POTENTIAL TIMBER SUPPLIES AND FOREST INDUSTRIAL DEVELOPMENT IN THE

Southeast River Basins

Prepared by the
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PREFACE

This report has been prepared by the Forest Service, United States Department of Agriculture, in response to a request of the U. S. Study Commission, Southeast River Basins. It presents:

1. Background information on the present forest resource situation and forest industries in the study area pertinent to the development of growth projections.

2. Projections of potential growth and the character of the timber that might be achieved in the Southeast River Basins by 1975 and 2000 under alternative management assumptions, including a comparison with the growth needed to supply a reasonable share of potential national demands for timber.

3. Projections of the potential growth of forest industries measured in terms of employment, payrolls, and value added by manufacture that could be supported in the Southeast River Basins by the timber growth achieved under the alternative management assumptions.

All data on forest resources have been compiled from Forest Survey records of the Southeastern and Southern Forest Experiment Stations. Data on output of timber products and on forest industries represent Forest Service estimates based on Bureau of the Census publications and Forest Service surveys.

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FOREST LAND AREAS

The Southeast River Basins is a 90,000 square mile area comprised of the 8 major river basins shown in figure 1. These basins include most of Georgia and small adjoining areas in North Carolina, South Carolina, Alabama, and northern Florida.

Commercial forest lands capable of producing commercial crops of timber cover some 38 million acres, or two-thirds of the Basins total area. There are some additional small areas of poorly drained forest land along the gulf coast and some forests in parks, but these comprise a negligible proportion of the total forest area. There are substantial areas of commercial forest land in all of the eight river basins (table 1).

Pine types cover nearly 21 million acres, or 55 percent of the total forest area (table 1). Bottom-land and upland hardwood types comprise 37 percent of the total area, and oak-pine types 8 percent.

Commercial forest lands in the Basins cut across three major geographic provinces--the Coastal Plain, the Piedmont and the Mountain. Each province has differences in soils and climate that affect the timber growing potential, including the species of trees that can be grown, their quality, and rates of growth.

Coastal Plain forests

The Coastal Plain is by far the most important province, both in area and inherent timber growth capacity. It contains about three-quarters of the forest area in the Southeast River Basins, mainly in uplands (table 2). These uplands include the flat sandy plains, locally called flatwoods, which extend up to 100 miles inland from the coast and mainly support longleaf pine on the drier sites and slash pine on the moisture sites. These flatwoods gradually give way to gently rolling uplands with heavier soils and with loblolly pine the dominant softwood.

About half of the upland area in the Coastal Plain is rated good timber growing site capable of producing more than 85 cubic feet of timber annually. About one-third is rated as fair site capable of producing between 50 and 85 cubic feet of timber annually. Less than 20 percent is considered poor timber-growing land capable of producing less than 50 cubic feet of timber a year. These poor sites include sandhill areas, largely in west Florida, which support sparse stands of short slow-growing longleaf pines usually in mixture with scrub oak, and poorly drained areas supporting pond pine often with a heavy shrub cover. Areas by site class and river basin are shown in appendix table 22.

Nearly all of the bottom lands are rated fair or good hardwood growing sites. The comparatively small area of poor site quality is largely made up of small ponds scattered throughout the Coastal Plain and supporting stands of slow-growing cypress and blackgum or dense shrub cover.

Pine types in the Coastal Plain comprise 56 percent of the commercial forest land (table 3). Another 7 percent of the area is oak-pine type in which pines make up between 25 and 49 percent of the tree cover. In the absence of special measures to discourage the hardwoods and favor the pine, these areas usually revert to hardwoods. Upland hardwoods predominate on another 13 percent of the Coastal Plain, largely on sandhill sites where longleaf pine has been cut out and scrub oak has occupied the land.

The remaining 24 percent of the forest land in the Coastal Plain, largely in strips along the major rivers, is in bottom-land hardwoods. These areas are subject to frequent flooding and are better suited to growing hardwoods and cypress than pine. Cypress and highly prized black, tupelo, and sweet gums make up an important part of the bottom-land stands. Less valuable water oaks are also abundant in these stands and tend to become the dominant species following the cutting of the more valuable gums and cypress.

SOUTHEAST RIVER BASINS STUDY AREA

FIGURE 1

TABLE 1.--Area of commercial forest land in the Southeast River Basins, by forest type groups and river basins, 1960

River basin	Total area	Forest type group			
		Pine	Oak-pine	Upland hardwoods	Bottom-land hardwoods
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Savannah	4,728	2,274	447	1,253	754
Ogeechee	2,135	1,135	185	229	586
Altamaha-Ocmulgee-Oconee	5,953	3,549	551	675	1,178
Satilla-St. Marys-Nassau	2,674	1,922	128	138	486
Suwannee	4,842	2,738	203	479	1,422
Ochlockonee-St. Marks	3,291	1,645	209	430	1,007
Apalachicola-Chattahoochee-Flint	7,719	3,973	738	1,669	1,339
Perdido-Escambia-Conecuh-Choctawhatchee	6,721	3,714	497	1,500	1,010
Total	38,063	20,950	2,958	6,373	7,782

Source: Forest Service, U.S. Department of Agriculture.

Piedmont forests

The Piedmont includes some 22 percent of the commercial forest land in the Southeast River Basins. About nine-tenths of the Piedmont area is uplands with smaller areas in tongues of bottom lands extending up from the Coastal Plains. Growth potential in the Piedmont is somewhat lower than in the Coastal Plain with 45 percent of the Piedmont rated good site. These good sites are mainly in the lower Piedmont where loblolly pine predominates. Northward through the Piedmont site quality decreases and shortleaf pine and Virginia pine are the predominant softwoods.

Mountain forests

The mountain portion of the Basins area contains less than 2 percent of the commercial forest land in the area. Sites in general are not as productive as in the Piedmont and are less suited to growing pine. Hardwoods are the natural cover over most of this area, although pine types occupy many of the thin-soiled ridgetops, southern slopes, and recently abandoned farm land on the lower slopes and valleys.

Stocking of forest land

At the present time the productive capacity of commercial forest lands in the Southeast River Basins is far from being utilized. A long history of cutting, fire, and poor management practices has resulted in timber stands that are understocked and generally of poor quality.

Trees qualifying as growing stock occupy about half of the commercial forest area (table 4). Cull trees, mostly hardwoods, occupy another 12 percent of the forest area. Much of the remaining forest area is occupied by shrubs or other cover that in varying degree deters the establishment of desirable trees.

Distribution of forest areas by stocking classes is shown in appendix table 23. About 19.3 million acres of commercial forest land in the Basins are relatively well stocked, i.e., with more than 70 percent stocking of growing stock trees. On the other extreme, about 3.6 million acres are essentially without any stocking of growing stock

TABLE 2. --Area of commercial forest land in the Southeast River Basins, by site classes, province and physiographic area, 1960

Province and physiographic area	Total	Site classes		
		Good[1]	Fair[2]	Poor[3]
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*
Coastal Plain:				
Uplands (includes flatwoods)	22,147	11,114	7,068	3,965
Bottom lands	7,010	2,021	4,202	787
Total	29,157	13,135	11,270	4,752
Piedmont:				
Uplands	7,443	3,303	3,018	1,122
Bottom lands	772	396	357	19
Total	8,215	3,699	3,375	1,141
Mountain:				
Uplands	691	219	344	128
Total:				
Uplands	30,281	14,636	10,430	5,215
Bottom lands	7,782	2,417	4,559	806
Total	38,063	17,053	14,989	6,021

[1] Sites capable of producing 85 or more cubic feet per acre annually.
[2] Sites capable of producing 50 to 85 cubic feet per acre annually.
[3] Sites capable of producing less than 50 cubic feet per acre annually.

Source: Forest Service, U.S. Department of Agriculture.

TABLE 3. --Area of commercial forest land in the Southeast River Basins, by physiographic area, forest type groups, and province, 1960

Province	Total area	Uplands				Bottom lands
		Total	Forest type group			
			Pine	Oak-pine	Hardwoods	
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Coastal Plain (includes flatwoods)	29,157	22,147	16,185	2,078	3,884	7,010
Piedmont	8,215	7,443	4,560	769	2,114	772
Mountain	691	691	205	111	375	0
Total	38,063	30,281	20,950	2,958	6,373	7,782

Source: Forest Service, U.S. Department of Agriculture.

TABLE 4. --Percent of stocking of commercial forest land in the Southeast River Basins, by physiographic area and site classes, 1960

Physiographic area and site class	Stocking		
	Growing stock[1]	Cull trees	Other[2]
	Percent	*Percent*	*Percent*
Uplands (includes flatwoods):			
Good[3]	61	9	30
Fair[4]	38	10	52
Poor[5]	21	10	69
Bottom lands:			
Good[3]	76	24	0
Fair[4]	51	24	25
Poor[5]	31	26	43
All areas	49	12	39

[1] Percent stocking of free growing trees, including softwood seedlings and hardwood saplings.
[2] Nonforest cover such as shrubs, rocks, and water areas less than 1 acre in size.
[3] Sites capable of producing 85 or more cubic feet per acre annually.
[4] Sites capable of producing 50 to 85 cubic feet per acre annually.
[5] Sites capable of producing less than 50 cubic feet per acre annually.

Source: Forest Service, U.S. Department of Agriculture.

trees. On these areas site preparation and planting ordinarily will be required to restore the land to productive condition. Areas 10 to 40 percent stocked make up 7.1 million acres and much of this area requires some interplanting or conversion cutting and planting if it is to be made productive in the foreseeable future. Areas 40-70 percent stocked total 8 million acres, and some treatment also will be required to increase stocking on these lands.

The good sites are better stocked with growing stock trees and have a smaller proportion of cull trees than the poorer sites (table 4). Bottom-land sites also, in general, are somewhat better stocked than the uplands. Although good pine sites are somewhat better stocked than poor sites, they respond more readily to efforts to increase stocking; support a larger number of stems per acre; and produce trees that are taller, contain less defect, and grow faster than those on poor sites. Hence management measures generally have highest productivity on the higher sites.

Even under intensive management it would not be possible to achieve complete stocking over extensive forest areas since some part of the forest area, such as small bodies of water, would not be stockable, while other areas would be temporarily nonstocked as a result of cutting, mortality, or presence of competing vegetation. The extent to which stocking could be increased is not known, but as much as 90 percent stocking might be attained.

Forest-land ownership

About two-thirds of the commercial forest land in the Basins area is owned by farmers and other nonindustrial forest owners (table 5). Most of this area is in relatively small tracts owned by thousands of individual owners. Nearly a quarter of the total area is in tracts owned by pulp companies and other forest industries. About 9 percent is publicly owned, largely in national forests.

TABLE 5.--Area of commercial forest land in the Southeast River Basins, by physiographic areas, ownership classes, and river basins, 1960

River basin	Total area	Uplands and flatwoods				Bottom lands			
		Total	Ownership class			Total	Ownership class		
			Public	Forest industry	Other private		Public	Forest industry	Other private
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Savannah	4,728	3,974	674	423	2,877	754	75	135	544
Ogeechee	2,135	1,549	192	348	1,009	586	39	140	407
Altamaha-Ocmulgee-Oconee	5,953	4,775	177	833	3,765	1,178	13	280	885
Satilla-St. Marys-Nassau	2,674	2,188	32	793	1,363	486	13	215	258
Suwannee	4,842	3,420	260	1,153	2,007	1,422	254	409	759
Ochlockonee-St. Marks	3,291	2,284	375	1,047	862	1,007	121	508	378
Apalachicola-Chattahoochee-Flint	7,719	6,380	342	866	5,172	1,339	57	217	1,065
Perdido-Escambia-Conecuh-Choctawhatchee	6,721	5,711	754	1,395	3,562	1,010	80	157	773
Total	38,063	30,281	2,806	6,858	20,617	7,782	652	2,061	5,069

Source: Forest Service, U.S. Department of Agriculture.

Trends in forest area

Beginning in colonial times and continuing through the early 1900's there was a steady decline in forest areas in the Basins, as well as in other parts of the United States, as land was cleared for farms and other uses. In the last few decades this trend has been reversed and the areas reverting to forests have exceeded the areas cleared. In recent years, however, this trend appears to have been slowing down.

Currently in southwest Georgia land clearing appears to be just about offsetting conversions to forests. Forest areas are decreasing in north Florida but this has been more than offset by increases in Southeast Georgia and the Piedmont areas in all Basin states. During the past 10 years the net effect of these changes has been an increase of 3 percent in the forest area in the Basins (table 6).

The changes in areas by forest type have been of larger significance in recent decades. Since 1950, for example, pine and oak-pine types in the Basins area decreased by 2.2 million acres, or 8 percent, while the area of upland hardwood types increased 3.2 million acres, or 98 percent.

These changes have not been associated with a reduction in pine growth, however, since the reductions in area of pine types were more than offset by increases in pine stocking on the areas remaining in pine and oak-pine types. The average stocking of pine in these types increased from about 40 percent in 1950 to 50 percent in 1960. Moreover, much of the shift from pine to hardwood types took place on land least suited to growing pine, mainly on the good north slope sites in the Piedmont where maintenance of pine is very difficult in the face of prolific growth of hardwoods, and the sandhill scrub oak areas where sites are low and pine is difficult to establish.

With respect to future trends in forest areas in the Basins it seems probable that there will be relatively little net change in the near future. Estimates of the U.S. Department of Agriculture, State and Local Committees for the National Inventory of Soil and Water Conservation Needs, for example, forecast a gain of about 1 percent in forest area in the Basins by 1975.

By the year 2000, on the other hand, it is possible that fairly substantial areas in the Basins might be converted to agricultural or other uses. Projections in a recent study of the U.S. Department of Agriculture[1] indicated that over the next four decades--depending on the population projection used--up to 106 million acres of the Nation's forest land might be converted to agricultural and other uses. As the Nation's population grows and demands for land for agriculture, urban areas, reservoirs, highways,

TABLE 6.--Area of commercial forest land in the Southeast River Basins, by physiographic area and forest type groups, 1950 and 1960

Physiographic area and forest type group	1950	1960	Change
	Thousand acres	*Thousand acres*	*Percent*
Uplands and flatwoods:			
Pine and oak-pine types	26,090	23,908	-8
Hardwood type	3,213	6,373	+98
All types	29,303	30,281	+3
Bottom lands	7,782	7,782	0
Total forest area	37,085	38,063	+3

Source: Forest Service, U.S. Department of Agriculture.

[1] U.S. Senate Select Committee on National Water Resources. Water Resources Activities in the United States, Land and Water Potentials and Future Requirements for Water. Committee Print No. 12, 1959.

recreation, and other purposes rise, there will inevitably be increasing competition for land now devoted to timber growing. The extent of losses of forest land to these other uses in the Southeast River Basins area is far from certain, however. Hence for the purposes of this report projections of future timber growth have been made assuming no change in the present area of forest lands.

The information on forest areas and growth rates per acre for different classes of forest land included in this report will provide a basis for adjustment of these growth projections if the Commission adopts other assumptions on forest land area in the Basins.

TIMBER VOLUMES

The volume of growing stock in the Southeast River Basins, i.e., the volume of trees of acceptable quality 5.0 inches and above in diameter and suitable now or potentially for saw logs is 20.6 billion cubic feet (table 7). This includes 12.3 billion cubic feet of

TABLE 7.--Volume of timber on commercial forest land in the Southeast River Basins, by kinds of timber and softwoods and hardwoods, 1950 and 1960

Kind of timber	1950	1960	Change
Sawtimber:			
Small:	*Million bd. ft.*	*Million bd. ft.*	*Percent*
Softwoods	27,606	30,145	+9
Hardwoods	9,684	10,250	+6
Total	37,290	40,395	+8
Large:			
Softwoods	11,192	7,235	-35
Hardwoods	13,618	12,129	-11
Total	24,810	19,364	-22
Total:			
Softwoods	38,798	37,380	-4
Hardwoods	23,302	22,379	-4
Total	62,100	59,759	-4
Growing stock:	*Million cu. ft.*	*Million cu. ft.*	*Percent*
Softwoods	11,876	12,329	+4
Hardwoods	7,949	8,295	+4
Total	19,825	20,624	+4
Cull timber:			
Softwoods	954	890	-7
Hardwoods	2,755	3,702	+34
Total	3,709	4,592	+24
All timber:			
Softwoods	12,830	13,219	+3
Hardwoods	10,704	11,997	+12
Total	23,534	25,216	+7

Source: Forest Service, U.S. Department of Agriculture.

softwoods and 8.3 billion cubic feet of hardwoods. Volumes by river basins are shown in appendix tables 24 and 25.

About 33 percent of the softwood growing stock volume is in poletimber trees, i.e., trees 5.0 to 9.0 inches d.b.h. The volume of softwood timber large enough and of good enough quality to make saw logs is 37.4 billion board feet. Only 19 percent of this volume is in large sawtimber trees, i.e., 15.0 inches in diameter and larger.

About 41 percent of the hardwood growing stock is in poletimber trees from 5.0 to 11.0 inches. The total volume of hardwood sawtimber is 22.4 billion board feet of which 54 percent is in trees 15.0 inches in diameter and larger.

Between 1950 and 1960, the total volume of both softwood and hardwood growing stock in the Basins area increased 4 percent, while volumes of sawtimber decreased 4 percent (table 7). The drop in sawtimber volume was a result of a 22 percent over-cut of large sawtimber trees, since the volume of small sawtimber trees increased 8 percent in this period. Thus the most important effect of changes in timber volume has been to reduce the average size and quality of the timber inventory.

Volumes of cull trees in 1960 amounted to 3.7 billion cubic feet of hardwoods and 0.9 billion cubic feet of softwoods. Together, these amounted to the equivalent of 22 percent of the volume of growing stock. During the decade 1950-60 hardwood cull tree volumes increased 34 percent while softwood cull tree volumes dropped 7 percent.

TIMBER GROWTH AND CUT

Net growth of softwood growing stock in the Basins in 1960 was 0.9 billion cubic feet (roughly 12.8 million cords), or 5 percent more than the cut (table 8). There was a substantial growth deficit for large sawtimber, but a surplus of growth over cut for small softwood sawtimber and for poletimber. About 94 percent of the softwood growth was southern pine and 6 percent cypress.

Growth of hardwood growing stock amounted to 0.4 billion cubic feet or 29 percent more than the cut. Growth of hardwood sawtimber was 1.2 billion board feet, or 16 percent more than the cut. Growth exceeded cut of hardwoods for both large and small sawtimber even though 70 percent of the hardwood sawtimber cut was large sawtimber. Size is of particular importance in hardwoods because most hardwood-using plants depend on large high-quality logs.

Mortality

The volume of trees dying annually from natural causes amounted to an estimated 184 million cubic feet in 1960, including 117 million cubic feet of softwoods and 67 million cubic feet of hardwoods (table 8). This represented a loss of 11 percent of the gross softwood growth and 15 percent of the gross hardwood growth.

The most common cause of mortality reported by the Forest Survey was natural suppression, although fire, insects, and diseases also resulted in significant losses. It is thus evident that there is an appreciable opportunity to increase growth through such measures as better protection and thinning, as well as through the recapture of areas now occupied by cull trees and competing vegetation.

Growth by sites

The better sites in the Southeast River Basins are producing by far the greater share of the current growth (table 9). Nearly two-thirds of the total growth of timber is

TABLE 8.--Net growth, mortality, and cut of timber on commercial forest land in the Southeast River Basins, by kinds of timber and softwoods and hardwoods, 1960

Kind of timber	Net growth	Mortality	Timber cut	Growth-cut ratio
Sawtimber:				
Small:	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Percent*
Softwoods	2,253	285	2,021	111
Hardwoods	437	74	309	141
Total	2,690	359	2,330	115
Large:				
Softwoods	920	116	1,315	70
Hardwoods	724	123	688	105
Total	1,644	239	2,003	82
Total:				
Softwoods	3,173	401	3,336	95
Hardwoods	1,161	197	997	116
Total	4,334	598	4,333	100
Growing stock:	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Percent*
Softwoods	921	117	881	105
Hardwoods	395	67	306	129
Total	1,316	184	1,187	111

Source: Forest Service, U.S. Department of Agriculture.

on that 45 percent of the forest area that is classified as "good" site. This is also the area that is most likely to be drawn upon if and when more forest land is needed for agriculture.

The wide variations in growth per acre that characterize different sites are illustrated in table 10. On good upland and flatwood sites, for example, annual growth amounts to 48 cubic feet per acre (about two-thirds of a cord) compared to 11 cubic feet per acre on poor sites. Average annual growth on good bottom-land sites is 58 cubic feet per acre, compared to 18 cubic feet on poor sites. In terms of sawtimber the differences in average growth per acre are even greater.

These differences in growth by site largely reflect both higher stocking and differences in average radial and height growth of trees. Annual radial growth of softwoods on good upland sites, for example, averages about 0.132 inch compared to 0.099 inch on poor sites. Trees on the poorer sites also tend to have more rot, crook, and sweep than trees of the same diameter on the better sites.

Trends in timber growth

In recent years, tree stocking and growth of both softwood and hardwood timber have been increasing as a result of substantial improvements in forest practices in the Southeast River Basins area. Thus, between 1950 and 1960, net annual growth of softwood growing stock increased 5 percent and hardwood growing stock 6 percent (table 11).

TABLE 9.--Net growth of growing stock and sawtimber on commercial forest land in the Southeast River Basins, by physiographic areas, softwoods and hardwoods, and site classes, 1960

GROWING STOCK

Site class	Total	Uplands and flatwoods			Bottom lands		
		Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million cu.ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Good[1].....	850	711	622	89	139	24	115
Fair[2].....	394	246	191	55	148	31	117
Poor[3].....	72	57	48	9	15	5	10
Total...	1,316	1,014	861	153	302	60	242

SAWTIMBER

	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
Good[1].....	2,947	2,442	2,216	226	505	106	399
Fair[2].....	1,182	709	570	139	473	115	358
Poor[3].....	205	166	149	17	39	17	22
Total...	4,334	3,317	2,935	382	1,017	238	779

[1] Sites capable of producing 85 or more cubic feet per acre annually.
[2] Sites capable of producing 50 to 85 cubic feet per acre annually.
[3] Sites capable of producing less than 50 cubic feet per acre annually.

Source: Forest Service, U.S. Department of Agriculture.

Growth of softwood sawtimber, however, showed a 4 percent drop as the result of heavy cutting pressures on the larger sizes of softwood timber. There was practically no change in the growth of hardwood sawtimber.

Better fire protection probably has been the most influential single factor explaining the rise in timber stocking and timber growth. Practically all the commercial forest area in the Basins has been under organized fire protection for at least 10 years and most of the area for at least 20 years. The increase in average pine stocking from 40 to 50 percent in pine types, in spite of the increased hardwood encroachment in pine stands following fire protection, largely reflects the reduction of the frequent and extensive wildfires that formerly killed millions of young trees annually and kept a large part of the area poorly stocked.

Extension of improved gum turpentining practices, along with a sharp cutback in the number of pine trees worked, has also contributed to improved forest conditions. Much woods burning in the past was done to keep stands clear of underbrush to facilitate turpentining and this served to keep extensive forest areas well below optimum density for timber production. Also fires were commonly allowed to spread to other stands where most of the young trees were killed before they became large enough to resist fire. Prior to the adoption of improved turpentining practices the butt sections of turpentined trees were usually unusable, and turpentined stands often did not have enough usable material to justify cutting for saw logs which at that time was virtually the only

TABLE 10. --Average net growth per acre of growing stock and sawtimber on commercial forest land in the Southeast River Basins, by physiographic areas, softwoods and hardwoods, and site classes, 1960

GROWING STOCK

Site class	Uplands and flatwoods			Bottom lands		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*
Good[1].....	48	42	6	58	10	48
Fair[2].....	23	18	5	33	7	26
Poor[3].....	11	9	2	18	5	13
Total..	33	28	5	39	8	31

SAWTIMBER

	Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*
Good[1].....	166	151	15	209	44	165
Fair[2].....	68	55	13	104	25	79
Poor[3].....	32	29	3	48	21	27
Total..	110	97	13	131	31	100

[1] Sites capable of producing 85 or more cubic feet per acre annually.
[2] Sites capable of producing 50 to 85 cubic feet per acre annually.
[3] Sites capable of producing less than 50 cubic feet per acre annually.

Source: Forest Service, U.S. Department of Agriculture.

market for pine. For the most part these stands were left to the ravages of fire, wind, and insects, and mortality in the early 1940's consequently was several times what it is today.

Formerly a great deal of woods burning was done in an attempt to improve forage for cattle. Today increased dependence upon improved pastures and high-grade stock has eliminated a good deal of such woods burning.

Increased planting also has contributed to increased pine stocking and in time will result in a substantial rise in volume growth. The number of pine seedlings distributed in the Basins area jumped from an estimated 79 million in 1950, for example, to 466 million in 1959. Forestry practices such as chemical control of hardwoods and site preparation with heavy machinery have shifted from an experimental to a production basis since 1950. In recent years thousands of acres of scrub oak and other low-grade hardwoods have been bulldozed and piled in windrows, and the cleared areas planted to pine.

Considerable areas also have been covered by timber stand improvement programs under which cull trees and other hardwoods have been killed to permit growth of pine timber. The full contribution of these planting and timber stand improvement programs will not be fully realized in terms of timber growth for another 20 to 30 years, but these contributions will be substantial, as indicated in the following section.

TABLE 11.--Net growth on commercial forest land in the Southeast River Basins, by kinds of timber and softwoods and hardwoods, 1950 and 1960, with projections to 1975 and 2000 by level of management

Year	Growing stock	Sawtimber		
		Total	Small	Large
	Million cu. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
1950:				
Softwoods	874	3,309	2,017	1,292
Hardwoods	373	1,156	402	754
Total	1,247	4,465	2,419	2,046
1960:				
Softwoods	921	3,173	2,253	920
Hardwoods	395	1,161	437	724
Total	1,316	4,334	2,690	1,644
With prospective management:				
1975:				
Softwoods	1,070	3,475	2,450	1,025
Hardwoods	460	1,280	555	725
Total	1,530	4,755	3,005	1,750
2000:				
Softwoods	1,329	3,973	2,759	1,214
Hardwoods	580	1,480	733	747
Total	1,909	5,453	3,492	1,961
With high-level management:				
1975:				
Softwoods	1,260	4,000	2,800	1,200
Hardwoods	540	1,460	660	800
Total	1,800	5,460	3,460	2,000
2000:				
Softwoods	1,817	5,390	3,771	1,619
Hardwoods	779	1,910	978	932
Total	2,596	7,300	4,749	2,551

Source: Forest Service, U.S. Department of Agriculture.

THE OUTLOOK FOR TIMBER GROWTH

Estimates of the timber growth that might be achieved in the Southeast River Basins by 1975 and the year 2000, assuming (a) prospective changes in forest management and (b) high-level management, are shown in table 11 and figures 2 and 3. Assumptions as to prospective management have been based on recent trends in forestry practices in the area and judgment as to the likely course of future events. High-level management is

defined as the application by the year 2000 on all the many ownerships in the Basins of the practices now being applied on the best managed lands in the Basins. This would require major improvements in cutting practices, planting, stand improvement, and protection, especially on farm and other small holdings.

Both projections indicate the likelihood of substantial increases in the availability of timber over the next four decades. With prospective management, for example, annual growth of all growing stock trees is expected to increase from 1.3 billion cubic feet in 1960 to 1.5 billion cubic feet in 1975, and to 1.9 billion cubic feet in the year 2000. Total growth of sawtimber is expected to increase from 4.3 billion board feet in 1960 to 4.8 billion board feet in 1975, and to 5.5 billion board feet in the year 2000. Growth of both growing stock and sawtimber would be substantially higher with high-level management (figs. 2 and 3).

These projections of growth over the next several decades were made by estimating the changes in the various factors affecting growth that would be likely to occur with prospective management and with high-level management. These include changes in prospective stocking, radial growth, mortality, net volume per tree, and timber cut. The areas covered by the specific management measures that might reasonably be expected to result in these changes in growth factors were then estimated for both the prospective and the high-level projection.

Trends in stocking

With prospective management, stocking is expected to increase from an average of 49 percent in 1960 (36 percent softwoods and 13 hardwoods) to about 69 percent by the

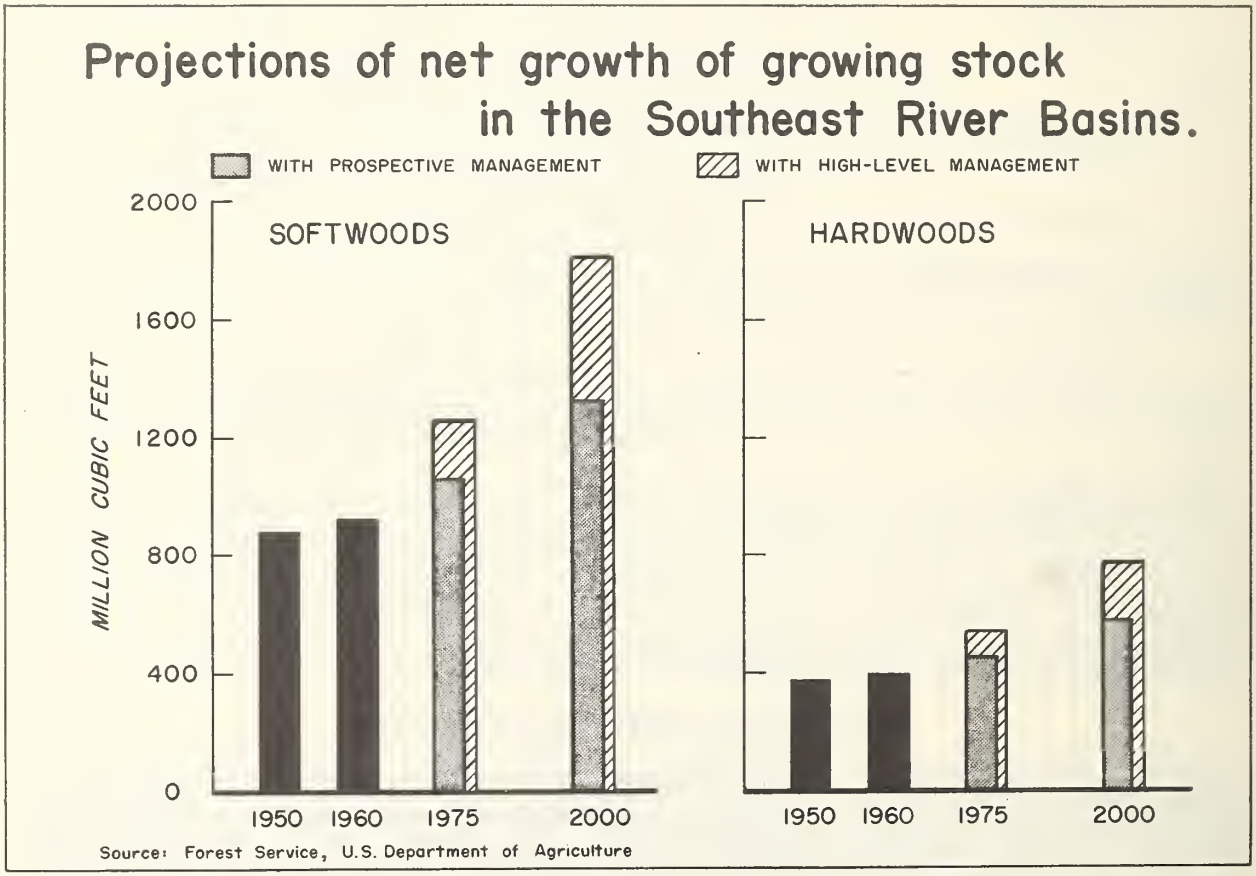

FIGURE 2

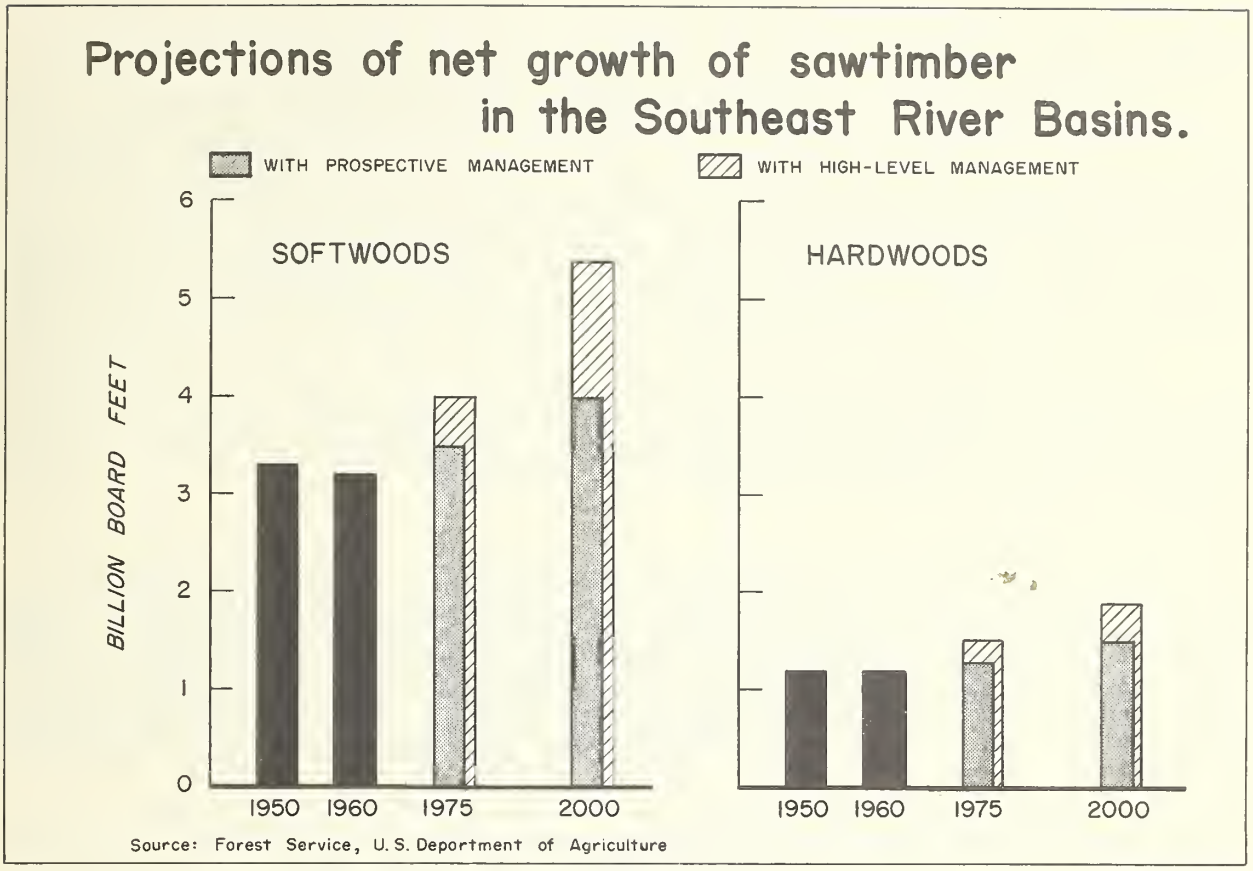

FIGURE 3

year 2000 (51 percent softwoods and 18 percent hardwoods). With high-level management, it is estimated that stocking would increase to an average of about 79 percent by the year 2000 (59 percent softwoods and 20 percent hardwoods).

Most of the increases in timber growth with prospective management are expected to come from increases in stocking. The annual task of increasing stocking includes the replacement of trees lost by cutting and mortality, plus restocking a portion of the present backlog of nonstocked areas. Part of the increase in stocking will take place naturally as a result of natural regeneration and increases in the size of trees in understocked stands. Other increases are assumed to come from increased planting, stand improvement, and thinning which would result in increased radial growth, reduced mortality, and increased net volume per tree.

With prospective management most of the practices applied, and therefore the greatest increases in stocking, are expected to be concentrated on the fair sites. The good sites are already fairly well stocked while on poor sites yields are low and costs of removing undesirable vegetation are relatively high. With high-level management, however, a significant part of the total effort probably would be applied on the poorer sites.

Trends in stand structure

Assumptions as to prospective numbers of trees by diameter classes were considered to be of particular importance in determining rotation age and the consequent size of timber likely to be available to forest industries. Stand structure is expressed in terms of the ratio between the number of trees in a 2-inch d.b.h. class and the number in the next larger class. This "q" ratio significantly affects the amount and character

of timber growth, especially ingrowth. If past trends were maintained, the "q" ratio would continue to rise markedly, with continued reductions in the average size of timber available in the area.

It was assumed, however, that the current stand structure with a rotation age of about 40 years on average sites would be maintained in the future, under both the prospective and high-level management assumptions. This expectation rests largely on the assumption that the recent downward trend in lumber production will continue for a few years, permitting growth to replace the cut of sawtimber. In order to increase sawtimber growth in the future above the levels shown in table 11, a reduction in the "q" ratio would be necessary. But this would require greater decreases in the immediate future cut of sawtimber than assumed, and this does not appear probable nor desirable in view of the adverse consequences of a major reduction in output on the lumber industry in the Basins.

Under different cutting and management assumptions, the "q" ratio could be reduced and rotations lengthened, and thus a larger output of sawtimber achieved than was considered likely in this analysis. It would be possible, for example, to assume that more pulpwood would be obtained from thinnings and stand improvement cuts, or from hardwoods, and less from softwood sawtimber-sized material.

Trends in mortality

It was assumed that with prospective management softwood mortality would drop from the present level of about 11 percent of gross growth to 8 percent by the year 2000, while hardwood mortality would drop from 15 percent at present to 12 percent by the year 2000. Under high-level management it was assumed that softwood mortality would fall to 5 percent of gross growth and hardwood mortality to 10 percent. These reductions would come in part from better protection but mainly from anticipation of mortality in thinning and stand improvement operations and from more complete salvage of dead timber.

Trends in radial growth and tree volumes

It was assumed that with prospective management radial growth of trees might increase an average of 5 percent, and with high-level management an average of 10 percent. Such increases would be expected to result from more favorable spacing and density of stands with resulting increases in vigor and growth rates.

With prospective management it was assumed that there would be no change in volume per tree grown, but for high-level management average volume per tree in the year 2000 was increased 10 percent over current average volumes. This increase would be a consequence of stand improvement and thinning operations which would leave the taller and less defective trees in the stands.

Cutting assumptions

For both growth projections it was assumed that the cut of timber products would be equal to growth in the year 2000, but that during the intervening years timber cut would be somewhat less than the growth. In 1975, for example, with prospective management, the cut of softwoods was assumed to be 94 percent of growth and the cut of hardwoods 88 percent. In 1960 the cut of softwoods was about 96 percent of growth and the cut of hardwoods about 77 percent of growth (table 8). It might be assumed that cut would equal growth in all years and that all of the increase in stocking would come from ingrowth. But this would result in a significant lowering of the average size of trees in future stands, and a major shift in growth and products cut from sawtimber to poletimber.

Areas treated under future management

A sizable part of the restocking needed to replace mortality and cut may be expected to take place naturally with no treatment other than protection. This will come both from natural regeneration and from the filling up of understocked stands as a result of growth

of existing trees. Such natural restocking can be expected to decrease somewhat in the future with the disappearance of unstocked old fields and the closing up of understocked stands that are now relatively free of inhibiting vegetation. With continued fire protection, both growing stock and inhibiting vegetation are expected to increase rather rapidly, thus increasing both the difficulty of natural restocking and the importance of other management measures.

In the case of softwoods, it was estimated that with prospective management 35 percent of the restocking during the period 1960-70 would take place naturally with no action other than protection, but this proportion would drop to 20 percent during the decade 1990-2000 as a result of changes in conditions favoring natural restocking. A much larger proportion of the total hardwood restocking is expected to take place naturally. This was estimated at 75 percent for the period 1960-70 and 60 percent in the decade 1990-2000.

Some portion of the area needing restocking also can be expected to regenerate naturally with only site preparation to remove inhibiting vegetation. With prospective management, it is estimated that something like 68,000 acres might be in this category during the first decade, increasing to about 169,000 acres annually in the last decade (table 12). Such site preparation is expected to result in an average of about 70 percent stocking on the areas treated.

Planting was assumed to be of major importance, particularly during the next 20 years. Thereafter planting is expected to drop off somewhat with emphasis shifting to stand improvement and thinnings. With prospective management, the rate of annual planting over the next 10 years is expected to average slightly higher than the current level--484,000 acres compared to 466,000 acres planted in 1960. This rate is expected to drop somewhat during the last two decades of the period. Much of the initial planting is expected to be on land that does not need site preparation, but as these areas are planted an increasingly large proportion will need site preparation prior to planting.

The greater initial emphasis on planting that is assumed will result in future growth following an S-shaped curve rather than a straight line. It is calculated, however, that growth is likely to start out below a straight line projection, cross it around 1975, and continue above it to the year 2000.

With high-level management, planting during the first two decades is assumed to be about 20 percent higher than under prospective management (table 13). It is also expected to drop somewhat in subsequent decades as the backlog of poorly stocked land is restocked.

Commercial thinning and timber stand improvement with prospective management are considered likely to remain at relatively low levels until at least 1970 and thereafter increase rapidly (table 12). The same general trend is considered likely under high-level management (table 13). It is further believed that emphasis during the next 40 years will shift somewhat from noncommercial stand improvement to commercial thinning as large areas of planted stands reach the thinning stage some time after 1970.

These assumptions as to areas treated, and resulting increases in growth, necessarily are based upon a considerable measure of judgment. They must therefore be regarded as subject to significant refinement as new information becomes available on relationships between management practices and resulting growth, and as the actual course of prospective events becomes more evident.

The growth projections with prospective management should not be regarded as the maximum reasonably attainable, nor should the high-level management projections be regarded as an absolute ceiling of growth that could be achieved during the period of projection. Earlier and/or more intensive application of management practices than assumed, or lower rates of cutting than assumed, could result in higher trends of growth to the year 2000.

In view of such factors as the character of ownership in the area and the magnitude of the capital investments required to put many stands in shape for future production, major changes in ownership, and a very great acceleration of assistance programs to

TABLE 12.--Areas assumed to be treated annually in the Southeast River Basins with prospective management, by kinds of treatment and 10-year periods, 1960-2000

Kind of treatment	Area treated annually			
	1960-70	1970-80	1980-90	1990-2000
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*
Site preparation for natural reproduction of:				
Softwoods	51	82	116	124
Hardwoods	17	19	41	45
Total	68	101	157	169
Planting without site preparation for:				
Softwoods	357	191	171	159
Hardwoods	0	0	0	0
Total	357	191	171	159
Planting with site preparation for:				
Softwoods	127	219	181	191
Hardwoods	0	0	0	0
Total	127	219	181	191
Commercial thinning for:				
Softwoods	24	171	358	576
Hardwoods	77	130	144	157
Total	101	301	502	733
Noncommercial thinning and deadening for:				
Softwoods	43	153	244	265
Hardwoods	46	52	57	94
Total	89	205	301	359

Source: Forest Service, U.S. Department of Agriculture.

expand planting and timber stand improvement would be necessary to raise projected growth materially above the estimates shown for prospective management. The problem of raising forest productivity involves large numbers of farmers and other small owners who in the aggregate own the major part of the forest resources in the Basins. These small ownerships average much lower in productivity than the public and industrial holdings, and much more effective protection and management than is now in sight will be necessary to achieve the levels of growth the Basins area should supply in the future.

Projected growth compared to national growth needs

In a recent appraisal of the present and future timber situation in the United States[2] the Forest Service published estimates of the amount of growth which would be needed to meet the Nation's potential demand for timber in 2000. The medium projection of needed growth was geared to a population estimate of 275 million in the year 2000, a gross national product of 1,200 billion dollars (1953 prices), continued availability of timber products at relative price levels approximating those of recent years, and the assumption

[2] U.S. Forest Service. Timber Resources for America's Future. U.S. Dept. Agr. Forest Resource Rpt. 14, 713 pp., illus. 1958.

TABLE 13.--Areas assumed to be treated annually in the Southeast River Basins with high-level management, by kinds of treatment and 10-year periods, 1960-2000

Kind of treatment	Area treated annually			
	1960-70	1970-80	1980-90	1990-2000
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*
Site preparation for natural reproduction of:				
Softwoods	56	123	135	147
Hardwoods	34	40	45	51
Total	90	163	180	198
Planting without site preparation for:				
Softwoods	389	216	178	129
Hardwoods	0	0	0	0
Total	389	216	178	129
Planting with site preparation for:				
Softwoods	173	287	211	229
Hardwoods	0	0	18	40
Total	173	287	229	269
Commercial thinning for:				
Softwoods	26	144	474	860
Hardwoods	120	140	159	179
Total	146	284	633	1,039
Noncommercial thinning and deadening for:				
Softwoods	62	176	379	413
Hardwoods	120	167	191	214
Total	182	343	570	627

Source: Forest Service, U.S. Department of Agriculture.

that industrial timber products would maintain the same relative position in the national economy. For the Nation as a whole this estimate of needed growth totalled 105 billion board feet of sawtimber, including 76 billion board feet of softwood sawtimber, as shown in the following tabulation.

Kind of timber	Needed growth (Billion bd. ft.)	Kind of timber	Needed growth (Billion cu. ft.)
Sawtimber:		**Growing stock:**	
Eastern softwoods	**43.1**	**Eastern softwoods**	**8.3**
Eastern hardwoods	**29.1**	**Eastern hardwoods**	**7.3**
Western species	**33.2**	**Western species**	**6.4**
Total	**105.4**	**Total**	**22.0**

The projections of national growth up to the year 2000 fall far short of these estimates of needed growth, indicating the necessity for much greater nation-wide forestry efforts than are in prospect. Large increases in growth are particularly needed from areas such as the Southeast Basins where timber growing and market conditions are especially favorable.

The share of the Nation's needed growth in 2000 which might reasonably be allocated to the Southeast River Basins is compared in the tabulation below with the projected growth in the Basins.

Kind of timber	Needed growth	Projected growth with prospective management	Projected growth with high-level management
	(Billion bd. ft.)	(Billion bd. ft.)	(Billion bd. ft.)
Sawtimber:			
Softwoods	7.7	4.0	5.4
Hardwoods	1.5	1.5	1.9
Total	9.2	5.5	7.3
	(Billion cu. ft.)	(Billion cu. ft.)	(Billion cu. ft.)
Growing stock:			
Softwoods	1.4	1.3	1.8
Hardwoods	.3	.6	.8
Total	1.7	1.9	2.6

These data indicate that the Basins are likely to supply a reasonable share of the Nation's potential demands for hardwood timber, and for softwood growing stock. However, the outlook for softwood sawtimber with both prospective management and the high-level management assumed is not favorable. Projected softwood sawtimber growth in 2000 under the assumptions of prospective management adopted in this analysis would be only about half that needed to meet a fair share of the medium projection of potential national demands for timber. And even the high-level projection would not provide an adequate supply of softwood sawtimber from the area. If the needed growth is not produced in the Basins area and other parts of the Nation, softwood timber supplies would fall short of potential demands, timber prices could be expected to rise in relation to competing materials, and consumption of timber curtailed below potential levels.

Closing the gap between the projected growth in the Basins and the estimate of needed growth of softwood sawtimber would require major acceleration and/or intensification of management practices beyond those assumed in tables 12 and 13. The indicated deficit in the year 2000 also might be reduced by a lengthening of timber rotations beyond that assumed in this study with a consequent interim reduction of sawtimber cut below that assumed likely in the next two or three decades. Major emphasis must be placed on greater investment and management programs.

Projected growth per acre

In case the Commission should adopt estimates of forest land area in the year 2000 that differ significantly from those assumed in this study, estimates of projected growth have been compiled for different site classes and physiographic areas (tables 14-17). Table 14, for example, shows a prospective growth of 63 cubic feet per acre on good

TABLE 14.--Projections of average net growth per acre with prospective management for growing stock and sawtimber on commercial forest land in the Southeast River Basins, by physiographic areas, softwoods and hardwoods, and site classes, 2000

GROWING STOCK

Site class	Uplands and flatwoods			Bottom lands		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*
Good[1]	63	54	9	57	7	50
Fair[2]	47	39	8	50	7	43
Poor[3]	18	14	4	32	6	26
Total	50	42	8	50	7	43

SAWTIMBER

	Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*
Good[1]	185	162	23	180	25	155
Fair[2]	139	119	20	133	25	108
Poor[3]	38	33	5	69	18	51
Total	144	125	19	141	24	117

[1] Sites capable of producing 85 or more cubic feet per acre annually.
[2] Sites capable of producing 50 to 85 cubic feet per acre annually.
[3] Sites capable of producing less than 50 cubic feet per acre annually.

Source: Forest Service, U.S. Department of Agriculture.

sites in the uplands and flatwoods, compared with an average of 48 cubic feet in 1960. Growth per acre on poor sites on the other hand is estimated at 18 cubic feet per acre, compared with 11 cubic feet in 1960.[3]

Similar projections of average net growth per acre assuming high-level management are shown in table 15. Projections of total net growth by different site classes and physiographic provinces are shown in table 16 for prospective management and in table 17 for high-level management.

These estimates of projected growth, as in the case of current growth, emphasize the major importance of site quality in timber production and management programs. More than half the projected total growth of timber in the Basins with prospective management is found on the 45 percent of the area that is of good site quality. Another 38 percent is found on the four-fifths of the area that is of fair site quality. Only 6 percent of the total projected growth is on the 16 percent of the area that is of poor site quality.

This concentration of timber growth on the better sites emphasizes the desirability of maintaining the higher sites in timber production to the extent feasible, and minimizing the transfer of such lands to nontimber uses.

[3] In deriving estimates of volume and growth in the Basins one volume table was used without adjustments for site differences. Since trees on good sites have greater average height and volume than trees on poor sites the actual differences between volume and growth by site have been understated to some extent.

TABLE 15.--Projections of average net growth per acre with high-level management for growing stock and sawtimber on commercial forest land in the Southeast River Basins, by physiographic areas, softwoods and hardwoods, and site classes, 2000

GROWING STOCK

Site class	Uplands and flatwoods			Bottom lands		
	All species	Softwoods	Hardwoods	All species	Softwoods	Hardwoods
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*
Good[1]	84	73	11	70	6	64
Fair[2]	64	54	10	66	5	61
Poor[3]	32	27	5	46	5	41
Total	68	59	9	65	5	60

SAWTIMBER

	Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*
Good[1]	245	219	26	217	19	198
Fair[2]	188	164	24	168	15	153
Poor[3]	77	67	10	94	12	82
Total	196	174	22	176	16	160

[1] Sites capable of producing 85 or more cubic feet per acre annually.
[2] Sites capable of producing 50 to 85 cubic feet per acre annually.
[3] Sites capable of producing less than 50 cubic feet per acre annually.

Source: Forest Service, U.S. Department of Agriculture.

TABLE 16.--Projections of net growth with prospective management for growing stock and sawtimber on commercial forest land in the Southeast River Basins, by physiographic areas, softwoods and hardwoods, and site classes, 2000

GROWING STOCK

Site class	Total	Uplands and flatwoods			Bottom lands		
		Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Good[1]	1,065	927	791	136	138	17	121
Fair[2]	724	495	411	84	229	32	197
Poor[3]	120	94	73	21	26	5	21
Total	1,909	1,516	1,275	241	393	54	339

See footnotes at end of table.

TABLE 16--Continued

SAWTIMBER

Site class	Total	Uplands and flatwoods			Bottom lands		
		Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
Good[1].....	3,143	2,708	2,371	337	435	60	375
Fair[2].....	2,056	1,449	1,241	208	607	114	493
Poor[3].....	254	198	172	26	56	15	41
Total....	5,453	4,355	3,784	571	1,098	189	909

[1] Sites capable of producing 85 or more cubic feet per acre annually.
[2] Sites capable of producing 50 to 85 cubic feet per acre annually.
[3] Sites capable of producing less than 50 cubic feet per acre annually.

Source: Forest Service, U.S. Department of Agriculture.

TABLE 17.--Projections of net growth with high-level management for growing stock and sawtimber on commercial forest land in the Southeast River Basins, by physiographic areas, softwoods and hardwoods, and site classes, 2000

GROWING STOCK

Site class	Total	Uplands and flatwoods			Bottom lands		
		Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Good[1].....	1,390	1,222	1,067	155	168	13	155
Fair[2].....	971	669	568	101	302	22	280
Poor[3].....	205	168	143	25	37	4	33
Total....	2,566	2,059	1,778	281	507	39	468

SAWTIMBER

	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft*
Good[1].....	4,110	3,585	3,205	380	525	46	479
Fair[2].....	2,728	1,961	1,711	250	767	69	698
Poor[3].....	477	401	349	52	76	10	66
Total....	7,315	5,947	5,265	682	1,368	125	1,243

[1] Sites capable of producing 85 or more cubic feet per acre annually.
[2] Sites capable of producing 50 to 85 cubic feet per acre annually.
[3] Sites capable of producing less than 50 cubic feet per acre annually.

Source: Forest Service, U.S. Department of Agriculture.

THE OUTLOOK FOR FOREST INDUSTRIES

This section of the report presents information on the output of timber products in the Southeast River Basins, the economic importance of forest industries in the area, and projections of the employment and income that might be supported if the projections of timber growth presented in the preceding section are realized.

The forest industries considered in this section include (a) logging or other harvesting of forest products and the management of forest lands, (b) lumber and other related wood products plants, and (c) pulp and paper plants.

In the aggregate these forest industries have been processing about 920 million cubic feet of timber annually (table 18). Pulpwood accounts for about half of this volume, saw logs a third, and fuelwood and industrial roundwood products such as veneer logs, poles and piling the remainder of about a fifth.

Trends in pulpwood production

The predominance of pulpwood as a timber product in the Basins is of rather recent origin. Since 1946 the output of pulpwood has more than tripled, rising from 2.0 million cords in that year to 6.5 million cords in 1959 (table 19). Although the proportion of hardwood pulpwood has been rising, softwoods still account for more than 90 percent of the pulpwood produced in the area.

Production of pulp chips from sawmill residues has become of considerable importance in recent years. In 1959 chip production amounted to 660 thousand cords, or 9 percent of the total pulpwood obtained from the Basins area. Some further increases in chip production may be realized by using hardwood residues and materials now wasted at small softwood mills, but this is likely to be of relatively limited importance in comparison with the output of roundwood.

Trends in lumber production

Lumber production in the Basins has dropped from about 2.8 billion board feet in 1946 to 1.8 billion board feet in 1959 (table 20). This decline in output of lumber has been largely the result of greater competition for wood from pulpmills which to an increasing extent have been utilizing sawtimber sizes of trees and a widespread reduction in the size and quality of southern pine timber available for lumber production. The decline in production of southern pine lumber has been accompanied by greater use of higher quality Douglas-fir and other western species in eastern lumber markets.

Trends in output of other products

The output of fuelwood and miscellaneous industrial wood products has also been declining in the Basins (table 18). The total volume of these products produced in 1959 amounted to 186 million cubic feet--about half what it was in 1946. Fuelwood, which has been increasingly displaced by more convenient fuels both for domestic purposes and for curing tobacco, accounted for nearly all of this drop, although the output of hewn trees and cooperage logs also has declined. Output of veneer logs, the most important of the industrial hardwood products and output of poles and piling have not shown much change in recent years.

Pine gum and stumps also are important forest products in the Basins area. In the 1959-60 season a total of 583 thousand barrels (435 pounds net weight) of crude gum was collected, or about half the production in 1945-46. Several hundred thousand tons of pine stumps used in the production of wood naval stores were also produced in the Basins.

Projected cut of timber products

With prospective management of the forest resource, output of timber products by the year 2000 is expected to amount to 2 billion cubic feet or 110 percent more than output in 1959 (table 18). With high-level management output might reach 2.7 billion cubic feet. About 70 percent of the projected output under both levels of management would be softwoods and 30 percent hardwoods.

TABLE 18.--Estimated timber products output from roundwood in the Southeast River Basins, by type of product and softwoods and hardwoods, 1946-59 with projections to 1975 and 2000

Year	All products			Saw logs			Pulpwood			Other products		
	Total	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods	Total	Soft-woods	Hard-woods
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
1946.....	952	679	273	452	347	105	145	140	5	355	192	163
1947.....	816	625	191	388	315	73	151	145	6	277	165	112
1948.....	--	--	--	--	--	--	207	199	8	--	--	--
1949.....	739	604	135	324	274	50	203	194	9	212	136	76
1950.....	991	779	212	454	367	87	259	252	7	278	160	118
1951.....	937	725	212	413	324	89	273	266	7	251	135	116
1952.....	946	766	180	438	364	74	285	275	10	223	127	96
1953.....	876	701	175	339	267	72	322	311	11	215	123	92
1954.....	880	697	183	340	267	73	338	323	15	202	107	95
1955.....	953	772	181	346	273	73	402	386	16	205	113	92
1956.....	962	788	174	344	272	72	423	407	16	195	109	86
1957.....	887	717	170	301	236	65	409	387	22	177	94	83
1958.....	825	668	157	257	204	53	409	380	29	159	84	75
1959.....	954	744	210	298	230	68	470	426	44	186	88	98
PROJECTIONS												
With prospective management												
1975.....	1,445	1,045	400	400	270	130	870	705	165	175	70	105
2000.....	2,000	1,405	595	575	380	195	1,175	935	240	250	90	160
With high-level management												
1975.....	1,645	1,190	455	455	310	145	990	800	190	200	80	120
2000.....	2,720	1,920	800	785	520	265	1,595	1,270	325	340	130	210

Source: Forest Service, U.S. Department of Agriculture. Estimates of timber products output for saw logs are based on lumber production data published by the Bureau of the Census.

TABLE 19.--Estimated pulpwood production in the Southeast River Basins, by softwoods and hardwoods, 1946-59

Year	Pulpwood production		
	Total	Softwoods	Hardwoods
	Million cords	*Million cords*	*Million cords*
1946	2.0	1.9	0.1
1947	2.1	2.0	.1
1948	2.9	2.8	.1
1949	2.8	2.7	.1
1950	3.6	3.5	.1
1951	3.8	3.7	.1
1952	3.9	3.8	.1
1953	4.5	4.3	.2
1954	4.7	4.5	.2
1955	5.6	5.4	.2
1956	5.9	5.7	.2
1957	5.7	5.4	.3
1958	5.7	5.3	.4
1959	6.5	5.9	.6

Source: Forest Service, U.S. Department of Agriculture.

The cut of products in 1975 is assumed to be somewhat less than projected growth in that year in order to permit a building up of timber inventories and continued increases in growth from understocked stands. Nevertheless the estimated output of products in 1975 is 1.4 billion cubic feet with prospective management or 51 percent above output in 1959, and 1.6 billion cubic feet with high-level management.

The distribution of the timber cut in 1975 and 2000 among saw logs, pulpwood, and other products is largely a matter of judgment. In this report, estimates of the future product mix have been based in part on recent trends in output and expectations as to the size and quality of timber that is likely to be available in the Basins. These estimates assume that pulpwood will increase from the present level of 49 percent of total output to about 60 percent in 1975, that saw logs will drop from 31 percent of the total output to about 28 percent, and that other products will drop from 20 percent of the output to 12 percent. This mix of timber products is assumed to continue between 1975 and 2000.

The resulting estimates of output of individual timber products are shown in table 18 and illustrated in figure 4. With prospective management the potential output of pulpwood is expected to rise from 470 million cubic feet (6.5 million cords) in 1959 to 870 million cubic feet (11.9 million cords) in 1975, and to 1,175 million cubic feet (16 million cords) by the year 2000. The output of saw logs might rise from about 300 million cubic feet at present to 400 million cubic feet in 1975 and 575 million cubic feet in 2000. The output of other products could increase from 186 million cubic feet at present to 250 million cubic feet in the year 2000. The output of timber products with high-level management would be substantially greater than these estimates in both 1975 and 2000. Beyond the year 2000 the cut of timber products could be expected to increase somewhat further under both management assumptions since many of the management measures adopted during the next couple of decades would not be fully reflected in growth and available cut until sometime after the year 2000.

TABLE 20.--Estimated lumber production in the Southeast River Basins, by softwoods and hardwoods, 1946-59

Year	Lumber production		
	Total	Softwoods	Hardwoods
	Billion bd. ft.	*Billion bd. ft.*	*Billion bd. ft.*
1946	2.8	2.1	0.7
1947	2.4	1.9	.5
1948	--	--	--
1949	2.0	1.7	.3
1950	2.8	2.2	.6
1951	2.5	2.0	.5
1952	2.7	2.2	.5
1953	2.1	1.6	.5
1954	2.1	1.6	.5
1955	2.1	1.6	.5
1956	2.1	1.6	.5
1957	1.9	1.5	.4
1958	1.6	1.3	.3
1959	1.8	1.4	.4

Source: Forest Service, U.S. Department of Agriculture, based on data published by the Bureau of the Census, U.S. Department of Commerce.

In view of the magnitude of potential demands for timber products outlined in a recent Forest Service appraisal of the timber situation,[4] it seems likely that the timber grown in the Basins Area will be fully utilized by forest industries, and that the actual output of products may approximate the growth. The Southeast Basins Area is a particularly favorable area from the standpoint of both production and marketing factors for intensive forest management and development of wood-using industries.

Employment and income in the forest products industries

Production of timber products is of major economic importance in the Basins. In 1958, for example, there were at least 114,000 workers employed in "primary" forest industries (table 21). The various types of establishments or activities included in these industries are listed in the appendix, tables 26 and 27. Somewhat more than half of the total employment was in logging, harvesting of pine gum and stumps, and management of forest lands. About a quarter of the total employment was in lumber and wood products manufacturing industries and the remaining one-fifth in the pulp and paper industries.

The total value added in these forest industries in 1958 amounted to an estimated 696 million dollars, of which 295 million was paid out to workers as wages and salaries (table 21). The distribution of value added among industries was significantly different from the distribution of employment. The pulp and paper industry, for example, accounted for about 45 percent of the total value added, harvesting and management 39 percent of the total, and the lumber and wood products industries 16 percent. These differences reflect such factors as the amount of capital used per employee, the skill of workers, and the number of hours worked per year.

[4] U.S. Forest Service. Timber Resources for America's Future. U.S. Dept. Agr. Forest Resource Rpt. 14, 713 pp., illus. 1958.

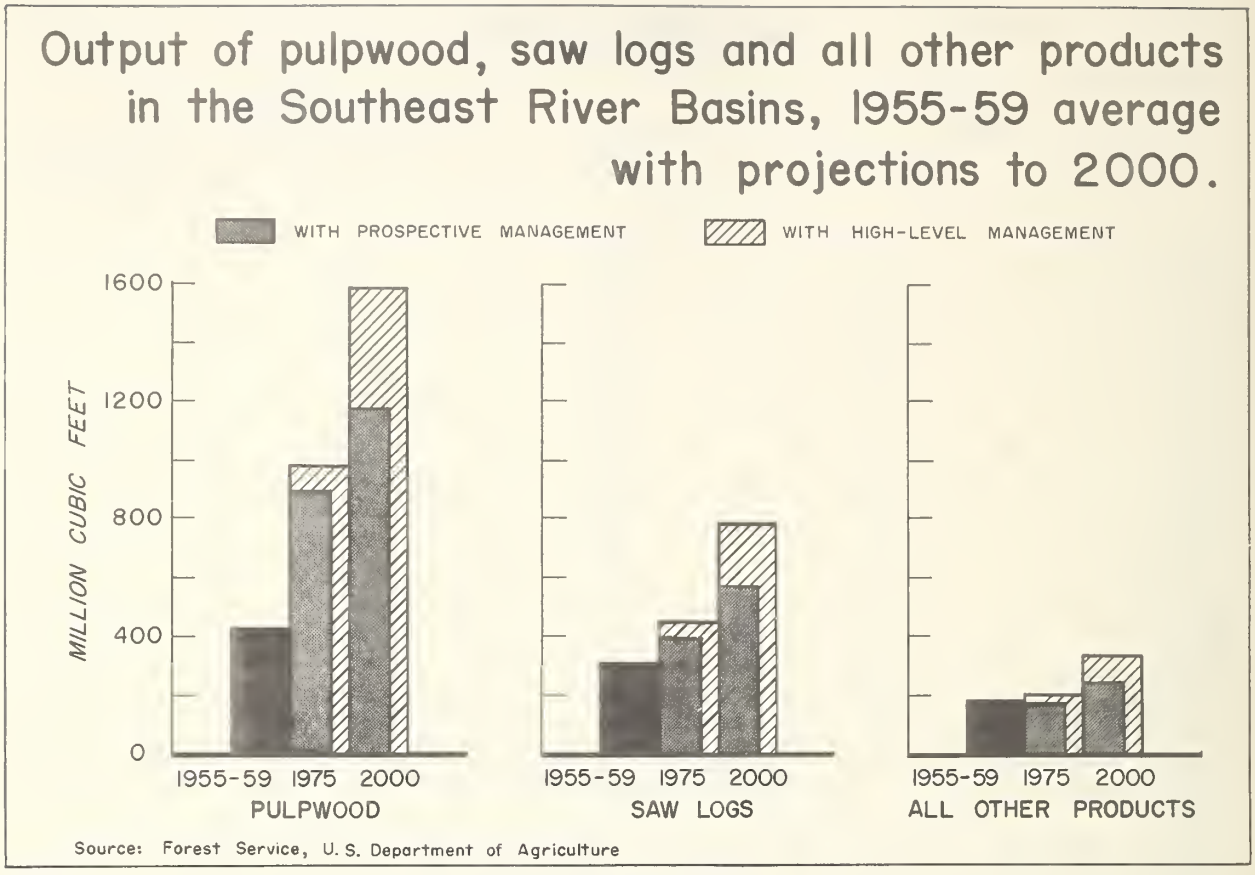

FIGURE 4

Additional employment, income, and payrolls in other industries and economic activities also should be attributed to the forest products produced in the Basins. For each employee engaged in the lumber and wood products and the pulp and paper industries, it is estimated that some 3 additional employees are working with wood in secondary manufacturing industries such as the furniture industry and in transportation, marketing, and construction activities using wood. Also, additional workers are employed in industries producing capital equipment and supplies used in harvesting and manufacturing forest products.

Projected increases in employment and income

Future employment in the harvesting and manufacture of forest products in the Basins will depend on the projected levels of timber output shown in table 18, on trends in productivity of employees in the forest industries, and on changes in the volume of secondary manufacturing operations that may supplement the primary manufacturing activities listed in table 27.

On the basis of very fragmentary data it is assumed that productivity of workers in the pulp and paper industry and in logging may increase in the future at an average annual rate of 2 percent per year--about the same as the average annual increase in productivity in all manufacturing industries.[5] In the lumber and wood products industries where rates of technological change are believed to have been slower than in industry generally, productivity is estimated to increase in the future by only 1 percent per year. These rates of change in productivity relate only to workers in the specified forest industries and do not make allowance for changes in output per man in the industries which supply capital equipment and materials to the local forest industries.

[5] U.S. Bureau of Labor Statistics, Indexes of Output per Man-Hour for Selected Industries: 1929 to 1955, and Trends in Output per Man-Hour in the Private Economy: 1909-1958, U.S. Dept. of Labor.

TABLE 21.--Estimated employment payrolls and value added in forest industries in the Southeast River Basins in 1958, with projections to 1975 and 2000

Industry	1958	With prospective management		With high-level management	
		1975	2000	1975	2000
Harvesting and management:					
Employees (number)	58,900	74,500	72,250	81,400	88,600
Payrolls (thousand dollars)	106,000	186,000	289,000	204,000	354,000
Value added (thousand dollars)	273,900	484,000	737,000	529,000	904,000
Lumber and wood products:					
Employees (number)	30,750	46,000	60,000	52,000	82,000
Payrolls (thousand dollars)	70,750	124,000	204,000	140,000	279,000
Value added (thousand dollars)	110,700	198,000	324,000	224,000	443,000
Pulp, paper and products:					
Employees (number)	24,350	40,000	40,000	46,000	55,000
Payrolls (thousand dollars)	118,100	272,000	428,000	313,000	589,000
Value added (thousand dollars)	311,700	716,000	1,132,000	823,000	1,557,000
Total:					
Employees (number)	114,000	160,500	172,250	179,400	225,600
Payrolls (thousand dollars)	294,850	582,000	921,000	657,000	1,222,000
Value added (thousand dollars)	696,300	1,398,000	2,193,000	1,576,000	2,904,000

Note: For further details see appendix, tables 26 and 27.

Source: Forest Service, U.S. Department of Agriculture.

In addition to these assumed changes in productivity which would lead to less employment per unit volume of output, it was also assumed, on the other hand, that some new employment would result from expansion of secondary manufacturing activities in the Basins, such as greater conversion of paper and paperboard into bags and boxes.

The resulting estimates of employment, based on these projected changes in output, productivity, and product mix are shown in detail in the appendix, tables 26 and 27, and are summarized in table 21. Total employment in the forest industries in the Basins in 1975 is estimated at 161 thousand workers with prospective management. In 2000 employment might amount to 172 thousand workers with prospective management, and as much as 226 thousand workers with high-level management.

Values added in the forest industries of the Basins in future years have been estimated on the assumption of constant prices and thus are expected to increase in accordance with the input of roundwood products shown in table 18. In addition it was necessary to add the values added in new secondary manufacturing activities. By 1975 total values added are calculated at 1.4 billion dollars with prospective management, or double the 0.7 billion dollars produced in 1958 (table 21). By the year 2000 values added could reach 2.2 billion dollars. With high-level management, values produced would, of course, be correspondingly higher.

Payrolls in the forest industries of the Basins with prospective management are calculated at nearly 0.6 billion dollars in 1975, or roughly double payrolls in 1958; payrolls in 2000 might reach 0.9 billion dollars. Methods used in estimating both values added and payrolls are outlined in the appendix, tables 26 and 27.

TABLE 22.--Area of commercial forest land in the Southeast River Basins, by physiographic areas, site classes, and river basins, 1960

River basin	Total area	Uplands and flatwoods				Bottom lands			
		Total	Site class			Total	Site class		
			Good[1]	Fair[2]	Poor[3]		Good[1]	Fair[2]	Poor[3]
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Savannah	4,728	3,974	1,651	1,632	691	754	367	358	29
Ogeechee	2,135	1,549	838	467	244	586	116	377	93
Altamaha-Ocmulgee-Oconee	5,953	4,775	2,523	1,661	591	1,178	448	608	122
Satilla-St. Marys-Nassau	2,674	2,188	1,502	481	205	486	93	307	86
Suwannee	4,842	3,420	2,068	1,058	294	1,422	399	806	217
Ochlockonee-St. Marks	3,291	2,284	1,113	757	414	1,007	232	672	103
Apalachicola-Chattahoochee-Flint	7,719	6,380	2,859	2,303	1,218	1,339	457	741	141
Perdido-Escambia-Conecuh-Choctawhatchee	6,721	5,711	2,082	2,071	1,558	1,010	305	690	15
Total	38,063	30,281	14,636	10,430	5,215	7,782	2,417	4,559	806

[1] Sites capable of producing 85 or more cubic feet per acre annually.
[2] Sites capable of producing 50 to 85 cubic feet per acre annually.
[3] Sites capable of producing less than 50 cubic feet per acre annually.

Source: Forest Service, U.S. Department of Agriculture.

TABLE 23.--Area of commercial forest land in the Southeast River Basins, by physiographic areas, stocking classes, and river basins, 1960

River basin	Total area	Upland and flatwoods					Bottom lands				
		Total	Stocking class				Total	Stocking class			
			70 percent or more	40-70 percent	10-40 percent	Less than 10 percent		70 percent or more	40-70 percent	10-40 percent	Less than 10 percent
	Thousand acres	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*	*Thousand acres*
Savannah	4,728	3,974	2,423	764	543	244	754	429	177	116	32
Ogeechee	2,135	1,549	715	266	423	145	586	446	66	68	6
Altamaha-Ocmulgee-Oconee	5,953	4,775	2,940	671	901	263	1,178	830	197	132	19
Satilla-St. Marys-Nassau	2,674	2,188	1,038	523	482	145	486	332	83	40	31
Suwannee	4,842	3,420	1,331	772	808	509	1,422	769	314	251	88
Ochlockonee-St. Marks	3,291	2,284	833	560	489	402	1,007	474	283	205	45
Apalachicola-Chattahoochee-Flint	7,719	6,380	3,224	1,352	1,208	596	1,339	836	239	190	74
Perdido-Escambia-Conecuh-Choctawhatchee	6,721	5,711	2,161	1,479	1,105	966	1,010	548	246	160	56
Total	38,063	30,281	14,665	6,387	5,959	3,270	7,782	4,664	1,605	1,162	351

Source: Forest Service, U.S. Department of Agriculture.

TABLE 24.--Volume of growing stock on commercial forest land in the Southeast River Basins, by physiographic areas, softwoods and hardwoods, and river basins, 1960

River basin	Total volume			Uplands and flatwoods			Bottom lands		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million cu. ft.	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*	*Million cu. ft.*
Savannah	2,789	1,485	1,304	2,152	1,418	734	637	67	570
Ogeechee	1,188	676	512	738	618	120	450	58	392
Altamaha-Ocmulgee-Oconee	3,497	2,115	1,382	2,514	2,005	509	983	110	873
Satilla-St. Marys-Nassau	1,726	1,337	389	1,307	1,215	92	419	122	297
Suwannee	2,739	2,009	730	1,714	1,597	117	1,025	412	613
Ochlockonee-St. Marks	1,952	1,154	798	1,062	896	166	890	258	632
Apalachicola-Chattahoochee-Flint	3,509	1,753	1,756	2,305	1,569	736	1,204	184	1,020
Perdido-Escambia-Conecuh-Choctawhatchee	3,224	1,800	1,424	2,268	1,643	625	956	157	799
Total	20,624	12,329	8,295	14,060	10,961	3,099	6,564	1,368	5,196

Source: Forest Service, U.S. Department of Agriculture.

TABLE 25.--Volume of sawtimber on commercial forest land in the Southeast River Basins, by physiographic areas, softwoods and hardwoods, and river basins, 1960

River basin	Total volume			Uplands and flatwoods			Bottom lands		
	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods	Total	Softwoods	Hardwoods
	Million bd. ft.	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*	*Million bd. ft.*
Savannah	7,788	4,223	3,565	5,823	3,972	1,851	1,965	251	1,714
Ogeechee	3,469	2,154	1,315	2,182	1,953	229	1,287	201	1,086
Altamaha-Ocmulgee-Oconee	9,947	5,939	4,008	6,805	5,554	1,251	3,142	385	2,757
Satilla-St. Marys-Nassau	4,731	3,752	979	3,608	3,390	218	1,123	362	761
Suwannee	8,044	6,097	1,947	5,019	4,741	278	3,025	1,356	1,669
Ochlockonee-St. Marks	5,958	3,780	2,178	3,403	2,940	463	2,555	840	1,715
Apalachicola-Chattahoochee-Flint	9,725	4,929	4,796	6,135	4,296	1,839	3,590	633	2,957
Perdido-Escambia-Conecuh-Choctawhatchee	10,097	6,506	3,591	7,460	5,914	1,546	2,637	592	2,045
Total	59,759	37,380	22,379	40,435	32,760	7,675	19,324	4,620	14,704

Source: Forest Service, U.S. Department of Agriculture.

TABLE 26.--Estimated employment and payrolls in harvesting forest products and forest management in the Southeast River Basins in 1958, with projections to 1975 and 2000

Item	1958	Prospective management		High-level management	
		1975	2000	1975	2000
Saw logs:					
Timber output (million cubic feet)	257	400	575	455	785
Output per employee (cubic feet)[1]	27,200	38,000	60,000	38,000	60,000
Employees (number)[2]	9,450	10,550	9,600	11,950	13,100
Pulpwood:					
Timber output (million cubic feet)	409	870	1,175	990	1,595
Output per employee (cubic feet)[1]	25,600	36,000	57,000	36,000	57,000
Employees (number)[2]	16,000	24,150	20,600	27,500	28,000
Other timber products:					
Timber output (million cubic feet)	159	175	250	200	340
Output per employee (cubic feet)[1]	16,800	24,000	37,000	24,000	37,000
Employees (number)[2]	9,450	7,300	6,750	8,350	9,200
Pine gum and stumps:					
Employees (number)[3]	18,000	25,000	25,000	25,000	25,000
Protecting and managing forest lands:					
Employees (number)[4]	6,000	7,500	10,300	8,600	13,300
All harvesting and management:					
Employees (number)	58,900	74,500	72,250	81,400	88,600
Average wages and salaries per employee (dollars)[5]	[6] 1,800	2,500	4,000	2,500	4,000
Payrolls (thousand dollars)[7]	106,000	186,000	289,000	204,000	354,000
Average value added per employee (dollars)[8]	4,650	6,500	10,200	6,500	10,200
Value added (thousand dollars)[9]	273,900	484,000	737,000	529,000	904,000

[1] Estimates for 1958 derived from data contained in the Forest Service report Equipment, Supplies, and Manpower Used by Primary Forest Products Industries, 1950. Projections for 1975 and 2000 are based on the assumption that productivity, i.e., output per employee will increase at an average annual rate of 2 percent.

[2] Estimates obtained by dividing timber products output by output per employee.

[3] Estimate of number of employees for 1958 derived from data on number of faces being worked and production of pine stumps, estimated unit labor requirements, and an assumed average of 200 working days per year. Projections based on the assumption that productivity will increase at an average annual rate of 2 percent.

[4] Projections of number of employees in protection and management allows for assumed increases in management.

[5] Average wages and salaries per employee assumed to increase in line with productivity at an average annual rate of 2 percent.

[6] Estimate derived from data published by the Bureau of the Census in the 1958 Census of Manufactures.

[7] Estimates obtained by multiplying average wages and salaries by total employment.

[8] Average value added per employee expected to increase in line with productivity at 2 percent per year.

[9] Projections obtained by multiplying average value added by total employment.

Source: Forest Service, U.S. Department of Agriculture.

TABLE 27.--Estimated employment, payrolls and value added by manufacture in primary forest product industries in the Southeast River Basins in 1958, with projections to 1975 and 2000

Industry	1958[1]	Prospective management		High-level management	
		1975	2000	1975	2000
Lumber and wood products[2]:					
Timber consumed or available for utilization (million cubic feet)[3]	328	520	750	590	1,025
Employees per million cubic feet of timber consumed in manufacturing (number)[4]	95	80	65	80	65
Employees in manufacturing (number)[5]	30,750	41,600	48,750	47,200	66,600
Employees in new secondary manufacturing not included above (number)[6]	--	4,400	11,250	4,800	15,400
Total employees (number)	30,750	46,000	60,000	52,000	82,000
Average wages and salaries per employee (dollars)[7]	2,300	2,700	3,400	2,700	3,400
Payrolls (thousand dollars)[8]	70,750	124,000	204,000	140,000	279,000
Average value added by manufacture per employee (dollars)[7]	3,600	4,300	5,400	4,300	5,400
Value added by manufacture (thousand dollars)[8]	110,700	198,000	324,000	224,000	443,000
Pulp, paper and products[9]:					
Timber consumed or available for utilization (million cubic feet)	409	870	1,175	990	1,595
Employees per million cubic feet of timber consumed in manufacturing (number)[10]	55	40	25	40	25
Employees in manufacturing (number)[5]	24,350	34,800	29,400	39,600	39,900
Employees in new secondary manufacturing not included above (number)[6]	--	5,200	10,600	6,400	15,100
Total employees (number)	24,350	40,000	40,000	46,000	55,000
Average wages and salaries per employee (dollars)[7]	4,850	6,800	10,700	6,800	10,700
Payrolls (thousand dollars)[8]	118,100	272,000	428,000	313,000	589,000
Average value added by manufacture per employee (dollars)[7]	12,800	17,900	28,300	17,900	28,300
Value added by manufacture (thousand dollars)[8]	311,700	716,000	1,132,000	823,000	1,557,000

[1] Estimates relating to employment, payrolls and value added for 1958 derived from data published by the Bureau of Census in the 1958 Census of Manufactures. All other data Forest Service estimates.

[2] Includes sawmills and planing mills, millwork plants, veneer and plywood plants, hardwood dimension and flooring mills, wood preservation plants, plants engaged in the manufacture of such products as prefabricated wooden buildings, boxes and crates, cooperage, pallets and skids, lasts, handtool handles, and other related plants. Estimates of employment, payrolls and value added that are reported in logging camps and logging contractors (Industry Code 2411) and that are combined with sawmills and not separately reported, which the Bureau of Census includes in this group, are shown in table 26 under harvesting.

Footnotes for table 27--Continued

[3] Includes saw logs, veneer logs and all other industrial wood products except pulpwood.
[4] Estimate for 1958 derived by dividing total number of employees by the volume of timber consumed. Projections based on the assumption that productivity, i.e., output per employee, will increase at an average annual rate of 1 percent.
[5] Projections obtained by multiplying number of employees needed to process a million cubic feet of timber by the volume of timber available for utilization.
[6] Employees resulting from an increase in secondary manufacturing activities such as the further manufacture of lumber into millwork, flooring, prefabricated buildings, wooden boxes, etc., or the manufacture of paper and paperboard into boxes, bags, etc. In the lumber and wood products industries the number of employees was increased by roughly 10 percent in 1975 and 25 percent in 2000. In the pulp, paper and products industries the number of employees was increased by roughly 15 percent in 1975 and 35 percent in 2000.
[7] Average wages and salaries and value added by manufacture per employee are assumed to increase in line with increased productivity, i.e., at an average annual rate of 1 percent in the lumber and wood products group and 2 percent in the pulp, paper and products group.
[8] Projections obtained by multiplying average wages and salaries and value added by manufacture per employee by total number of employees.
[9] Includes pulp, paper, board mills, and mills engaged in such activities as paper coating and glazing, and the conversion of paper and paperboard into such products as envelopes, bags, sanitary napkins, and boxes.
[10] Estimate for 1958 derived by dividing total number of employees by the volume of timber consumed. Projections based on the assumption that productivity, i.e., output per employee, will increase at an average annual rate of 2 percent.

Source: Forest Service, U.S. Department of Agriculture.

Definitions

Commercial forest land. Forest land which is producing or capable of producing crops of industrial wood, and not withdrawn from timber utilization.

Commercial thinning. The removal of some of the trees in an immature and predominantly even-aged stand beyond the sapling stage to recover and use material that would be lost through mortality and to improve the quality and growth of the trees in the remaining stand.

Cull trees. Live trees of sawtimber or poletimber size that are unmerchantable for saw logs now or prospectively because of defect, rot, or species.

Desirable trees. Growing-stock trees having no serious defects in quality limiting present or prospective use, relatively high vigor and containing no pathogens that may result in death or serious deterioration before rotation age. They include the type of trees forest managers aim to grow, that is, the trees left in silvicultural cutting or favored in cultural operations.

Forest type groups. Groups of local forest cover types, as follows:

Bottom-land hardwoods (Oak-gum-cypress). Bottom-land forests in which 50 percent or more of the stand is tupelo, blackgum, sweetgum, or oaks, or southern cypress, singly or in combination, except where pines comprise 25-49 percent, in which case the stand would be classified oak-pine. (Common associates include cottonwood, willow, ash, elm, hackberry, and maple.)

Oak-pine. Forests in which 50 percent or more of the stand is hardwoods, usually upland oaks, but in which southern pines make up 25-49 percent of the stand. (Common associates include gum, hickory, and yellow-poplar.)

Pine. Forests in which 50 percent or more of the stand is longleaf pine, slash pine, loblolly pine, shortleaf pine, or other southern yellow pines, singly or in combination. (Common associates include oak, hickory, and gum.)

Upland hardwoods (Oak-hickory). Forests in which 50 percent or more of the stand is upland oaks or hickory, singly or in combination, except where pines comprise 25-49 percent, in which case the stand would be classified oak-pine. (Common associates include yellow-poplar, elm, maple, and black walnut.)

Growing stock volume. Volume of sound wood in the bole of sawtimber and poletimber trees from stump to a minimum 4.0-inch top outside bark.

Growth:

a. Net annual growth of growing stock. The annual change in volume of sound wood in live sawtimber and poletimber trees resulting from natural causes.

b. Net annual growth of sawtimber. The annual change in net board-foot volume of live sawtimber trees resulting from natural causes.

Mortality:

a. Mortality of growing stock. The volume of sound wood in live sawtimber and poletimber trees dying annually from natural causes.

b. Mortality of sawtimber. The net board-foot volume of sawtimber trees dying annually from natural causes.

Noncommercial thinning. The removal of unmerchantable trees to improve the quality and growth of the trees in the remaining stand.

Poletimber trees. Live trees of commercial species 5.0 to 9.0 inches in diameter at breast height for softwoods and 5.0 to 11.0 inches in diameter at breast height for hardwoods, and of good form and vigor.

Saplings. Live trees of commercial species 1.0 inch to 5.0 inches in diameter at breast height and of good form and vigor.

Sawtimber trees. Live trees of commercial species 9.0 inches and larger in diameter at breast height for softwoods and 11.0 inches and larger in diameter at breast height for hardwoods, and containing at least one saw log.

Sawtimber volume. Net volume of the saw-log portion of live sawtimber trees, in board feet International 1/4-inch log rule.

Seedlings. Live trees of commercial species less than 1.0 inch in diameter at breast height that are expected to survive according to regional standards.

Site classes. A classification of forest land in terms of inherent capacity to grow crops of industrial wood.

Stocking. A measure of area occupancy by trees of specified classes. Three categories of stocking are considered in the Survey: (1) all live trees, (2) growing-stock trees, and (3) desirable trees. Stocking in terms of all trees is used in the delineation of forest land and forest types. Stocking in terms of growing-stock trees is used in stand-size and age classifications. Stocking in terms of desirable trees is used in delineating area condition and stand treatment classes.

Stocking percentage. Current area occupancy or stocking in relation to specified stocking standards.

Timber cut:

a. Timber cut from growing stock. The volume of sound wood in live sawtimber and poletimber trees cut for forest products during a specified period, including both roundwood products and logging residues.

b. Timber cut from sawtimber. The net board-foot volume of live sawtimber trees cut for forest products during a specified period, including both roundwood products and logging residues.

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