foresight to invest now in future pine production.

Continuation of present pine regeneration trends on private, nonindustrial ownerships developed over the past 10 years will lead to a major reduction in pine forest types available for harvest after 2000-2010 A. D. The anticipated shortfall in Mississippi 20 to 30 years from now can be reduced if regeneration efforts are encouraged. The private, nonindustrial ownership group must double regeneration performance over the next decade. This goal can be accomplished only with a well coordinated cooperative effort on the part of all concerned groups, agencies, companies and professionals. Investments in forest industry development will not be undertaken without assurances that future raw material supplies will be adequate. Future raw material supplies in Mississippi will be determined to a large extent by regeneration accomplishments on private, nonindustrial ownerships.

Current public assistance programs are working, but these programs are restrained by limited budgets and manpower of the sponsoring agency. The current public assistance programs must be increased by 33% to guarantee a minimum of 400,000 acres of pine regeneration in the 1980s. Forest industries bear much responsibility for future softwood availability, and their management needs to consider the benefits possible from the increasing landowner assistance progams.

Stand-Age Analysis of Timber on Mississippi's Private, Nonindustrial Forests

Forestry dominates land use in Mississippi with 55% of the total land area classified as commercial forest, and 73% of this is in private, nonindustrial ownerships (Moak 1977). Therefore, private, nonindustrial forests must contribute a high proportion of future industrial wood requirements. This report focuses on the relationship of the present age distribution of Mississippi's softwood timber to the future availability of timber.

Stand-age profiles may be used to define the age-class distribution of an even-aged forest, with each age class represented by areas of equal productivity in an optimum regulated situation (Knight 1977). A balanced age-class distribution permits sustained harvest at a constant rate over time, but shortfalls and overages may occur because of changing economic circumstances. We present in this bulletin current stand-age profiles of Mississippi's forest resource as a guide to projecting potential problems in timber availability. The primary emphasis of the publication is on nonindustrial, private landowners and the forest resource base controlled by this group.

Highlights

Pine regeneration reached a high level in Mississippi in the early 1950s. Almost 1.2 million acres of pine on all ownerships is now between 20 and 29 years old. Pine regeneration, particularly on the private, nonindustrial ownerships, has declined by about 50% since the early 1950s, and less than 600 thousand acres of pine in Mississippi are in the less than 10 years-old age class (Figure 1a).

Private, nonindustrial owners control a major portion of Mississippi's valuable pine and oak-pine forest lands. Therefore, the state's future timber economy will be determined largely by the management and investment decisions of these forest landowners.

Stand-Age Profiles

Statewide Analysis

Stand-age profiles were developed for Mississippi to provide information on prospective softwood availability from private, nonindustrial forests over the next 30-40 years. The data were derived from 1977 Forest Survey plot summaries provided by the Southern Forest Experiment Station, U. S. Forest Service, New Orleans, Louisiana.

We define an ideal stand age distribution as equal acreages among stand-age classes up to a rotation age. Uniform age-class distributions permit a sustained allowable cut based on area control. Statewide differences in objectives, ownerships, species, sites, markets and other factors cause acreage variations among age classes, but general analyses of stand-age patterns provide an assessment of future softwood availability. This stand-age analysis of Mississippi's timberland provides particular insight because most of the State's timber stands are classified as even age[1] (Figure 1).

Statewide stand-age profiles are very unbalanced (Figure 1). Private, nonindustrial ownerships dominate nearly all age classes and forest types and contribute significantly to the uneven distribution below age 40. Age classes 20-29 and 30-39 years are consistently high regardless of forest

[1]*Even-aged stands defined by the USFS Forest Survey occur when 50% of the dominant and codominant trees are within a single 20 year age class.*

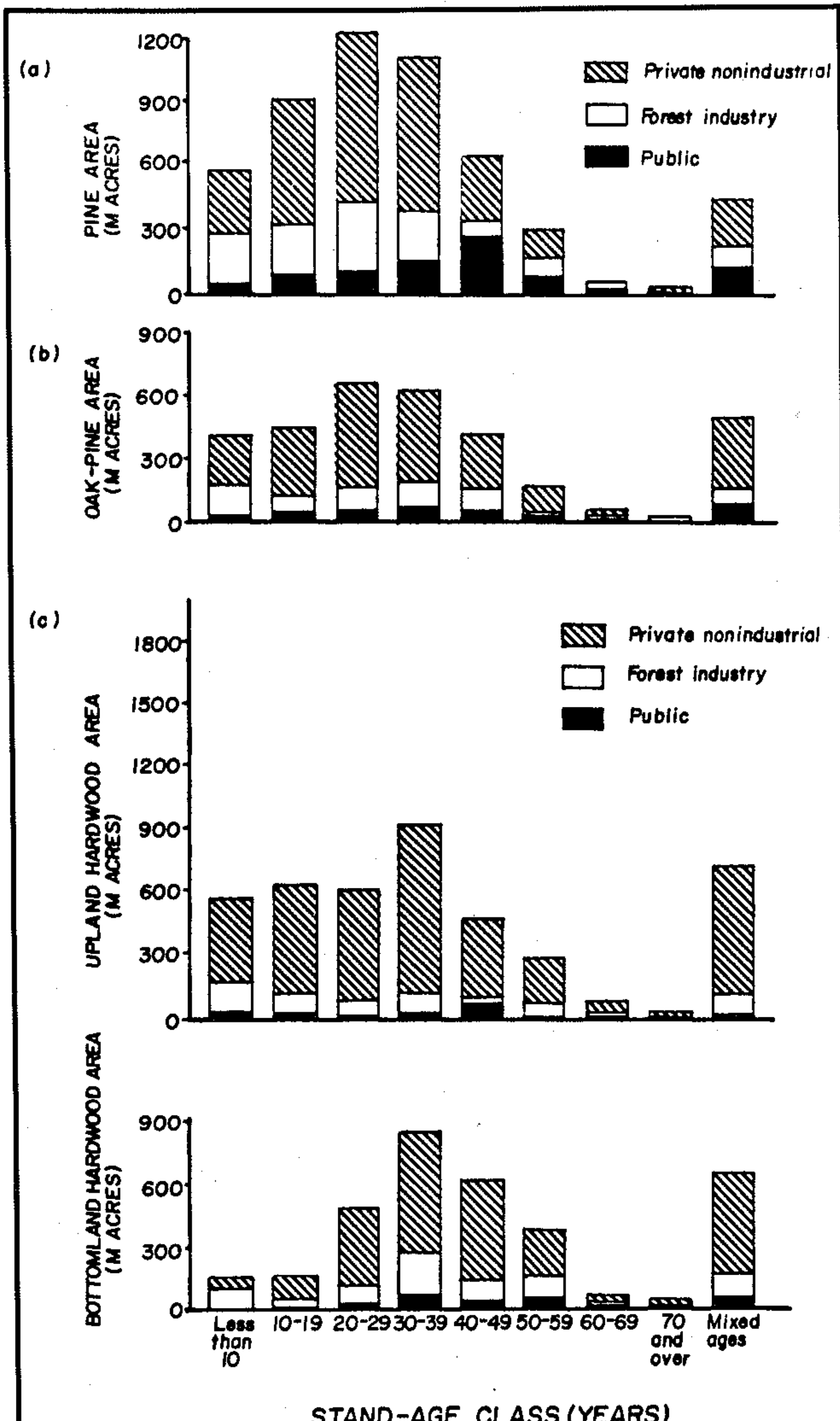

Figure 1. Area of commercial Forest Land in pine, oak-pine and hardwood forest types, by stand-age class and ownership class, Mississippi, 1977

type. This condition results primarily from the high rates of cropland retirement in Mississippi during the late 1940s and early 1950 s. The relatively low acreages in the older age classes indicate that much of the area that reverted to forestry more than 40 years ago has been harvested.

Age classes less than 10 and 10 to 19 years (Figure 1a) provide a measure of pine regeneration. Mississippi's forest industry is producing reasonably well-balanced age-class distributions of pine through regeneration efforts on industrial holdings, but this is not occurring on private, nonindustrial lands. Private, nonindustrial pine forest types include 811 M acres in the 20- to 29-years age class, 575 M acres in the 10- to 19-years age class and only 293 M acres in the less than 10-years age class. The smaller pine acreages in the younger age classes on private, nonindustrial lands have resulted from discontinued cropland retirement and post-harvest invasion of hardwoods on many pine sites harvested in the last 20 years. This hardwood encroachment has resulted in more uniform age-class distributions in the oak-pine and upland hardwood forest types (Figures 1b & c).

Most private, nonindustrial landowners have never perceived that investing in pine regeneration is to their economic self-interest (Boyce and Knight 1977). The southern pine timber available today occurs primarily because retired farmland seeded naturally from adjacent stands. Owners of these lands did not intentionally plan for Mississippi's present softwood resource but merely saw personal advantages from not farming. There have been no net additions of pine-regenerated acres to the forest land base since the discontinuation of cropland retirement about 15 to 20 years ago. As a result, only 9% of Mississippi's 3.2 million acres of private, nonindustrial pine forests is less than 10 years old. Many private, nonindustrial pine stands harvested in the last 20 years have reverted to poor quality, low value hardwoods. Consequently, future softwood supplies may be limited. Providing pine regeneration after harvest of pine lands is essential if Mississippi's current softwood production is to be maintained beyond the next 20 years.

The full impact of current state and federal assistance programs on private, nonindustrial reforestation is not reflected in Figure 1 because these programs were initiated only a few years before the 1977 Forest Survey. The Forest Incentives Program (FIP) and Mississippi's Forest Resource Development Program (FRDP) will have a significant impact on future pine age-class distributions at the present 30 M-acre annual rate of planting and seeding private, nonindustrial land. However, these programs will not create a balanced distribution at current levels of regeneration. Program accomplishments will have to increase 33% to guarantee 400,000 acres of pine regeneration in Mississippi during the 1980s.

Regional Analysis

The U. S. Forest Service divides Mississippi into five regions based on physical geography (Figure 2). Stand-age profiles for the Delta, North, Central, South and Southwest Regions are presented in Figures 3 to 7, respectively. The upland and bottomland hardwood forest types were analyzed as a single hardwood category in this study.

Delta Region---Pine and oak-pine forest types occupied a relatively small acreage in the region and are omitted from Figure 3. The total forested acreage in the Delta is diminishing over time, and smaller acreages in the younger age classes have resulted. This trend is expected to continue as harvested private, nonindustrial acreage is converted to agricultural use.

North Region---Private, nonindustrial ownership's dominate forest types and age classes in the region (Figure 4). A large proportion of the commercial forest land is in private, nonindustrial hardwoods. The relatively high proportion of private, nonindustrially owned pine growing stock reaching pulpwood and small sawlog ages may be the result of planting efforts on the Yazoo-Little Tallahatchie Watershed.

Central Region---Private, nonindustrial landowners control much of the acreage of merchantable-age stands (Figure 5). The stand-age profile (Figure 5a) indicates significant decreases in total pine area as

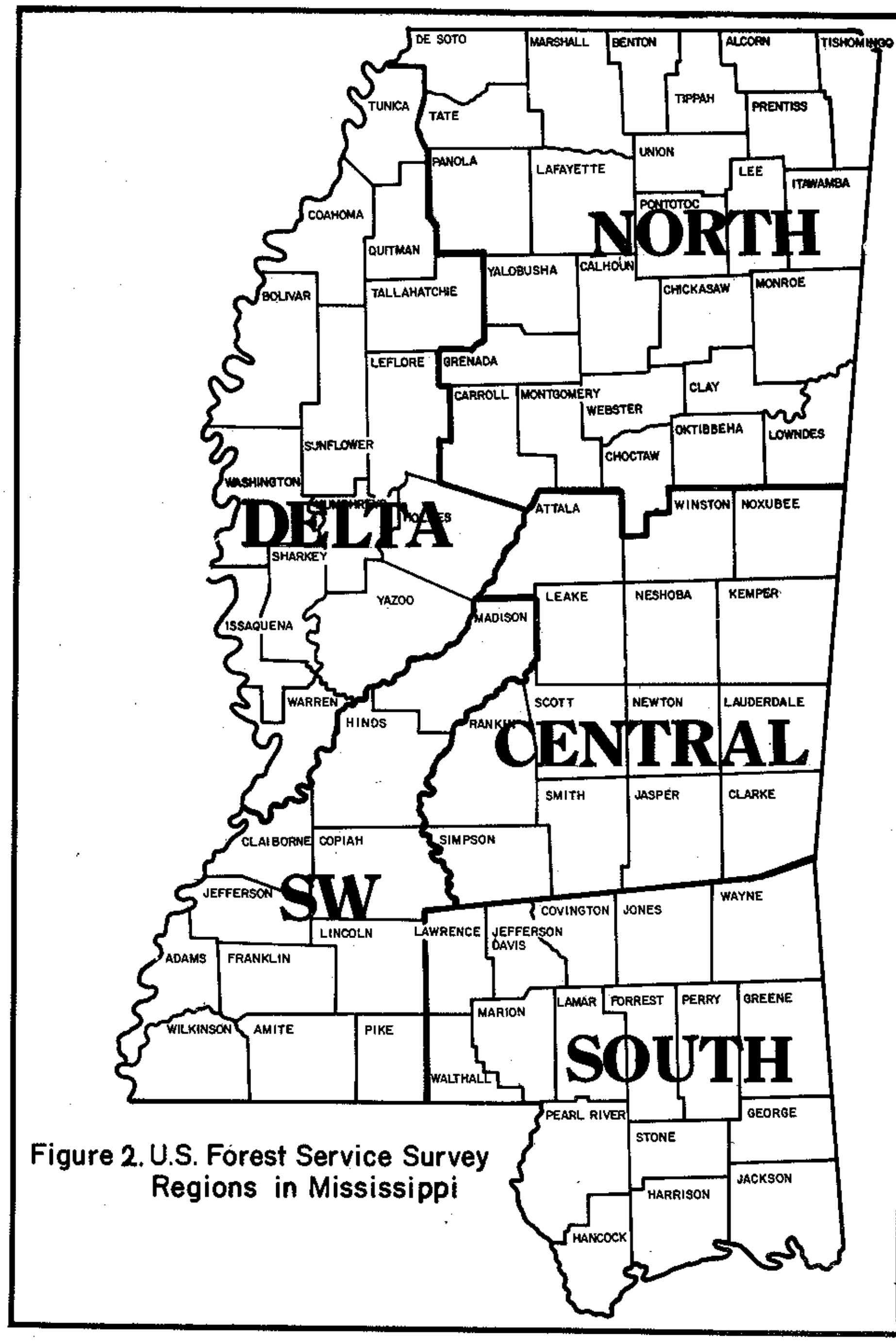

Figure 2. U.S. Forest Service Survey Regions in Mississippi

stand age decreases. The acreage decreases are due chiefly to private, nonindustrial timber-harvesting activity.

South Region---The region has a relatively lower proportion of oak-pine and hardwood forest types, irrespective of ownership class (Figure 6). The dominance of pine forest types over other forest types occurs across all age classes. Industry is less dependent on private, nonindustrial lands for softwood supply than in other regions. High industrial wood consumption and Hurricane Camille resulted in a softwood inventory increase of only 8% from 1967 to 1977 (Murphy 1978). Areas damaged by Hurricane Camille in 1969 have since been reforested, and age class is more balanced. More recent damage by Hurricane Frederick, not reflected in this analysis of 1977 data, may result in another imbalance between softwood growth and removals.

Southwest Region---This is geographically the smallest forest survey region in the state. A high proportion of the total forested area is in private, nonindustrial ownerships and covered with hardwood forest types. Future softwood availability becomes a problem in this region because of lower pine acreages in younger age classes, the proximity of high levels of industry activity and a high level of private, nonindustrial ownership.

All Regions---Several implications for the future may be drawn from the regional stand-age analyses. The Delta produces very little softwood material and is not expected to contribute significantly to future softwood requirements. The North Region has a high proportion of softwood growing stock reaching merchantable age and offers opportunities for industrial expansion. Two pulpmills will be constructed in this Region

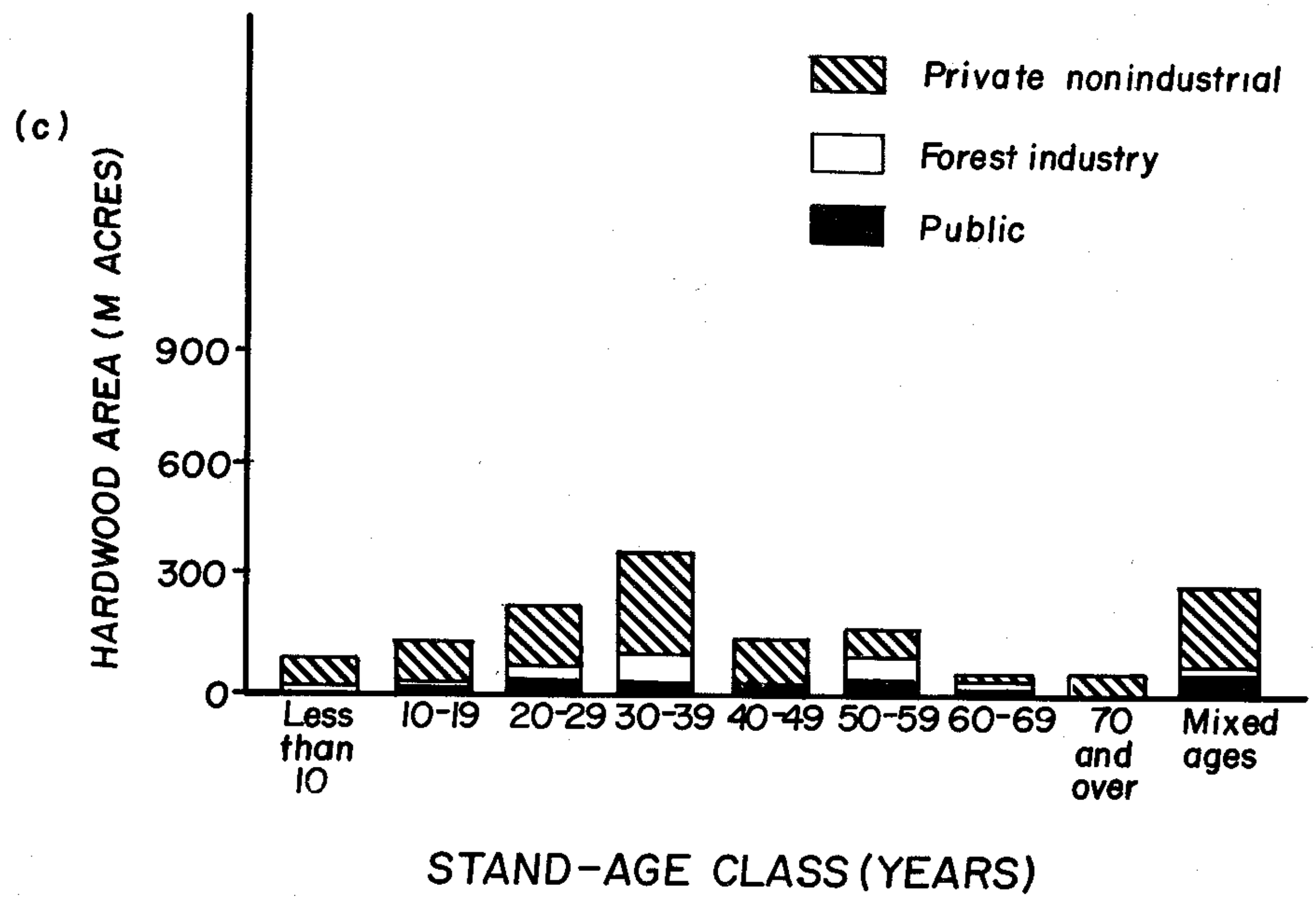

Figure 3. Area of commercial Forest Land in hardwood forest types, by stand-age class and ownership class, Delta Region, 1977

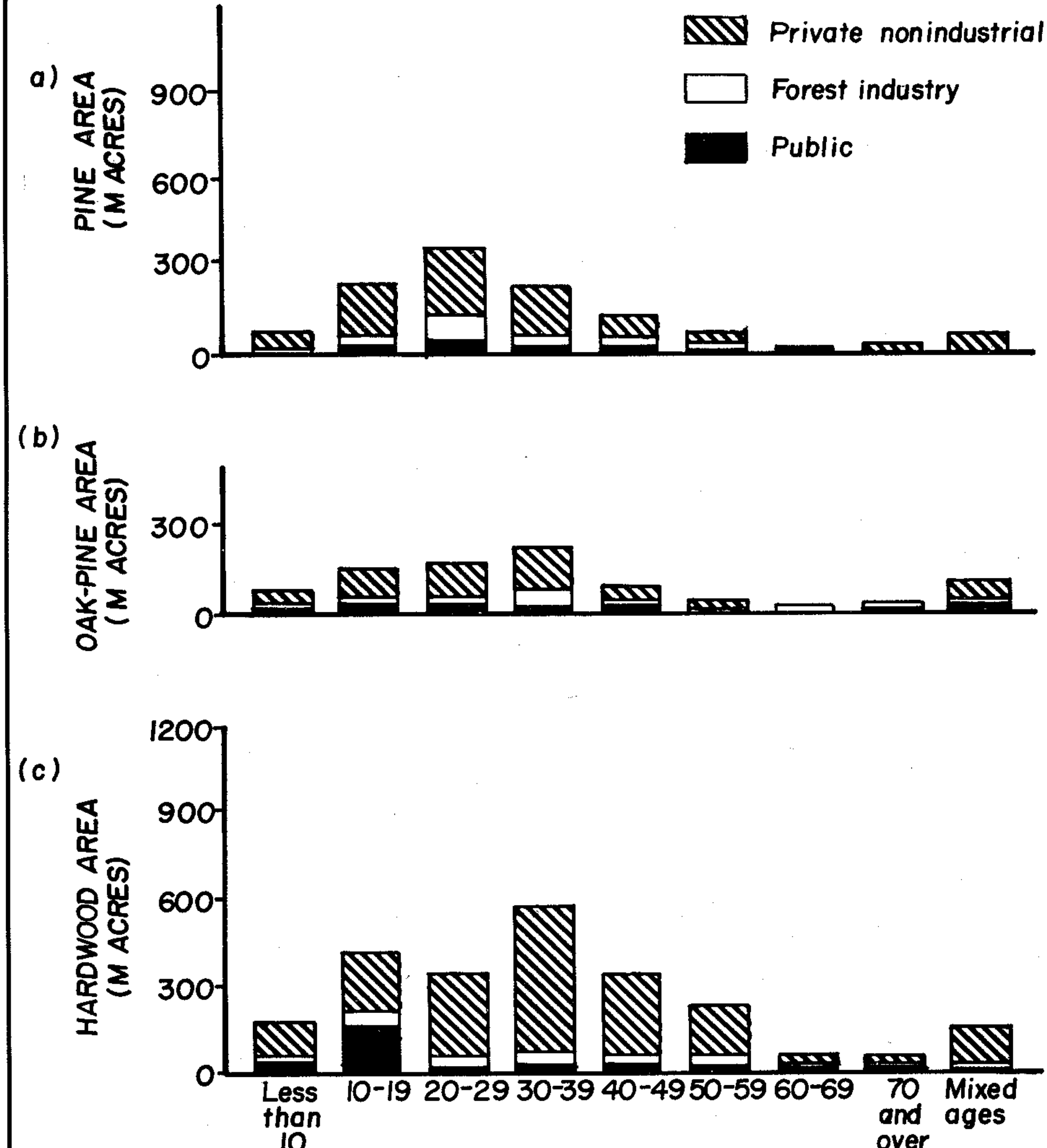

Figure 4. Area of commercial Forest Land in pine, oak pine, and hardwood forest types, by stand-age class and ownership class, North Region, 1977

during the 1980s. The North Region experienced a 78% net gain in softwood growing-stock volume from 1967 to 1977 (Murphy 1978). The Central and the North Regions offer many opportunities for increasing future softwood production. Both regions contain large acreages of private, nonindustrial upland hardwoods that could be converted to pine forest types. Industry in the Central Region will be able to sustain harvests from company lands, but competition for private, nonindustrial softwoods will increase as future supplies become more restricted. Improving forest management will become more attractive to individual landowners as their resource becomes more valuable and markets improve.

The stand-age distribution of softwoods in the South Region is nearly balanced. Future expansion by the forest industry in the region does not appear likely without

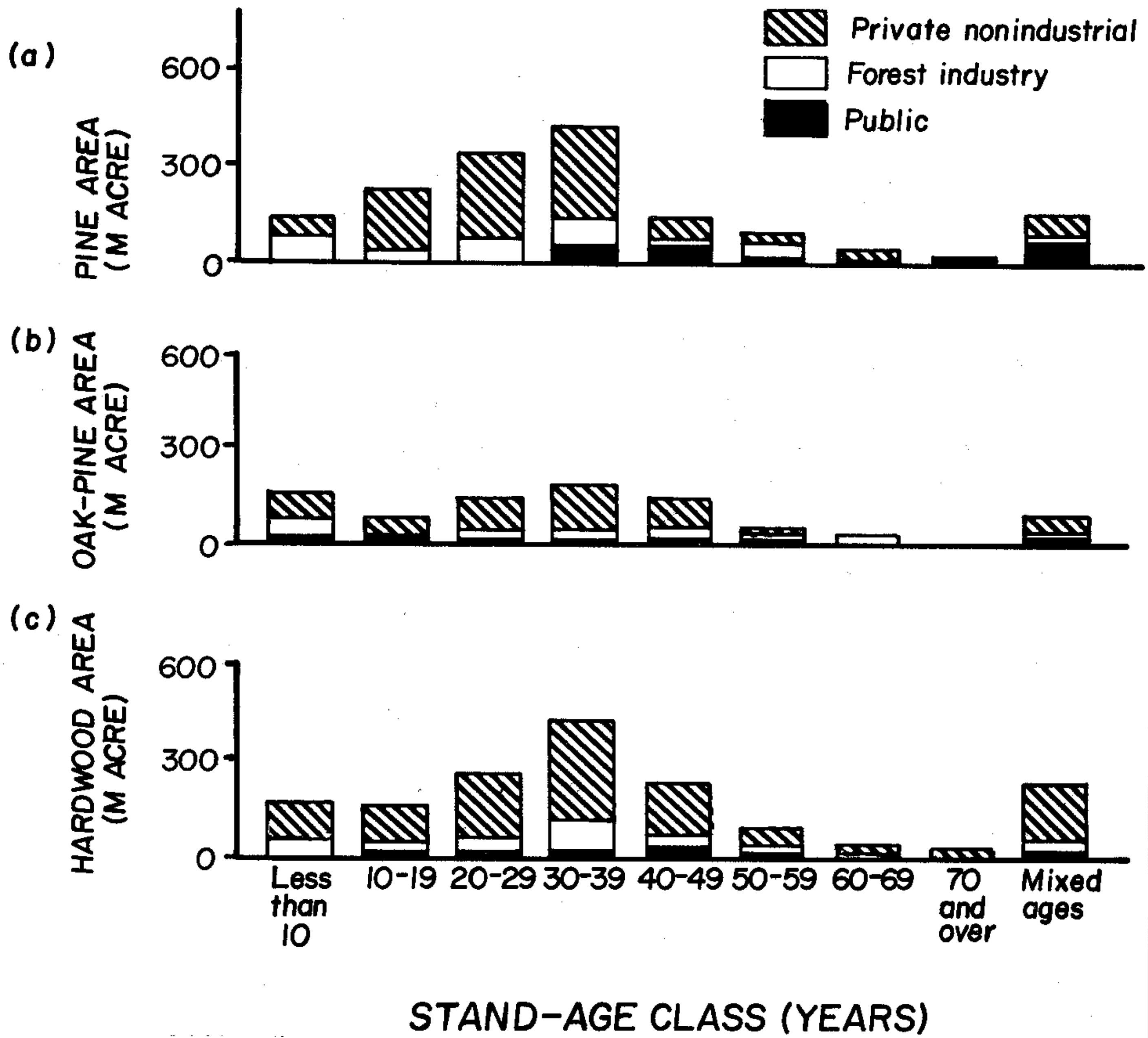

Figure 5. Area of commercial Forest Land in pine, oak pine, and hardwood forest types, by stand-age class and ownership class, Central Region, 1977.

technological advances because growth and removals are nearly equal.

The forest industry in the Southwest Region harvested 60% more pine sawtimber from company lands than was grown in 1976 (Murphy 1978), and the high proportion of private, nonindustrial lands must contribute an increasing share of future requirements. Favorable conditions for improving forest management on private, nonindustrial lands will result from the increased competition for softwood in the Region.

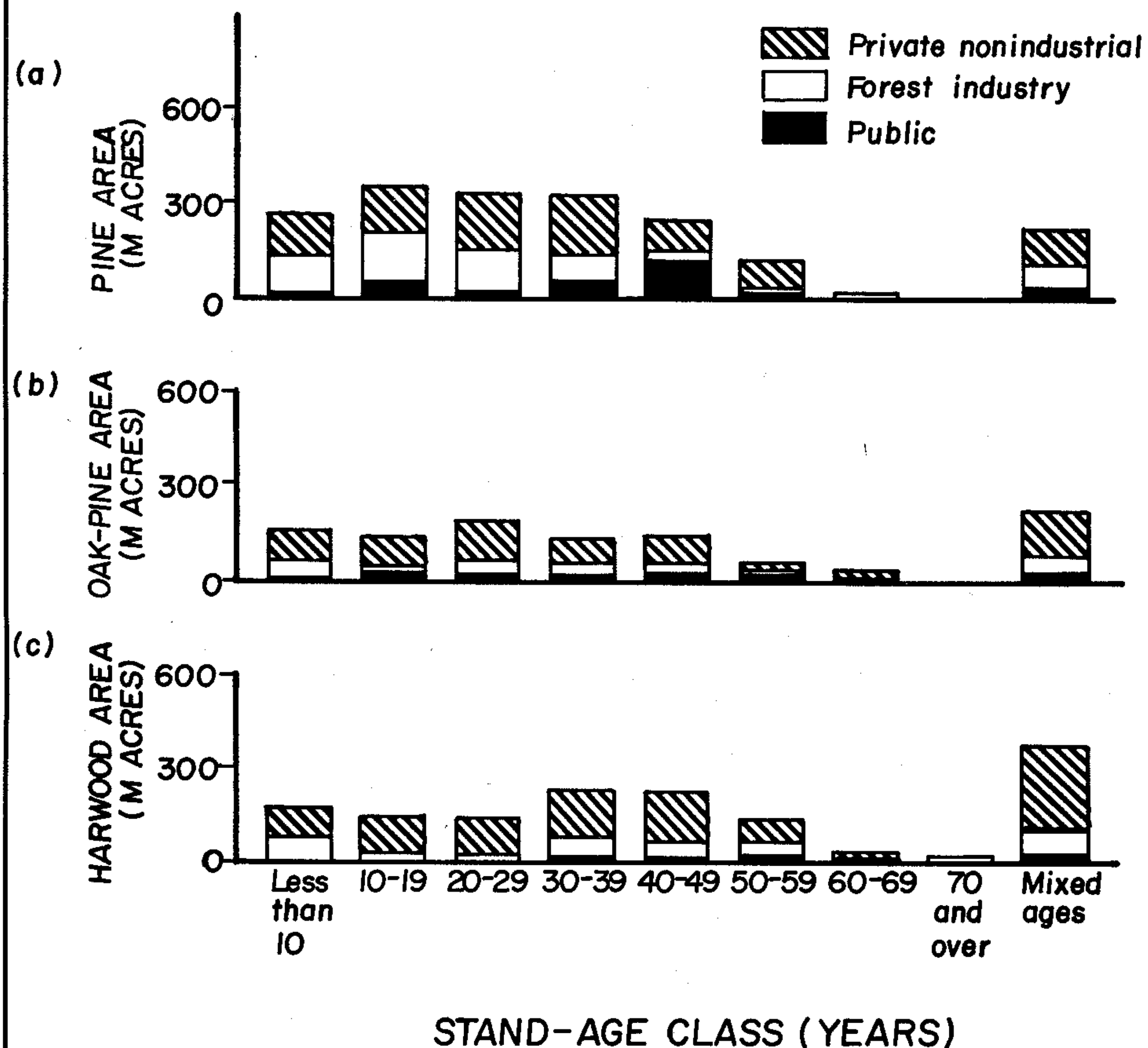

Figure 6. Area of commercial Forest Land in pine, oak-pine, and hardwood forest types, by stand-age class and ownership class, South Region. 1977

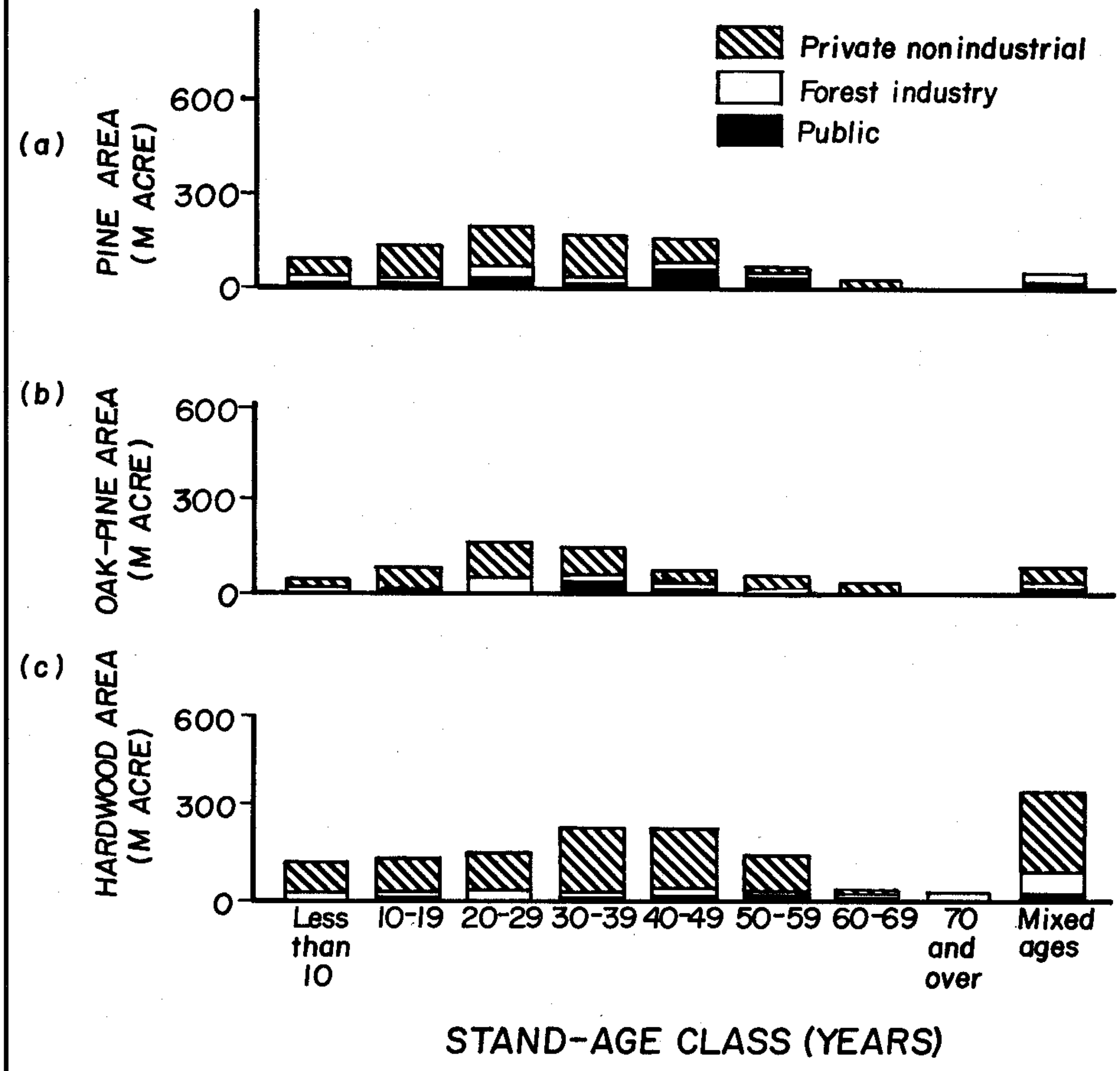

Figure 7. Area of commercial Forest Land in pine, oak pine, and hardwood forest types, by stand-age class and ownership class, Southwest Region, 1977.

Stand-Age Distribution by Site

Site quality determines the ability of an area to respond to forest management practices in both the short run and the long run. Distributions of acres of forest land by stand-age class for four forest types and three ownership groups are presented in Tables 1 and 2 for high and medium sites. High sites are considered to be capable of producing 120 cubic feet of wood per acre per year in fully stocked natural stands. Medium sites are capable of producing between 50 and 120 cubic feet. Low sites were not examined because fewer than 350 M acres in Mississippi were classed in the 1977 Forest Survey as incapable of producing at least 50 cubic feet of wood per acre per year.

Private, nonindustrial forests include 67% of the 3 MM acres classified as good site and 62% of the pine acreage on good sites. Only 5% of the private, nonindustrial pine area on good sites stocked in pine is in the less than 10-years age class while 31% is in the 30- to 39-years age class.

Industrial lands support a reasonably uniform age-class distribution of pine on medium sites, but private, nonindustrial lands do not (Table 2). However, both industrial and private, nonindustrial high-site lands support an unbalanced distribution of pine acres because of smaller acreages in the younger age classes (Table 1). More regeneration efforts need to be devoted to higher site lands. The better sites need a higher priority for harvesting and replanting because of their higher productive capacity.

Stand-Age Distribution of Volume

Average volumes of growing stock per acre on Mississippi's commercial forest land by ownership group, forest type and stand-age class are presented in Table 3. Growing stock levels of industrial and private, nonindustrial landowners are comparable for both pine and oak-pine forest types, but these groups are producing at only 60 and 56% of their productive potentials (Porterfield et al, 1978).

Total volume estimates were developed by adjusting average volume per acre by acreage. Estimated total volumes statewide are presented by stand-age classes for three ownership groups and four forest types (Table 4). Private, nonindustrial landowners control 59% of the estimated total pine volume.

An estimated 484.3 MMCF of pine were removed from Mississippi forests in 1976 (Murphy 1978). No significant shortfall in softwood supply is expected in the next 20 years, assuming the 1976 harvest level continues. However,

Table 1. Area of commercial forest land on good sites, by broad forest type and ownership group and by stand-age class, Mississippi, 1977.

Broad Forest Type and Ownership Class	All Classes	STAND-AGE-CLASS 10	10-19	20-29	30-39	40-49	50-59	60-69	70+	Mixed
	M ACRES									
PINE										
Public	158.1	-	7.0	-	40.0	52.6	12.8	16.3	5.6	23.8
Industry	180.4	12.9	23.8	37.5	51.8	-	37.2	-	-	17.2
PNI	549.6	28.8	102.7	150.7	168.1	41.7	11.3	-	6.6	39.7
Total	888.1	41.7	133.5	188.2	259.9	94.3	61.3	16.3	12.2	80.7
OAK-PINE										
Public	56.7	-	10.5	4.3	11.2	24.5	-	-	-	6.2
Industry	119.3	5.3	-	30.1	33.2	27.8	11.9	5.8	-	5.2
PNI	469.4	33.8	33.7	119.2	109.0	85.7	11.2	20.6	-	56.2
Total	645.4	39.1	44.2	153.6	153.4	138.0	23.1	26.4	-	67.6
UPLAND HWD.										
Public	38.2	-	5.2	5.7	-	10.9	10.8	-	-	5.6
Industry	96.8	23.7	12.3	18.5	21.6	6.3	-	-	-	14.4
PNI	447.9	59.1	45.9	66.6	108.5	62.1	19.9	25.1	-	60.7
Total	582.9	82.8	63.4	90.8	130.1	79.3	30.7	25.1	-	80.7
BOTTOMLAND HWD.										
Public	73.2	-	-	21.4	9.6	6.2	18.8	5.6	-	11.6
Industry	249.9	29.5	12.9	42.2	54.9	36.1	24.2	6.7	-	43.4
PNI	607.9	19.0	30.0	83.7	121.5	140.4	59.2	10.9	7.2	136.0
Total	931.0	48.5	42.9	147.3	186.0	182.7	102.2	23.2	7.2	191.0

younger stands with smaller stems will be harvested, and industry needs to prepare for processing smaller raw material.

Any substantial increases in short-run consumption will have to be achieved by increasing per acre output. Per acre outputs can be augumented through better use and through improved management and technology.

The pulpwood industry in the South is an example of how timber supply can be increased effectively by technological improvements. Production can be increased 10 to 15% by using tree-length harvesting and log transportation systems (Porterfield and von Segen 1976). Short-run availability also may be increased by per acre production gains obtained through thinning and timber stand improvement.

Table 2. Area of commercial forest land on medium sites, by broad forest type and ownership class and by stand-age class, Mississippi, 1977.

Broad Forest Type and Ownership Class	All Classes	STAND-AGE CLASS 10	10–19	20–29	30–39	40–49	50–59	60–69	70+	MIXED
	M ACRES									
PINE										
Public	610.5	22.0	63.3	80.4	102.7	194.8	53.1	9.6	5.4	79.2
Industry	1,123.0	221.5	218.1	284.3	177.9	79.5	44.8	-	-	96.9
PNI	2,531.5	241.8	466.3	635.9	570.3	281.3	125.1	13.2	7.0	190.6
Total	4,265.0	485.3	747.7	1,000.6	850.9	555.6	223.0	22.8	12.4	366.7
OAK-PINE										
Public	300.5	17.9	38.7	38.2	59.3	34.7	23.6	11.7	5.6	70.8
Industry	523.5	149.1	45.1	78.3	83.9	71.2	17.3	7.0	11.2	60.4
PNI	1,768.0	196.8	305.5	370.6	336.9	168.7	96.8	5.7	-	287.0
Total	2,592.0	363.8	389.3	487.1	480.1	274.6	137.7	24.4	16.8	418.2
UPLAND HWD.										
Public	164.8	17.9	17.8	6.2	29.8	48.9	-	5.6	16.7	21.9
Industry	466.1	123.7	69.1	49.4	62.9	17.9	58.7	9.8	-	74.6
PNI	3,021.7	338.3	450.4	451.3	661.4	340.6	201.7	35.7	10.7	531.6
Total	3,652.6	479.9	537.3	506.9	754.1	407.4	260.4	51.1	27.4	628.1
BOTTOMLAND HWD.										
Public	190.7	-	10.6	16.4	48.4	34.7	33.9	18.0	-	28.7
Industry	478.3	23.9	27.4	29.7	124.9	75.7	83.6	11.7	11.1	90.3
PNI	1,888.9	87.5	96.1	306.1	513.5	315.6	178.3	15.2	29.6	347.0
Total	2,557.9	111.4	134.1	352.2	686.8	426.0	295.8	44.9	40.7	466.0

Table 3. Average volume on commercial forest land, by broad ownership class and forest type and by stand-age class, Mississippi, 1977.

Broad Ownership and Forest Type	All Classes	STAND-AGE CLASS 10	10–19	20–29	30–39	40–49	50–59	60–69	70+	Mixed
	CUBIC FEET PER ACRE									
PUBLIC										
Pine	1918	232	626	1519	2179	2209	2343	2297	3073	2017
Oak-Pine	1457	693	835	927	1482	1971	1815	2197	2425	1646
Upland Hwd.	1390	361	888	1731	1234	1611	1858	2802	2165	1051
Bottomland Hwd.	1794	-	649	1585	1817	1807	1979	2434	-	1662
INDUSTRY										
Pine	1293	148	957	1552	1768	1941	2391	-	-	1424
Oak-Pine	1079	157	599	1108	1570	1786	2491	1765	932	1014
Upland Hwd.	878	182	408	682	1539	1240	1580	1076	-	1415
Bottomland Hwd	1569	329	1059	968	1484	2006	1914	2109	2086	1866
PRIVATE NONIND.										
Pine	1435	565	972	1508	1778	1901	1764	1653	1900	1410
Oak-Pine	1118	292	608	1068	1460	1624	1465	2948	-	1186
Upland Hwd.	1022	337	599	884	1248	1410	1537	1733	1984	1101
Bottomland Hwd	1399	278	501	1273	1525	1665	1685	1925	1349	1441

Table 4. Total volume on commercial forest land, by broad ownership class and forest type and by stand-age class, Mississippi, 1977.

Broad Ownership class and forest type	All Classes	10	10–19	20–29	30–39	40–49	50–59	60–69	70+	Mixed
	STAND-AGE CLASS (MMCF)									
PUBLIC										
Pine	1,511.0	6.6	47.7	131.0	311.0	558.1	154.4	71.6	22.8	207.8
Oak-Pine	522.8	12.4	41.1	39.4	104.5	116.7	42.8	25.7	13.5	126.7
Upland Hwd.	281.4	6.5	20.5	20.6	36.8	96.2	20.1	15.6	36.2	28.9
Bottomland Hwd.	465.1	-	6.9	59.8	105.4	74.0	104.3	57.3	-	57.4
Total	2,780.3	25.5	116.2	250.8	557.7	845.0	321.6	170.2	72.5	420.8
INDUSTRY										
Pine	1,716.4	34.8	242.4	507.7	406.0	154.4	208.6	-	-	162.5
Oak-Pine	742.9	25.1	31.2	132.8	192.3	176.8	73.0	22.4	10.4	78.9
Upland Hwd.	498.2	26.9	35.7	46.3	130.0	30.0	92.8	10.6	-	125.9
Bottomland Hwd	1,097.5	17.6	42.7	59.3	259.0	212.7	195.1	38.7	23.1	249.3
Total	4,055.0	104.4	352.0	746.1	987.3	573.9	569.5	71.7	33.5	616.6
PRIVATE NONIND.										
Pine	4,476.2	115.5	558.8	1,222.9	1,323.5	614.1	253.6	21.8	25.8	340.2
Oak-Pine	2,545.8	67.3	213.3	534.3	651.1	421.7	167.2	77.6	-	413.3
Upland Hwd.	3,634.6	140.0	300.2	462.6	1,008.9	587.3	350.6	105.5	21.2	658.3
Bottomland Hwd	3,441.7	24.2	69.0	482.2	927.8	750.1	400.1	50.2	49.6	688.5
Total	14,098.3	347.0	1,141.3	2,702.0	3,911.3	2,373.2	1,171.5	255.1	96.6	2,100.3

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