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POLE AND PILE TIMBER IN FOUR SOUTHEASTERN SURVEY UNITS

By

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* - This is an advance release of Forest Survey data that will be included in complete reports to be published later. This information is subject to correction or amplification as computations proceed.

POLE AND PILE TIMBER

IN FOUR SOUTHEASTERN SURVEY UNITS

This release presents, for four Forest Survey units, advance information on the amount and character of timber that is suitable for conversion into poles and piles. These units, shown in Figure 1, lie in South Carolina, Georgia, and northeast Florida, in the coastal plain region. Along the Atlantic and Gulf coasts the terrain is characterized by sandy, poorly drained flatwoods that extend from twenty miles inland on the Gulf Coast of Florida to over one hundred miles in southeast Georgia. Behind the coastal strip the country is gently rolling. Thirty percent of the area is in rolling uplands; 40 percent in flatwoods; 27 percent in bays, ponds, swamps, and branches; and 3 percent is in river bottoms.

The area is well served by railroads. Port facilities are available at Charleston, S. C.; Savannah and Brunswick, Ga.; and Jacksonville and Fernandina, Fla. River transportation exists on the St. Johns and Savannah Rivers and is feasible on several other larger streams. The Intercoastal waterway, available for barge transportation and rafting, passes down the Atlantic Coast. An extensive system of paved, improved, and country roads serves practically the entire area. With the exception of the interiors of a few of the larger swamps, poles and piles can be and are moved to shipping points from all parts of the region.

Commercial wood preserving plants are located, within the area covered, at Savannah and Brunswick, Ga.; and at Jacksonville, Fla. Nearby commercial plants drawing a part of their supplies from the same region are at Charleston and Spartanburg, S. C.; Augusta and Atlanta, Ga.; Birmingham, Montgomery, Brewton, and Mobile, Ala.; Pensacola, Fla.; and Chattanooga, Tenn. Railroad creosoting plants are located at Macen, Ga., and at Gainesville and Hull, Fla. The Gainesville plant is inactive.

Information presented in this release is based on data gathered during 1934 and 1935 by the Southern Forest Survey, an activity of the Southern Forest Experiment Station of the U. S. Forest Service. Trained cruisers measured the timber and recorded the forest and land-use conditions on nearly 38,000 quarter acre sample plots systematically located at intervals of 660 feet on parallel compass lines, 10 miles apart, run entirely across the area from east to west. The preliminary estimates presented here are subject to revision later in final survey unit reports.

While estimates are given here of the number of trees that have the qualifications for pole and pile use, no attempt is made to show what part of this resource is available for this use. Other wood-products industries must be supplied with raw materials, and are constantly converting pole and pile timber into other commodities. In the final unit and regional reports, analysis and interpretation of the resource situation will be undertaken.

In the presentation of these data, it is to be noted that owing to the sampling method used in collecting them, usually the greater the area or volume in any given classification the more accurate are the data for that classification. Classes that are of infrequent occurrence and relatively small in quantity cannot generally be determined with as high a degree of accuracy as is obtainable for classes that occur more frequently and in substantially greater quantities.

LAND AREA

The four survey units covered in this release include a land area of approximately 30 million acres, of which over 20 million acres are in for-

The following estimate covers the pine species only. No pole and pile estimate has been made for cypress and hardwood species. The trees suited for use as poles and piles occur scattered throughout the forest stands of the area, singly and in groups. They are found mainly in the areas occupied by the longleaf-slash and loblolly-shortleaf-hardwood forest types, but also occur in the other type areas.

It is believed that the estimate of the number of pole and pile trees is very conservative. The difficulty of accurately judging standing trees in respect to their ability to meet the exacting technical specifications of users of poles and pile can be readily appreciated. It is likely that the estimate of the number of suitable trees may be short of the actual number on the area. The chief value of the estimate to the industry lies in its true reflection of the proportion of lengths and sizes occurring in the forest stands in the several units.

Table 4 shows the total number of trees in the combined four survey units that will meet standard specifications, classifying them according to principal species group, turpentine status, pole and pile length class and tree-diameter class. The tree-species groups and turpentine conditions are as follows:

Round longleaf and slash pines:	Trees of these species that have not been turpentined.
Turpentined longleaf and slash pines:	Trees that are being or have been turpentined, and consequently bear one or more turpentine faces on the butt section.
Loblolly and other pines:	Loblolly, shortleaf, pond, and scrub pines. A small amount of cedar is included.

The area covered by this estimate is in the heart of the active naval stores belt, and, as a rule, trees of the longleaf and slash pine species will be turpentined before being cut for any other use. The presence of one or more turpentine faces usually reduces the length that may be used for a pole or pile by from 5 to 10 feet. This reduction has been made by the cruisers in the case of turpentined trees. Loblolly, shortleaf, pond, and scrub pines do not have this naval stores complex.

In the four survey units, there are 77,842,000 pine trees suited for pole and pile use. For the region as a whole, 73 percent of the suitable trees will produce poles or piles in the 20-and 25-foot length classes; 21 percent will produce 30-and 35-foot lengths; and 6 percent will produce lengths of 40 feet or longer.

In Tables 4 to 7, the number of trees suitable for poles and piles of the various lengths is shown for each of the four survey units and classified according to tree diameter. Aside from the total numbers of suitable trees, and the proportions by species and turpentine conditions, which differ considerably, a striking similarity exists between the figures for all four units. Almost half of the pole and pile timber in the South Carolina unit is loblolly pine. In each of the other three units, over 90 percent is longleaf and slash pine. In Georgia Unit No. 1, almost two-thirds of the suitable longleaf and slash pine trees carry turpentine faces; in Georgia Unit No. 2, over half; and in the Florida and South Carolina units, only about one-third are so faced, as yet.

TABLE 3. - *Number of trees suited for pole and pile use, four survey units combined (S.C. No. 1, Ga. Nos. 1 and 2, and Fla. No. 1)*

Tree diameter class	Species group	Pole or piling length (feet) 20	25	30	35	40	45	50	55+	Total	Percent of total
Inches		Thousands of trees									
7.0 - 8.9	Round longleaf and slash pines	13,918	3,558	1,653	164	-	-	-	-	19,293	24.8
	Turpentined longleaf and slash pines	3,795	1,138	384	150	-	-	-	-	5,467	7.0
	Loblolly and other pines	1,702	365	108	-	-	-	-	-	2,175	2.8
	Total	19,415	5,061	2,145	314	-	-	-	-	26,935	34.6
9.0 - 10.9	Round longleaf and slash pines	4,422	2,306	1,494	763	284	79	-	-	9,368	12.1
	Turpentined longleaf and slash pines	5,261	2,124	995	574	339	-	-	-	9,293	11.9
	Loblolly and other pines	1,714	698	426	215	65	-	-	-	3,118	4.0
	Total	11,397	5,128	2,915	1,572	688	79	-	-	21,779	28.0
11.0 - 12.9	Round longleaf and slash pines	1,303	1,064	748	604	351	132	70	-	4,272	5.5
	Turpentined longleaf and slash pines	3,588	2,050	1,214	833	583	111	-	-	8,379	10.8
	Loblolly and other pines	1,009	663	584	310	214	-	-	-	2,780	3.5
	Total	5,900	3,777	2,546	1,747	1,148	243	70	-	15,431	19.8
13.0 - 14.9	Round longleaf and slash pines	323	416	339	310	224	149	60	29	1,850	2.4
	Turpentined longleaf and slash pines	1,525	1,206	872	649	410	144	37	9	4,852	6.2
	Loblolly and other pines	374	427	462	253	148	72	25	6	1,767	2.3
	Total	2,222	2,049	1,673	1,212	782	365	122	44	8,469	10.9
15.0 - 16.9	Round longleaf and slash pines	47	140	144	129	107	69	30	32	698	0.9
	Turpentined longleaf and slash pines	396	466	430	324	174	72	54	25	1,941	2.5
	Loblolly and other pines	96	224	299	178	95	63	26	15	996	1.3
	Total	539	830	873	631	376	204	110	72	3,635	4.7
17.0 - 18.9	Round longleaf and slash pines	-	41	61	57	44	31	20	15	269	0.3
	Turpentined longleaf and slash pines	59	201	242	176	89	31	21	35	854	1.1
	Loblolly and other pines	-	93	155	105	53	39	12	13	470	0.6
	Total	59	335	458	338	186	101	53	63	1,593	2.0
All diameter classes	Round longleaf and slash pines	20,013	7,525	4,439	2,047	1,010	460	180	76	35,750	46.0
	Turpentined longleaf and slash pines	14,624	7,185	4,137	2,706	1,595	358	112	69	30,786	39.5
	Loblolly and other pines	4,895	2,470	2,034	1,061	575	174	63	34	11,306	14.5
	Total	39,532	17,180	10,610	5,814	3,180	992	355	179	77,842	100.0
	Percent of total	50.7	22.1	13.6	7.5	4.1	1.3	0.5	0.2	100.0	

TABLE 4. - *Number of trees suited for pole and pile use, South Carolina Unit No. 1*

Tree diameter class	Species group	Pole or piling length (feet)								Total	Percent of total
		20	25	30	35	40	45	50	55+		
Inches		---------- Thousands of trees ----------									
7.0 - 8.9	Round longleaf and slash pines	2,070	595	170	-	-	-	-	-	2,835	18.0
	Turpentined longleaf and slash pines	408	106	39	-	-	-	-	-	553	3.5
	Loblolly and other pines	1,064	97	61	-	-	-	-	-	1,222	7.8
	Total	3,542	798	270	-	-	-	-	-	4,610	29.3
9.0 - 10.9	Round longleaf and slash pines	653	537	266	168	51	-	-	-	1,675	10.7
	Turpentined longleaf and slash pines	521	187	125	38	-	-	-	-	871	5.5
	Loblolly and other pines	1,183	356	277	119	39	-	-	-	1,974	12.5
	Total	2,357	1,080	668	325	90	-	-	-	4,520	28.7
11.0 - 12.9	Round longleaf and slash pines	238	302	219	106	87	-	-	-	952	6.0
	Turpentined longleaf and slash pines	277	154	138	71	6	-	-	-	646	4.1
	Loblolly and other pines	704	389	370	157	141	-	-	-	1,761	11.2
	Total	1,219	845	727	334	234	-	-	-	3,359	21.3
13.0 - 14.9	Round longleaf and slash pines	61	112	119	58	36	-	-	-	386	2.4
	Turpentined longleaf and slash pines	135	113	103	71	12	-	-	-	434	2.8
	Loblolly and other pines	261	273	283	141	100	32	-	-	1,090	6.9
	Total	457	498	505	270	148	32	-	-	1,910	12.1
15.0 - 16.9	Round longleaf and slash pines	10	42	58	32	6	-	-	-	148	1.0
	Turpentined longleaf and slash pines	32	41	42	29	10	-	-	-	154	1.0
	Loblolly and other pines	67	158	193	97	61	29	-	-	605	3.8
	Total	109	241	293	158	77	29	-	-	907	5.8
17.0 - 18.9	Round longleaf and slash pines	-	16	26	19	-	-	-	-	61	0.4
	Turpentined longleaf and slash pines	3	26	29	19	7	-	-	-	84	0.5
	Loblolly and other pines	-	74	109	64	32	16	-	-	295	1.9
	Total	3	116	164	102	39	16	-	-	440	2.8
All diameter classes	Round longleaf and slash pines	3,032	1,604	858	383	180	-	-	-	6,057	38.5
	Turpentined longleaf and slash pines	1,376	627	476	228	35	-	-	-	2,742	17.4
	Loblolly and other pines	3,279	1,347	1,293	578	373	77	-	-	6,947	44.1
	Total	7,687	3,578	2,627	1,189	588	77	-	-	15,746	100.0
	Percent of total	48.8	22.7	16.7	7.6	3.7	0.5	-	-	100.0	

TABLE 5. - *Number of trees suited for pole and pile use, Georgia Unit No. 1*

Tree diameter class	Species group	Pole or piling length (feet) 20	25	30	35	40	45	50	55+	Total	Percent of total
Inches		Thousands of trees									
7.0 - 8.9	Round longleaf and slash pines	3,553	887	445	50	-	-	-	-	4,935	19.2
	Turpentined longleaf and slash pines	1,961	598	199	87	-	-	-	-	2,845	11.0
	Loblolly and other pines	255	106	19	-	-	-	-	-	380	1.5
	Total	5,769	1,591	663	137	-	-	-	-	8,160	31.7
9.0 - 10.9	Round longleaf and slash pines	915	430	298	150	56	19	-	-	1,868	7.2
	Turpentined longleaf and slash pines	2,450	993	443	270	168	-	-	-	4,324	16.8
	Loblolly and other pines	209	134	59	38	9	-	-	-	449	1.8
	Total	3,574	1,557	800	458	233	19	-	-	6,641	25.8
11.0 - 12.9	Round longleaf and slash pines	277	199	137	131	68	34	19	-	865	3.3
	Turpentined longleaf and slash pines	1,715	1,006	579	414	311	66	-	-	4,091	15.9
	Loblolly and other pines	146	134	103	74	35	-	-	-	492	1.9
	Total	2,138	1,339	819	619	414	100	19	-	5,448	21.1
13.0 - 14.9	Round longleaf and slash pines	78	90	65	75	56	44	18	10	436	1.7
	Turpentined longleaf and slash pines	760	604	426	321	221	81	22	6	2,441	9.5
	Loblolly and other pines	62	84	100	62	25	21	16	3	373	1.4
	Total	900	778	591	458	302	146	56	19	3,250	12.6
15.0 - 16.9	Round longleaf and slash pines	12	35	32	34	37	25	12	12	199	0.8
	Turpentined longleaf and slash pines	221	258	240	131	100	43	34	16	1,093	4.2
	Loblolly and other pines	19	43	68	53	22	22	16	9	252	1.0
	Total	252	336	340	268	159	90	62	37	1,544	6.0
17.0 - 18.9	Round longleaf and slash pines	-	9	13	12	16	12	7	6	75	0.3
	Turpentined longleaf and slash pines	37	115	146	103	53	22	12	25	513	2.0
	Loblolly and other pines	-	16	37	31	15	16	9	10	134	0.5
	Total	37	140	196	146	84	50	28	41	722	2.8
All diameter classes	Round longleef and slesh pines	4,835	1,650	990	452	233	134	56	28	8,378	32.5
	Turpentined longleaf and slash pines	7,144	3,574	2,033	1,376	853	212	68	47	15,307	59.4
	Loblolly and other pines	691	517	386	258	106	59	41	22	2,080	8.1
	Total	12,670	5,741	3,409	2,086	1,192	405	165	97	25,765	100.0
	Percent of total	49.2	22.3	13.2	8.1	4.6	1.6	0.6	0.4	100.0	

TABLE 6. - *Number of trees suited for pole and pile use, Georgia Unit No. 2*

Tree diameter class	Species group	Pole or piling length (feet)								Total	Percent of total
		20	25	30	35	40	45	50	55+		
Inches		Thousands of trees									
7.0 - 8.9	Round longleaf and slash pines	2,064	518	259	29	-	-	-	-	2,870	27.6
	Turpentined longleaf and slesh pines	499	153	51	22	-	-	-	-	725	6.9
	Loblolly and other pines	121	52	9	-	-	-	-	-	182	1.8
	Total	2,684	723	319	51	-	-	-	-	3,777	36.3
9.0 - 10.9	Round longleaf end slash pines	709	333	230	115	45	16	-	-	1,448	13.9
	Turpentined longleaf and slash pines	745	304	137	86	54	-	-	-	1,326	12.8
	Loblolly and other pines	127	82	36	23	7	-	-	-	275	2.6
	Total	1,581	719	403	224	106	16	-	-	3,049	29.3
11.0 - 12.9	Round longleaf and slash pines	195	137	96	89	48	26	13	-	604	5.8
	Turpentined longleaf end slash pines	527	298	166	115	89	16	-	-	1,211	11.7
	Loblolly and other pines	61	54	45	32	16	-	-	-	208	2.0
	Total	783	489	307	236	153	42	13	-	2,023	19.5
13.0 - 14.9	Round longleaf and slash pines	39	44	32	38	28	23	10	3	217	2.1
	Turpentined longleaf and slash pines	230	176	125	93	64	22	6	-	716	6.9
	Loblolly and other pines	19	29	32	19	10	6	3	-	118	1.1
	Total	288	249	189	150	102	51	19	3	1,051	10.1
15.0 - 16.9	Round longleaf and slash pines	6	13	9	13	13	9	3	4	70	0.7
	Turpentined longleaf and slash pines	54	63	54	45	26	10	7	3	262	2.5
	Loblolly and other pines	4	10	16	9	3	3	3	3	51	0.5
	Total	64	86	79	67	42	22	13	10	383	3.7
17.0 - 18.9	Round longleaf and slesh pines	-	3	3	4	3	3	3	-	19	0.2
	Turpentined longleaf and slesh pines	6	19	20	16	10	3	3	3	80	0.8
	Loblolly and other pines	-	-	3	3	3	4	-	-	13	0.1
	Total	6	22	26	23	16	10	6	3	112	1.1
All diameter classes	Round longleaf and slash pines	3,013	1,048	629	288	137	77	29	7	5,228	50.3
	Turpentined longleaf and slash pines	2,061	1,013	553	377	243	51	16	6	4,320	41.6
	Loblolly and other pines	332	227	141	86	39	13	6	3	847	8.1
	Total	5,406	2,288	1,323	751	419	141	51	16	10,395	100.0
	Percent of totel	52.0	22.0	12.7	7.2	4.0	1.4	0.5	0.2	100.0	

TABLE 7. - *Number of trees suited for pole and pile use, Florida Unit No. 1*

Tree diameter class	Species group	Pole or piling length (feet) 20	25	30	35	40	45	50	55+	Total	Percent of total
Inches		Thousands of trees									
7.0 - 8.9	Round longleaf and slash pines	6,231	1,558	779	85	-	-	-	-	8,653	33.4
	Turpentined longleaf and slash pines	927	281	95	41	-	-	-	-	1,344	5.2
	Loblolly and other pines	262	110	19	-	-	-	-	-	391	1.5
	Total	7,420	1,949	893	126	-	-	-	-	10,388	40.1
9.0 - 10.9	Round longleaf and slash pines	2,145	1,006	700	350	132	44	-	-	4,377	16.9
	Turpentined longleaf and slash pines	1,545	640	290	180	117	-	-	-	2,772	10.7
	Loblolly and other pines	195	126	54	35	10	-	-	-	420	1.6
	Total	3,885	1,772	1,044	565	259	44	-	-	7,569	29.2
11.0 - 12.9	Round longleaf and slash pines	593	426	296	278	148	72	38	-	1,851	7.1
	Turpentined longleaf and slash pines	1,069	592	331	233	177	29	-	-	2,431	9.3
	Loblolly and other pines	98	86	66	47	22	-	-	-	319	1.3
	Total	1,760	1,104	693	558	347	101	38	-	4,601	17.7
13.0 - 14.9	Round longleaf and slash pines	145	170	123	139	104	82	32	16	811	3.1
	Turpentined longleaf and slash pines	400	313	218	164	113	41	9	3	1,261	4.9
	Loblolly and other pines	32	41	47	31	13	13	6	3	186	0.7
	Total	577	524	388	334	230	136	47	22	2,258	8.7
15.0 - 16.9	Round longleaf and slash pines	19	50	45	50	51	35	15	16	281	1.1
	Turpentined longleaf and slash pines	89	104	94	69	38	19	13	6	432	1.7
	Loblolly and other pines	6	13	22	19	9	9	7	3	88	0.3
	Total	114	167	161	138	98	63	35	25	801	3.1
17.0 - 18.9	Round longleaf and slash pines	-	13	19	22	25	16	10	9	114	0.4
	Turpentined longleaf and slash pines	13	41	47	38	19	6	6	7	177	0.7
	Loblolly and other pines	-	3	6	7	3	3	3	3	28	0.1
	Total	13	57	72	67	47	25	19	19	319	1.2
All diameter classes	Round longleaf and slash pines	9,133	3,223	1,962	924	460	249	95	41	16,087	62.0
	Turpentined longleaf and slash pines	4,043	1,971	1,075	725	464	95	28	16	8,417	32.5
	Loblolly and other pines	593	379	214	139	57	25	16	9	1,432	5.5
	Total	13,769	5,573	3,251	1,788	981	369	139	66	25,936	100.0
	Percent of total	53.1	21.5	12.5	6.9	3.8	1.4	0.5	0.3	100.0	

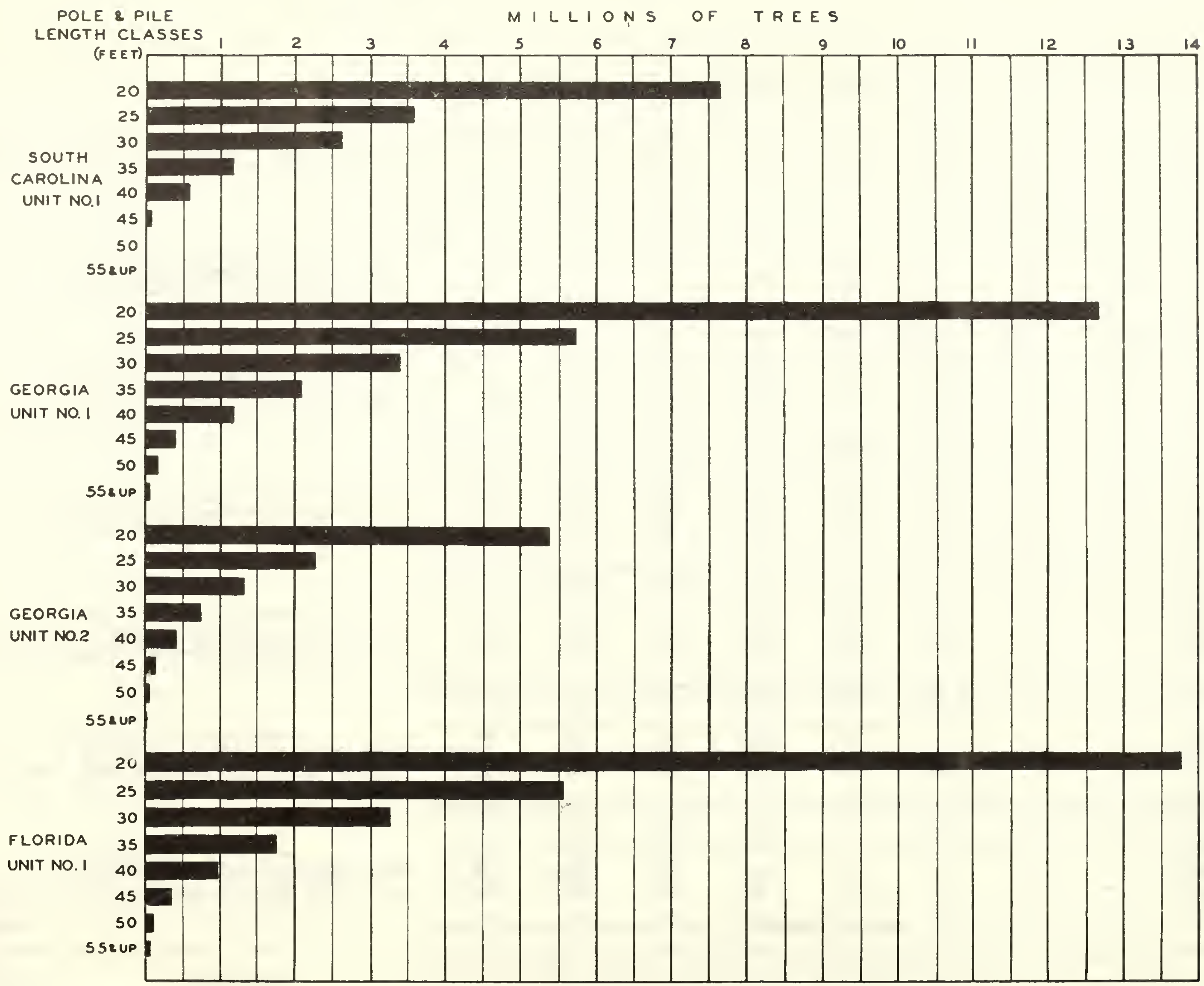

FIGURE 2. - POLE AND PILE TIMBER IN FOUR SOUTHEASTERN SURVEY UNITS

As to the relative showing of lengths, Georgia Unit No. 1 has the highest percentage of pole and pile timber that will produce lengths of 40 feet or longer, and the South Carolina unit has the lowest percentage that will produce such lengths. On the other hand, the South Carolina unit has the highest proportion, 24 percent, that will produce 30-and 35-foot lengths, and the Florida unit is at the bottom of the list with 19 percent of the pole and pile timber suited for these commonly used lengths. The relative proportions of different pole and pile lengths in the several units is shown graphically in Figure 2.

The frequency with which suitable trees occur is an important consideration. In this connection, an analysis was made that involved the assumption that the pine pole and pile timber occurs principally in sawtimber-size stands where pine comprises all or an important part of the forest. The large acreage of stands of less than sawtimber-size, and of predominantly hardwood and cypress forest types was eliminated from consideration. The remaining acreage, that is, the sawtimber acreage in the pine forest types for a given unit, was divided into the number of pole and pile trees for that unit. This gave a figure of the average number of suitable trees per acre for the forest stands in which the pole and pile timber is concentrated. The average figures for suitable trees of all length-classes are as follows: South Carolina Unit No. 1, 12.2 trees per sawtimber acre; Florida Unit No. 1, 11.6 trees; Georgia Unit No. 1, 9.1 trees; and Georgia Unit No. 2, 8.6 trees. For the 30-and 35-foot length-classes the average figures obtained are: South Carolina Unit No. 1, 3.0 per sawtimber acre; Florida Unit No. 1, 2.3 trees; Georgia Unit No. 1, 1.9 trees; Georgia Unit No. 2, 1.7 trees. The average figures for the length-classes of 40 feet and longer are: Florida Unit No. 1, 0.7 trees per sawtimber acre; Georgia Unit No. 1, 0.6 trees;Georgia Unit No. 2 and the South Carolina unit, 0.5 trees. It will be noted that the South Carolina unit averages highest for all lengths, excepting those of 40 feet and longer; the Florida unit ranks second; Georgia Unit No. 1, third; and Georgia Unit No. 2, fourth. A large proportion of the suitable timber in the Florida unit, however, is round longleaf and slash pine, which will probably be worked for turpentine before being cut for any other use. Discounting for the effect of future turpentining may put Georgia Unit No. 1 ahead of the Florida unit in this rating.

SUMMARY

The four survey units covered in this release,South Carolina No. 1, Georgia No. 1 and 2, and Florida No. 1,include a land area of 30 million acres, of which 20 million are in forest. Longleaf and slash pine types occupy 69 percent of the forest area; loblolly-shortleaf-hardwood types, 16 percent; and hardwood types, 15 percent. Old growth stands occupy 18 percent of the forest area; second growth 67 percent;reproduction 6 percent; and clear-cut areas 9 percent.

Trees suited for pole and pile use occur scattered throughout the forest stands, a tree here and there, most of which are accessible. The four units contain 78 million trees classified as potential pole and pile timber. 73 percent of these will produce poles and piles in the 20- and 25-foot lengths;21 percent will produce 30-and 35-foot lengths,which are the lengths most commonly used;and 6 percent will produce lengths of 40 feet or more.

In the South Carolina unit, almost half of the pole and pile timber is loblolly pine. In each of the Georgia and Florida units, over 90 percent is longleaf and slash pine. Aside from the total numbers of suitable trees, and the proportions by species and turpentine conditions, a striking similarity exists between the figures for all four units. The per acre frequency with which suitable trees occur in the area from which most poles will be cut averages highest in the South Carolina unit, with the Florida unit second, Georgia Unit No. 1 third, and Georgia Unit No. 2 fourth.

The naval stores industry is dominant over the area, possibly excepting a part of the South Carolina unit, and longleaf and slash pine trees are usually turpentined before being cut for any other use. Other forest industries, such as sawmills, container plants, and pulp mills, customarily cut pole and pile timber for their commodities without regard to its higher value for other uses.

It would be greatly to the financial advantage of timber owners if more attention were paid to converting each tree into the most valuable commodity that its qualifications would permit. Trees that would produce poles and piles should not be cut for pulpwood, for ties, or for low grade lumber. On the other hand, and in furtherance of better integration of forest industries, the users of poles and piles should more nearly harmonize their specifications and requirements with the woods run of lengths and diameters. This would materially increase the supply of merchantable pole and pile material and would encourage timber owners to give special consideration to the needs of the industry.

FOREST SURVEY RELEASE* No. 22 December 18, 1936

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

SAWTIMBER AND CORDWOOD VOLUMES

IN THE SOUTH LOUISIANA DELTA

A Progress Report

By

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

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* - This is an advance release of Forest Survey data that will be included in complete reports to be published later. This information is subject to correction or amplification as computations proceed.

SAWTIMBER AND CORDWOOD VOLUMES

IN THE SOUTH LOUISIANA DELTA

This report deals with the Delta and adjoining hardwood areas of south Louisiana and includes all or parts of 32 parishes lying south of the Red River, below the city of Alexandria. In the Delta proper, forest land is confined principally to the lower-lying areas,with cultivated fields on the higher lands that border the larger streams.Extensive backwater flood areas occur near the junction of the Red River with the Mississippi and along the lower Atchafalaya River. Extensive areas of cypress-tupelo swamp occur in the lower Delta and in the Lake Maurepas-Lake Pontchartrain region. West of Bayou Teche is a higher-lying area of terrace formation or prehistoric Mississippi flood-plain. A natural prairie section, now predominantly agricultural, extends through the western part of the unit, where the only forest lands are found bordering the streams in belts from one-half to several miles in width. Areas of true uplands occur east of the Mississippi River and in Evangeline Parish. The entire Gulf Coast strip is a marshy, low-lying belt up to 30 or more miles wide.

While the principal drainage to the Gulf is through the Mississippi and Atchafalaya Rivers, the entire Delta is much dissected by bayous and other waterways. Most of the larger waterways and many of the lesser ones are available for barge transportation. Several wood-using plants make use of water transportation in obtaining their raw materials. The Intra-Coastal Waterway crosses the lower part of the area by means of natural waterways and land cuts via New Orleans, Houma, Morgan City, and thence to the Sabine River,near Orange, Texas. An alternate route between New Orleans and Morgan City leaves the Mississippi River at Plaquemine. New Orleans and Baton Rouge have facilities for ocean-going vessels.

The lines of seven major railroads traverse the unit. These are the Chicago, Rock Island & Pacific, the Illinois Central,the Louisiana & Arkansas, the Louisiana Southern, the Missouri Pacific, the Southern Pacific,and the Texas & Pacific. New Orleans also is a terminal point for the Southern, the Louisville & Nashville, and the Gulf, Mobile & Northern Railroads. Approximately 1,000 miles of paved highways connect the principal cities and towns but tend to be concentrated in the agricultural areas. Natural gas, oil,salt,and sulphur are produced in large quantities in and adjoining this unit. Also a small amount of limestone is produced; and at Morgan City is a large plant producing crushed shell,from which it is possible to make lime, used in certain pulping processes.

Information presented in this release is based on data gathered during the fall and winter of 1934-35 by the Forest Survey. Trained timber cruisers measured the timber and recorded the forest and land-use conditions on over 13,000 quarter-acre sample plots systematically located at intervals of 660 feet on parallel compass lines 10 miles apart run entirely across the area from east to west. The preliminary estimates presented here are subject to revision later in the final report. Any changes made, however, will probably be neither extensive nor basic.

In the presentation of these survey data, it is to be noted that owing to the sampling method used in collecting them, usually the greater the area or volume in any given classification the more accurate are the data for that classification. Classes that are of infrequent occurrence and relatively small in quantity generally cannot be determined with as high a degree of accuracy as is obtainable for classes that occur more frequently and in substantially greater quantities. Area and volume figures for some of the less common classifications are given despite a knowledge that they may have a relatively large error. Data for any area or volume less than 1 percent of the total should be considered as indicating only the relative magnitude of the item.

Land Area

The land surface of this unit is divided almost equally between forests, lands in agricultural use, and coastal marshes. Slightly more than one-third of the agricultural area was natural prairie but is now devoted principally to rice production.

Table 1. -- Land area classified according to use

Land use	Area in acres	Percent of total area
Forest	3,735,400	32.6
Agricultural 1/	3,728,400	32.5
Other 2/	4,011,100	34.9
Total land area	11,474,900	100.0

1/ Includes both old and new cropland, idle and abandoned fields, and improved pastures.

2/ Includes marsh, non-meandered waterways, towns and villages, and rights-of-way for roads, railways, and transmission lines.

Forest Area

Five percent of the forest area is on river margins; 37 percent in swamp; 39 percent on bottomlands; 12 percent in second-bottoms and terraces; and 7 percent in true uplands. In Table 2, the forest area of the unit is classified according to forest condition and type-group. The various forest conditions are defined as follows:

Old growth:	Stands composed predominantly of sawtimber trees with the characteristics of the original mature trees of the region.
Uncut:	Old-growth stands from which less than 10 percent of the volume has been cut.
Partly cut:	Old-growth stands from which at least 10 percent of the volume has been removed, but which are still characterized by residual trees from the old-growth forest.
Second growth:	Stands that have succeeded the original forest as a result of cutting or other causes.
Sawlog-size: Uncut:	Second-growth stands in which the sawlog-size trees contain at least 600 board feet per acre, and from which less than 10 percent of the board-foot volume has been cut.
Partly cut:	Second-growth stands from which 10 percent or more of the board-foot volume has been cut, but in which the remaining sawlog-size trees contain at least 400 board feet per acre.
Under-sawlog size:	Second-growth stands composed predominantly of under-sawlog-size trees. The sawlog-size trees present contain less than 600 board feet per acre.
Reproduction:	Re-stocking areas not falling into any of the above classifications and bearing 80 or more seedlings per acre that are less than 1 inch in diameter at breast height.
Clear-cut:	Cut-over areas on which an insufficient quantity of young growth has come in to classify them either as second growth or reproduction.
Nonproductive:	Forest areas that are monopolized by a forest growth of no economic value, such as buttonbush and planer trees. These areas usually are not large, contiguous areas, but instead occur as small islands scattered throughout the forest stands.

The forest type-groups are designated by the species that predominate in the stands; other species are associated with them in all groups.

The cypress-tupelo type-group occurs in deep swamps, and in most of it the original timber has been all or partly logged off. The partly cut old-growth condition is composed principally of stands from which only the cypress has been removed, leaving the stand of tupelo gum practically intact. Second-growth cypress-tupelo areas should prove to be an excellent source of pulpwood.

The cottonwood-willow type-group consists in reality of two separate but closely related types since the two species seldom grow together. Cottonwood in pure stands usually grows on high, sandy river-margins or on old fields; in the bottoms willow in pure stands commonly grows on low banks along rivers and on new-made lands. Much of the small willow in this unit occurs in the basin of the lower Atchafalaya River and upper Grand Lake.

In the oak-mixed hardwoods type-group, 81 percent of the uncut old-growth area consists of overcup oak-pecan stands, most of which are considered of only slight commercial value at the present time. The oak-mixed hardwoods type-group is composed of the following forest types: Oak-mixed hardwoods, overcup oak-pecan, pine-hardwoods, upland hardwoods, and pin oak.

In the gum-mixed hardwoods type-group, 65 percent of the uncut old-growth area is in the red gum-water oaks type, which includes the timber of the highest present commercial value. The gum-mixed hardwoods type-group is made up of the following forest types: Red gum-water oaks, hackberry-elm-ash, scrub coastal hardwoods, and scrub coastal cypress.

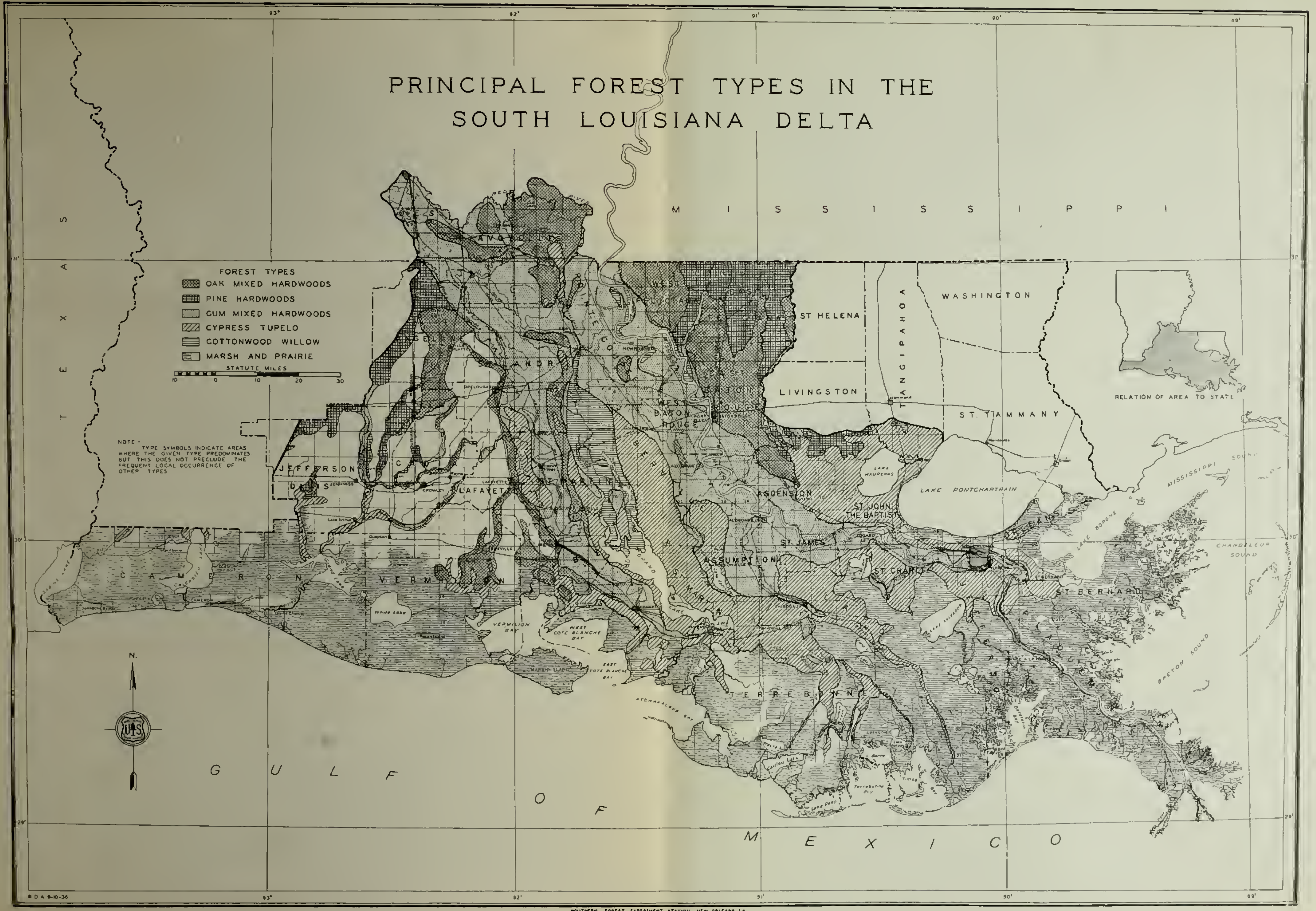
Table 2. -- Forest area classified according to forest condition and type-group

Forest condition	Type-group				Total	Percent of total forest area
	Cypress-tupelo	Cotton-wood-willow	Oak-mixed hardwoods	Gum-mixed hardwoods		
	Acres					
Old growth:						
Uncut	48,900	-	145,700	54,200	248,800	6.7
Partly cut	179,000	-	178,200	148,300	505,500	13.5
Second growth:						
Sawlog size:						
Uncut	381,500	125,700	371,000	426,900	1,305,100	34.9
Partly cut	38,400	16,600	127,400	101,300	283,700	7.6
Under sawlog size	387,600	285,400	212,100	304,700	1,189,800	31.9
Reproduction	2,600	18,400	16,600	19,100	56,700	1.5
Clear-cut	41,000	2,600	12,200	8,800	64,600	1.7
Nonproductive	13,100	28,800	900	38,400	81,200	2.2
Total all conditions	1,092,100	477,500	1,064,100	1,101,700	3,735,400	100.0
Percent of total forest area	29.2	12.8	28.5	29.5	100.0	

Note: Classifications totalling less than 40,000 acres are subject to a relatively large probable error and should be considered as indicating only the relative magnitude of the item.

FOREST TYPE MAP

SOUTH LOUISIANA DELTA


PRINCIPAL FOREST TYPES IN THE SOUTH LOUISIANA DELTA
FOREST TYPES
OAK MIXED HARDWOODS
PINE HARDWOODS
GUM MIXED HARDWOODS
CYPRESS TUPELO
COTTONWOOD WILLOW
MARSH AND PRAIRIE
STATUTE MILES
NOTE - TYPE SYMBOLS INDICATE AREAS WHERE THE GIVEN TYPE PREDOMINATES, BUT THIS DOES NOT PRECLUDE THE FREQUENT LOCAL OCCURRENCE OF OTHER TYPES
MISSISSIPPI
TEXAS
WASHINGTON
ST HELENA
TANGIPAHOA
LIVINGSTON
ST. TAMMANY
RELATION OF AREA TO STATE
JEFFERSON DAVIS
LAFAYETTE
ST MARTIN
WEST BATON ROUGE
ASCENSION
ST JOHN THE BAPTIST
ST JAMES
ASSUMPTION
ST CHARLES
ST BERNARD
CAMERON
VERMILION
TERREBONNE
LAKE PONTCHARTRAIN
LAKE BORGNE
CHANDELEUR SOUND
BRETON SOUND
White Lake
VERMILION BAY
WEST COTE BLANCHE BAY
EAST COTE BLANCHE BAY
MARSH ISLAND
ATCHAFALAYA BAY
Terrebonne Bay
GULF OF MEXICO
N.
R D A 9-10-36
SOUTHERN FOREST EXPERIMENT STATION, NEW ORLEANS LA.

Board-foot Volume

In this estimate, the stand of sawlog-size trees is given in terms of board feet as measured by the Doyle log-rule. The estimate is given as net woods scale, that is, allowance has been made for the material that would be left in the woods because of rot, fire-scar, crook, limbiness, and similar reasons, but no allowance has been made for cull from the mill log-scale. Sawlog-size trees are here defined as trees that contain at least one usable 12-foot log and that will yield at least 50 percent of their gross volume in sound material; in the case of hardwoods and cypress the minimum breast-height diameter must be 13 inches, and in pines, 9 inches. In the case of trees of valuable species and large diameter, trees are considered merchantable where the value of the material will justify cutting for less than 50 percent of the gross volume.

Because profitable utilization for lumber under existing practices imposes certain minimum requirements of quality and quantity, the board-foot volume estimate is classified according to its occurrence on what may be termed "commercial" and "noncommercial" areas. Areas designated as "commercial" contain 1,000 or more board feet per acre of logs of a size and quantity that will produce at least 30 percent of No.1 Common (or better) grade of lumber, or that are of comparable value for the manufacture of cooperage and small-dimension material. "Noncommercial" areas fall below the above requirement and are considered unsuited for profitable utilization at the present time by industries requiring high-grade sawtimber such as those which now predominate. The commercial and noncommercial areas are further classified as uncut old-growth (virgin) stands, other sawlog-size stands, and other areas.

The sawtimber stand of the unit as shown in Table 3 totals 6-1/2 billion board feet (Doyle) of which 3-1/2 billion board feet are on commercial areas. The volume in uncut old-growth stands on commercial areas represents, for the most part, the best of the present sawtimber. Tupelo gum, including some swamp black gum, constitutes more than one-third of the volume on commercial areas. Other principal species, in the order of their occurrence on commercial areas, are red gum, loblolly pine, cypress, red oaks, white oaks, bitter pecan, elm, ash, willow, and cottonwood. Of the volume on noncommercial areas a large portion consists of low-grade overcup oak and bitter pecan located in the Mississippi and Red River backwater areas.

Although a large portion of this unit was originally covered with the finest and most extensive stand of cypress in the South and for many years supported a thriving cypress lumber industry, the present stand of cypress sawtimber is only a remnant of the original stand. This unit continues, however, to be an important though secondary factor in cypress production. Stands of second-growth cypress sawtimber have only a limited occurrence. The characteristic species of the second-growth stands on a greater part of the extensive cypress-tupelo area is tupelo, not cypress, which apparently becomes an important component of second-growth stands only under certain favorable combinations of site with other circumstances. The young cypress grows quite rapidly until it attains tie-timber size, after which the growth declines rapidly. Resistance to decay, a valuable characteristic of old-growth cypress is largely lacking in the wood of second-growth cypress.

Table 3. -- Net board-foot volume, Doyle scale, on commercial and noncommercial areas

Species group	On commercial areas		Total	On non-commercial areas	Total volume
	Old growth uncut	Other saw-log size			
	Thousand board feet 1/				
White oaks	65,000	68,400	133,400	305,100	438,500
Red oaks	73,000	236,600	309,600	416,600	726,200
Red gum	158,300	265,500	423,800	344,500	768,300
Tupelo and black gum	268,600	1,016,200	1,284,800	280,700	1,565,500
Cypress	58,400	257,600	316,000	170,600	486,600
Pine	175,600	244,000	419,600	302,500	722,100
Cottonwood, willow, magnolia, maple, etc.	10,700	181,900	192,600	301,800	494,400
Ash, hackberry, elm, hickory, pecan, etc.	96,900	347,000	443,900	833,900	1,277,800
Total	906,500	2,617,200	3,523,700	2,955,700	6,479,400

1/ Because of the prevalence in this area of a large proportion of trees of small size, the Doyle scale understates the true volume. Mill cut would probably overrun the total volume shown by 30%.

The approximate composition of several of the species groups, based on the total volume is as follows:

a. White oaks:

White oaks	29 percent
Overcup & post oaks	71 "

b. Cottonwood, willow, magnolia, maple, etc.:

Cottonwood	23 percent
Willow	48 "
Magnolia, maple, etc.	29 "

c. Ash, hackberry, elm, hickory, pecan, etc.:

Ash	15 percent
Hackberry	9 "
Elm	22 "
Bitter pecan	32 "
Hickory	4 "
Sweet pecan	3 "
Other species	15 "

d. Pine group:

Practically all loblolly pine

The sawtimber estimate for commercial and noncommercial areas is shown graphically in Figure 2.

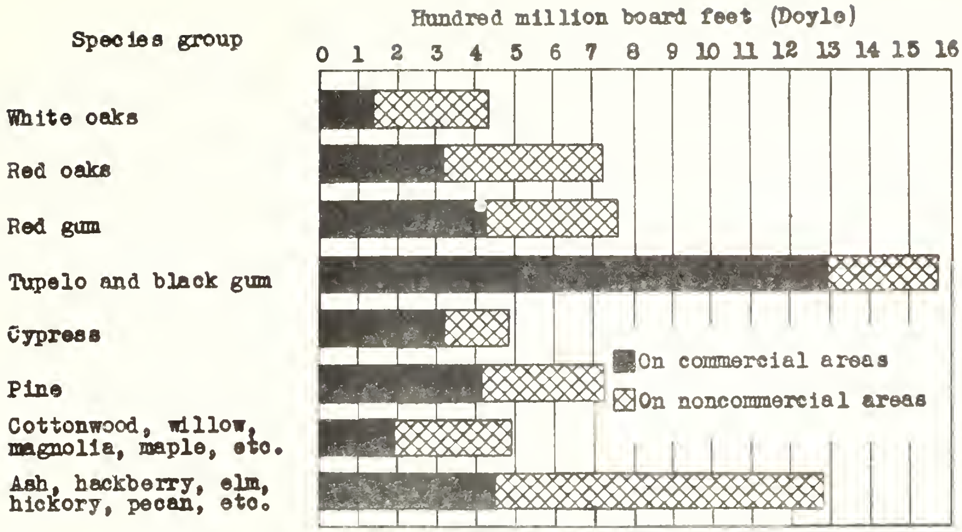


Figure 2. -- Board-foot volumes on commercial and noncommercial areas

Cordwood Volume

In the cordwood estimate, the stand of good trees 5 inches or over in diameter outside the bark at breast height is expressed in terms of standard cords of 4 x 4 x 8 feet, using a factor of 90 cubic feet per cord for pine and cypress and 80 cubic feet for hardwood. In sawlog-size trees, only the sawlog portion is included; while in under-sawlog-size trees, the stemwood to a variable top diameter (minimum 4 inches) is taken. No deduction is made for woods cull, that is, those parts of trees that would be left in the woods because of rot, fire-scar, crook, bad knots, or other defects; but this deduction would probably be less than 2 percent, and sound cull trees that are usable for cordwood would much more than offset this loss.

In table 4 the cordwood volume is classified according to pulping and nonpulping species-groups. The pine volume shown is practically all loblolly pine. The pulping hardwoods are further classified into light-pulping and dark-pulping species-groups, according to the color of the pulp that is obtained. The light-pulping species include tupelo and black gum, red gum, cottonwood, maple, and similar species. The dark-pulping species are willow and cypress. The non-pulping species are oak, pecan, hackberry, elm, ash, hickory, etc.

In the cypress-tupelo type-group, tupelo gum composes the bulk of the light-pulping volume, and cypress the greater part of the dark-pulping volume. In the cottonwood-willow type-group cottonwood composes the greater part of the light-pulping volume, and willow almost all of the dark-pulping volume.

The estimate of cordwood volume, by species-groups and diameter classes is shown graphically in Figure 3.

Table 4. - Cordwood volume of pulping and nonpulping species

Species-group	Diameter group[1/]	Type-group: Cypress-tupelo	Type-group: Cotton-wood-willow	Type-group: Oak-mixed hardwoods	Type-group: Gum-mixed hardwoods	Total	Percent of total volume
	Inches	Thousand cords [2/]					
Pulping species:							
Pine:	6 & 8	neg.	neg.	502	2	504	1.3
	10 & 12	1		764	2	767	2.0
	14,16 & 18	-	-	812	5	817	2.1
	20 & over	-	-	644	-	644	1.7
Total		1	neg.	2,722	9	2,732	7.1
Light-pulping hardwoods:	6 & 8	2,086	150	257	428	2,921	7.6
	10 & 12	2,400	127	372	639	3,538	9.2
	14,16 & 18	2.744	172	525	1,056	4,497	11.7
	20 & over	2,336	148	437	1,183	4,104	10.6
Total		9,566	597	1,591	3,306	15,060	39.1
Dark-pulping hardwoods:	6 & 8	900	751	23	114	1,788	4.7
	10 & 12	1,206	868	27	160	2,261	5.9
	14,16 & 18	990	564	36	118	1,708	4.4
	20 & over	515	183	15	62	775	2.0
Total		3,611	2,366	101	454	6,532	17.0
Total pulping species		13,178	2.963	4,414	3,769	24,324	63.2
Nonpulping species:							
Hardwoods:	6 & 8	303	180	711	1,174	2,368	6.2
	10 & 12	298	139	1,261	1,862	3,560	9.3
	14,16 & 18	123	59	1,867	2,000	4,049	10.5
	20 & over	67	16	2,467	1,613	4,163	10.8
Total nonpulping species		791	394	6,306	6,649	14,140	36.8
Total all species		13,969	3,357	10,720	10,418	38,464	100.0
Percent of total volume		36.3	8.7	27.9	27.1	100.0	

1/ Diameter of trees was measured outside bark $4\frac{1}{2}$ feet from the ground. Trees ranging from 5.0 to 6.9 inches in diameter are placed in the 6 inch class; corresponding limits apply to the other classes.

2/ Classifications totalling less than 400,000 cords are subject to a relatively large probable error and should be considered as indicating only the relative magnitude of the item.

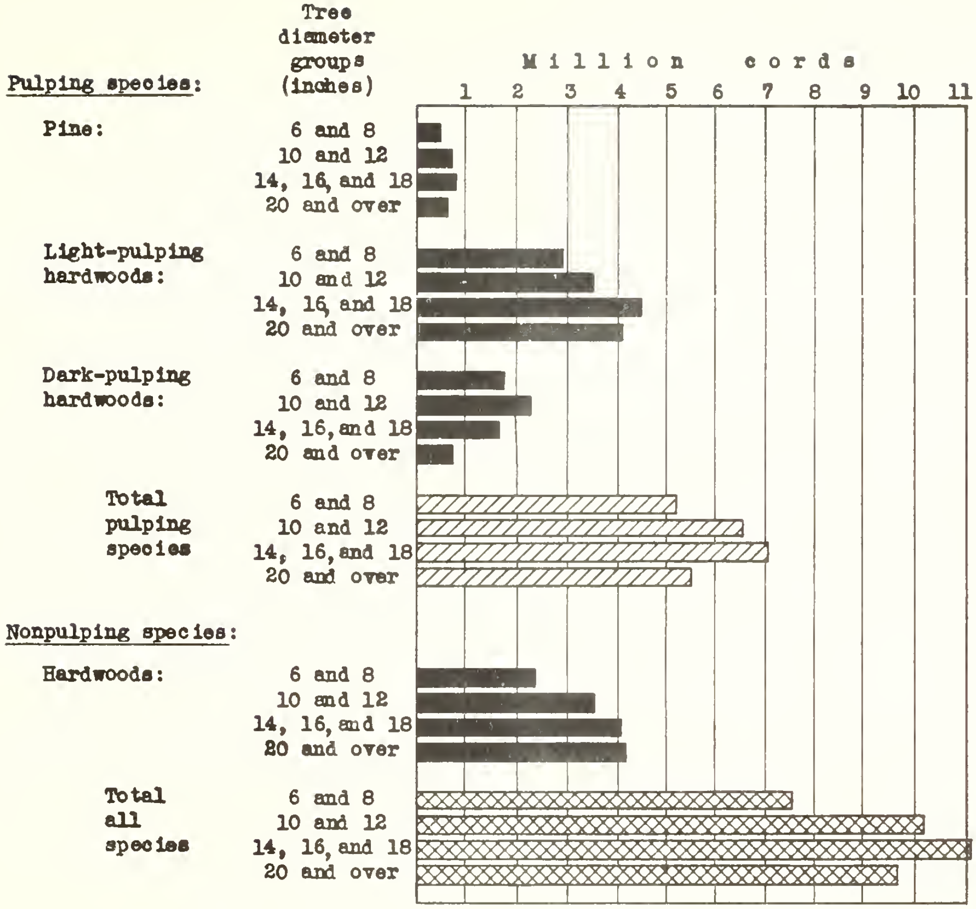


Figure 3. -- Cordwood volume of pulping and nonpulping species

The cordwood volume of pulping and nonpulping species on the average acre of each forest type group is given in Table 5 and classified according to tree-diameter groups. This average acre volume is a theoretical figure arrived at by dividing the cordwood volume in each type-group by the total acreage of the group, including reproduction and clear-cut areas. It provides a means of comparing the different type-groups with respect to species composition, diameter distribution, and density. The general average for the unit including all types is over 10 cords per forest acre.

Table 5. -- Cordwood volume of pulping and nonpulping species on the average acre of each forest type-group

Tree species-group	Tree diameter groups	Forest type-group			
		Cypress-tupelo	Cotton-wood-willow	Oak-mixed hardwoods	Gum-mixed hardwoods
	Inches	Cords			
Pulping species:					
Pine:	6 & 8	neg.	neg.	.47	neg.
	10 & 12	neg.	-	.72	neg.
	14,16 & 18	-	-	.76	.01
	20 & over	-	-	.60	-
Total		neg.	neg.	2.55	.01
Light-pulping hardwoods:	6 & 8	1.91	.31	.24	.39
	10 & 12	2.20	.27	.35	.58
	14,16 & 18	2.51	.36	.50	.96
	20 & over	2.14	.31	.41	1.07
Total		8.76	1.25	1.50	3.00
Dark-pulping hardwoods:	6 & 8	.82	1.57	.02	.10
	10 & 12	1.11	1.82	.03	.14
	14,16 & 18	.91	1.18	.03	.11
	20 & over	.47	.38	.01	.06
Total		3.31	4.95	.09	.41
Total pulping species:		12.07	6.20	4.14	3.42
Nonpulping species:					
Hardwoods:	6 & 8	.28	.38	.67	1.07
	10 & 12	.27	.29	1.19	1.69
	14,16 & 18	.11	.13	1.75	1.82
	20 & over	.06	.03	2.32	1.46
Total nonpulping species		.72	.83	5.93	6.04
Total all species		12.79	7.03	10.07	9.46

Other Information

In 1935 there were operating in this unit 68 sawmills and 16 other primary wood-products plants, which depended wholly or in part upon the forests of the area for their timber.

Because of the prevalence on a large part of the forest area of residual trees of poor quality or little-used species, and of trees of the smaller diameters, it will be some time before many of the stands are merchantable from a sawtimber viewpoint. In the meantime, the removal of a part of the stand of small trees for pulpwood or other products would provide an immediate return and, at the same time, hasten the growth of the remaining trees to larger sizes.

The indiscriminate cutting of small trees would probably involve the removal of potential sawtimber trees which would work to the future disadvantage of the lumber and other wood-products industries. An integration of the demands of the pulp industry for cheap, small-size wood and of the lumber and other wood-products industries for larger, high-grade timber is entirely feasible, however, and could be worked out to the advantage of both.

The large, second growth cypress-tupelo area and the willow and cottonwood areas appear to be especially suited for pulpwood utilization. Because of the suitability of the area for barge transportation and the nearness to port facilities, and because no pulpwood is being drawn from the area at present, this unit appears to offer attractive opportunities for the hardwood pulp industry.

FOREST SURVEY RELEASE* No. 23 January 4, 1937

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

SAWTIMBER AND CORDWOOD VOLUMES
IN SOUTHWEST LOUISIANA

A Progress Report

By

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

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FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

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SAWTIMBER AND CORDWOOD VOLUME

IN SOUTHWEST LOUISIANA

The forest survey unit which embraces southwest Louisiana (see figure 1) extends west from the prairie section and the Delta to Texas; and from Cameron Parish north for over 120 miles to the north boundaries of Sabine, Grant, and LaSalle Parishes and to the Red River in Natchitoches Parish. It includes all of six parishes and parts of seven others, an area of 5,774,200 acres, almost four-fifths of which is forest land. From a prairie and flatwoods belt extending across the southern part of the unit and averaging about 25 miles in width, rolling uplands rise gradually to the northern boundary, where elevations exceed 300 feet.

Originally, except in a few sections, this region was covered with one of the finest longleaf-pine forests in the South. At the present time, only a few large tracts of virgin pine and hardwood timber remain, all of which are owned by operating lumber companies. In the northern part of the region, from which the original timber has been cut, most of the forest area is becoming re-stocked with loblolly and shortleaf pines; while the central portion is characterized by extensive clear-cut areas that have not as yet restocked; and the south and southwestern portions support some fairly well stocked stands of second growth. Only a small part of the region - chiefly the prairie and Red River Valley sections - is devoted to agriculture; but within the unit, or in adjoining areas, large quantities of oil, natural gas, sulphur, common salt, and alkali are produced.

The region is traversed by the lines of six major railroads, and two or three smaller railroads serve parts of it. A good system of hard-surfaced and improved country roads connects the principal points. Port facilities are available at Lake Charles, which is also on the Intracoastal Waterway.

Information presented in this release is based on data gathered during 1934 and 1935 by the Southern Forest Survey, an activity of the Southern Forest Experiment Station of the U. S. Forest Service. Trained cruisers measured the timber and recorded the forest and land-use conditions on over 7,000 quarter-acre sample plots systematically located at intervals of 660 feet on parallel compass lines, 10 miles apart, run entirely across the area from east to west. The preliminary estimates presented here are subject to revision later in final survey unit reports.

Owing to the sampling method used in collecting these data, it usually holds that the greater the area or volume in any given classification the more accurate are the data for that classification. Classes that are of infrequent occurrence and relatively small in quantity cannot generally be determined with as high a degree of accuracy as is obtainable for classes that occur more frequently and in substantially greater quantities. Area and volume figures are given for some of the less common classifications despite a knowledge that they may have a relatively large error. Data for any classification totaling less than one percent of the total should be considered as indicating only the relative magnitude of that item.

Land Area and Use

In table 1, the land area is classified according to its major uses.

Table 1. -- Land area classified according to use

Land use	Area in acres		Percent of total area	
Forest:				
Productive	4,541,900		78.7	
Nonproductive 1/	1,600		negl.	
		4,543,500		78.7
Agricultural:				
In cultivation	617,400		10.7	
Out of cultivation:				
Idle	141,100		2.4	
Abandoned	68,600		1.2	
Improved pasture	96,700		1.7	
Total agricultural		923,800		16.0
Other non-forest: Prairie, Marsh, Waterways, Towns, villages, Roads, railroads, etc.		306,900		5.3
Total area		5,774,200		100.0

1/ Forest land that does not have the qualities essential for the growth of commercial timber.

Forest Area

Seventy-two percent of the forest area is in the rolling uplands; 7 percent in the flatwoods; 10 percent in swamps, bays, ponds, and branches; and 11 percent in river bottoms. In table 2, the forest area of the unit is classified according to forest condition and type-group. The forest conditions are defined as follows:

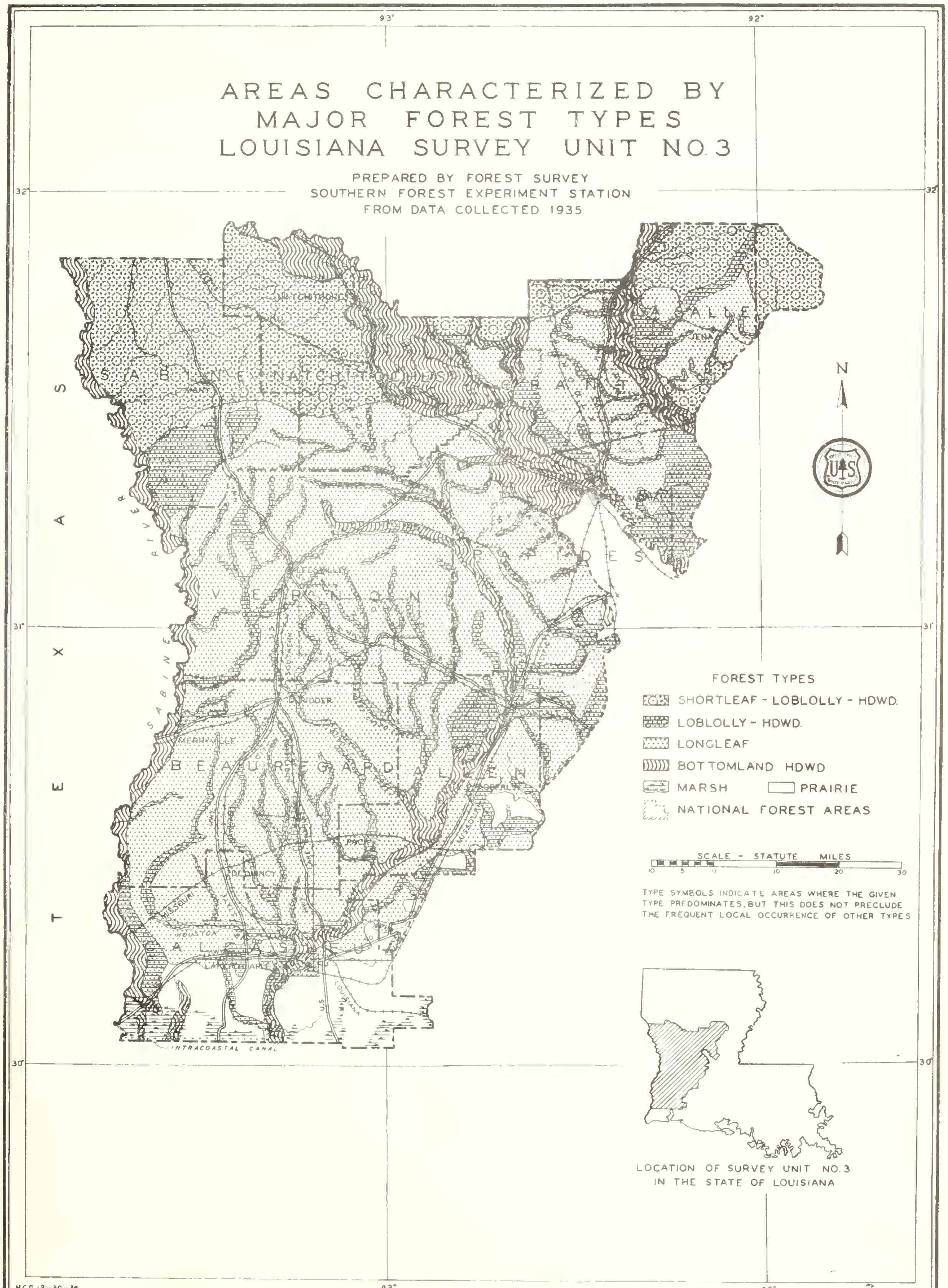
AREAS CHARACTERIZED BY
MAJOR FOREST TYPES
LOUISIANA SURVEY UNIT NO. 3
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FROM DATA COLLECTED 1935
FOREST TYPES
SHORTLEAF - LOBLOLLY - HDWD.
LOBLOLLY - HDWD.
LONGLEAF
BOTTOMLAND HDWD
MARSH
PRAIRIE
NATIONAL FOREST AREAS
SCALE - STATUTE MILES
TYPE SYMBOLS INDICATE AREAS WHERE THE GIVEN TYPE PREDOMINATES, BUT THIS DOES NOT PRECLUDE THE FREQUENT LOCAL OCCURRENCE OF OTHER TYPES
LOCATION OF SURVEY UNIT NO. 3
IN THE STATE OF LOUISIANA
T E X A S
SABINE RIVER
SABINE
NATCHITOCHES
GRANT
LA SALLE
RAPIDES
VERNON
BEAUREGARD
ALLEN
CALCASIEU
INTRACOASTAL CANAL
N
93°
92°
32°
31°
30°
H.C.G. 12-30-36
E.R.B. 2-7-36

Figure 1.

Old growth:	Stands composed predominantly of sawtimber trees with the characteristics of the original mature trees of the region.
Uncut:	Old-growth stands from which less than 10 percent of the volume has been cut.
Partly cut:	Old-growth stands from which at least 10 percent of the volume has been removed, but which are still characterized by residual trees from the old-growth forest.
Second growth:	Stands that have succeeded the original forest as a result of cutting or other causes.
Sawlog size: Uncut:	Second-growth stands in which the sawlog-size trees contain at least 600 board feet per acre, and from which less than 10 percent of the board-foot volume has been cut.
Partly cut:	Second growth stands from which at least 10 percent of the board-foot volume has been cut, but which still contain at least 400 board feet per acre in sawlog-size trees.
Under-sawlog size:	Second-growth stands composed predominantly of under-sawlog-size trees.
Reproduction:	Re-stocking areas bearing 80 or more seedlings per acre that are less than 1 inch in diameter at breast height.
Clear-Cut:	Cut-over areas on which the young growth that has come in is insufficient to classify them either as second growth or reproduction.

The forest type-groups are designated by the species that predominate in the stands; other species are associated with them in all groups.

Most of the remaining uncut, old-growth (virgin) pine is located in Vernon, Natchitoches, and Rapides Parishes. A small amount is in LaSalle Parish. A greater part of the uncut, old-growth hardwood is located in the Sabine River bottom in Vernon and Sabine Parishes. Over half of the present longleaf pine type consists of clear-cut areas that have not re-stocked. Practically all of the loblolly and shortleaf pine areas are in second growth.

Table 2. -- Forest area classified according to forest condition and type-group

Forest condition	Forest type-group: Longleaf pine	Forest type-group: Loblolly-shortleaf pine	Forest type-group: Hardwoods	Total	Percent of total forest area
	---------------- Acres 1/			------------------	
Old growth:					
Uncut	58,500	12,500	145,000	216,000	4.8
Partly cut	64,700	21,000	199,600	285,300	6.2
Total	123,200	33,500	344,600	501,300	11.0
Second growth:					
Sawlog size:					
Uncut	187,100	647,900	246,300	1,081,300	23.8
Partly cut	59,300	365,600	195,700	620,600	13.7
Under-sawlog size	383,500	393,700	245,600	1,022,800	22.5
Reproduction	153,500	49,900	28,900	232,300	5.1
Total	783,400	1,457,100	716,500	2,957,000	65.1
Clear-cut	1,055,600	21,800	6,200	1,083,600	23.9
Total forest area	1,962,200	1,512,400	1,067,300	4,541,900	
Percent of total forest area	43.2	33.3	23.5		100.0

1/ Since classifications totaling less than 45,000 acres may have a relatively large error, they should be considered as indicating only the comparative magnitude of the item.

Board-Foot Volume

In this estimate, as shown in table 3, the stand of sawlog-size trees is expressed in terms of board feet as measured by the Doyle log-rule. The estimate is given as net mill scale, that is, allowance has been made for material that would be left in the woods because of rot, crook, limbiness, and similar reasons; and allowance has also been made for mill cull, that is, sweep and interior defect. Sawtimber trees are here defined as trees that contain at least one usable 12-foot log and that will yield at least 50 percent of their gross volume in sound material; in the case of pines and cypress the minimum breast-height diameter must be 9 inches, and in hardwoods, 13 inches. Trees of valuable species and large diameter are considered merchantable, however, if the value of the material will justify cutting for a smaller proportion than 50 percent of the gross volume.

Table 3. -- Net board-foot volume classified according to species-group and forest condition

Species-group	Forest condition		Total
	Old growth	Second growth	
	---------------- Thousand board feet ---------		
Longleaf pine	854,500	269,200	1,123,700
Loblolly and shortleaf pine	199,800	1,789,300	1,989,100
Gums, cottonwood, magnolia, maple, etc.	761,500	563,200	1,324,700
Oaks, beech, hickories, elms, etc. 1/	977,100	1,066,500	2,043,600
Total	2,792,900	3,688,200	6,481,100

1/ Includes cypress.

CORDWOOD VOLUME

In this estimate, the entire stand of good trees 5 inches or over in diameter, outside the bark at breast height, is expressed in terms of standard (4 x 4 x 8 feet) cords. Sawtimber trees, which are covered in the estimate of board-foot volume, are also included in this estimate. In undersawlog-size trees and sawlog-size pines, the trunk is included up to a variable top-diameter, with 4 inches as a minimum; while in sawlog-size hardwoods and cypress only the sawtimber portion is included. No deduction is made for woods cull, that is, that part of the tree that would be left in the woods because of rot, fire-scar, crook, bad knots, or other defects; this deduction would be approximately 4 percent, but sound cull trees that are usable for cordwood would somewhat offset this loss.

In table 4, the cordwood volume is classified according to pulping and nonpulping species-groups. In the longleaf pine type-group, longleaf pine comprises practically all of the pine volume; and in the loblolly-shortleaf pine type-group, practically all of the pine volume is of these species. The pulping hardwood species include red gum, black gum, tupelo, bay, magnolia, maple, and the other softer hardwoods. The nonpulping hardwoods include oak, hickory, beech, ash, elm, etc. Since cypress is generally not used for pulpwood, it is included with the nonpulping hardwoods. That a large part of the longleaf pine is contained in the remaining old-growth stands, while most of the loblolly and shortleaf pine is second growth, is reflected in the fact that only 34 percent of the longleaf pine cordwood volume is in trees less than 13 inches in diameter, while 62 percent of the loblolly and shortleaf pine volume is in these smaller diameters.

The estimate of cordwood volume, classified according to species-groups and diameters of trees, is shown graphically in figure 2.

Table 4. Cordwood volume of pulping and nonpulping species

Species group	Diameter class 1/	Forest type-group: Longleaf pine	Forest type-group: Loblolly-shortleaf pine	Forest type-group: Hardwoods	Total	Percent of total volume
	-- Inches --	------- Thousand cords 2/	-----------			
Pulping species:						
Pine	6 & 8	565	3,282	267	4,114	10.7
	10 & 12	1,171	4,185	193	5,549	14.4
	14,16 & 18	1,377	3,476	51	4,904	12.8
	20 & over	1,698	1,360	14	3,072	8.0
Total		4,811	12,303	525	17,639	45.9
Hardwoods	6 & 8	28	722	849	1,599	4.2
	10 & 12	40	768	1,348	2,156	5.6
	14,16 & 18	23	580	1,650	2,253	5.9
	20 & over	5	286	2,072	2,363	6.1
Total		96	2,356	5,919	8,371	21.8
Total pulping species		4,907	14,659	6,444	26,010	67.7
Nonpulping species:						
Hardwoods	6 & 8	175	1,364	1,337	2,876	7.5
	10 & 12	117	1,302	1,547	2,966	7.7
	14,16 & 18	75	1,042	2,149	3,266	8.5
	20 & over	19	506	2,765	3,290	8.6
Total nonpulping species		386	4,214	7,798	12,398	32.3
Total all species		5,293	18,873	14,242	38,408	
Percent of total volume		13.8	49.1	37.1		100.0

1/ Diameter of trees was measured outside of bark $4\frac{1}{2}$ feet from the ground, except on the turpentined pines, on which it was measured 10 feet from the ground. Trees ranging from 5.0 to 6.9 inches in diameter are placed in the 6-inch class; corresponding limits apply to the other classes.

2/ Since classifications totaling less than 400,000 cords may have a relatively large error they should be considered as indicating only the comparative magnitude of the item.

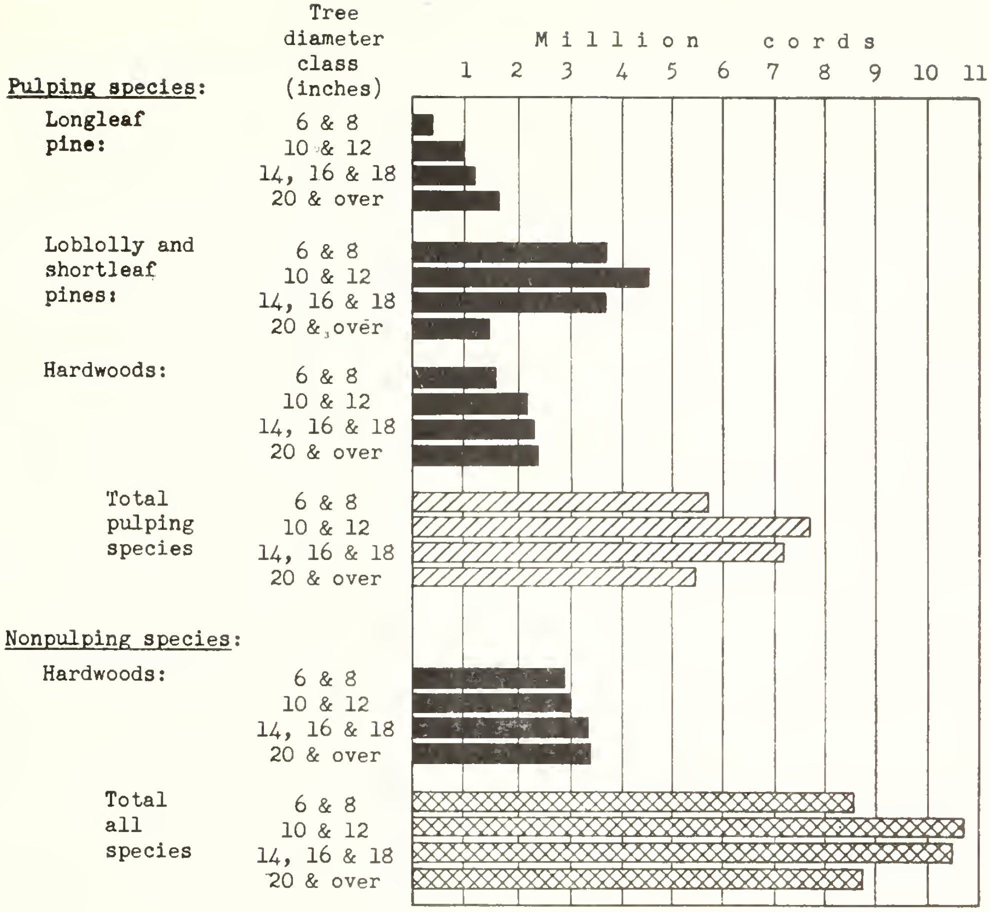

Figure 2. -- Cordwood volume of pulping and nonpulping species

In table 5 is the cordwood volume of pulping and nonpulping species on the average "stocked" acre of each forest type-group, classified according to tree-diameter classes. This average-acre volume in a theoretical per-acre average of the forest stands of all conditions, not including the clear-cut and reproduction areas, whose present cordwood stand in practically nil. This table thus provides a means of comparing the different type-groups with respect to species composition, diameter distribution, and average density.

Other Information

There were operating in this unit in 1935, 112 sawmills of all sizes, 1 pulp mill, and 3 other small primary wood-products plants. Twenty-seven of the sawmills are in the "large mill" class, that, is they have a daily capacity of 40,000 board feet or more; while 70 mills have a daily capacity of less than 20,000 board feet. In addition to the pulp mill at Elizabeth, which uses the sulphate process and has a daily capacity of 55 tons of pulp, a 200-ton sulphate mill at Hodge and a 500-ton plant at West Monroe draw a part of their wood supplies from here. At a fourth pulp-and-paper plant, located at Orange, Tex., the paper-mill is active but the pulp mill has been discontinued.

Table 5.

Average gross cordwood volume of pulping and nonpulping species-groups (excluding clear-cut and reproduction) by diameter class and type-group

Species groups	Tree diameter classes	Type-groups: Longleaf pine	Type-groups: Loblolly-shortleaf pine	Type-groups: Hardwoods
		Cords		
Pulping species:				
Pines	6 & 8	.70	2.28	.26
	10 & 12	1.41	3.07	.19
	14,16 & 18	1.79	2.41	.05
	20 & over	2.25	.77	.01
Total pines		6.15	8.53	.51
Hardwoods	6 & 8	.04	.50	.82
	10 & 12	.05	.53	1.30
	14,16 & 18	.02	.40	1.60
	20 & over	.01	.20	2.01
Total hardwoods		.12	1.63	5.73
Total pulping		6.27	10.16	6.24
Nonpulping species:				
Hardwoods 1/	6 & 8	.20	.94	1.29
	10 & 12	.14	.90	1.49
	14,16 & 18	.08	.72	2.08
	20 & over	.02	.35	2.68
Total nonpulping		.44	2.91	7.54
Total all species		6.71	13.07	13.78

1/ Cypress is included in nonpulping hardwoods.

FOREST SURVEY RELEASE* NO. 24 March 13, 1937

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

SAWTIMBER AND CORDWOOD VOLUMES IN CENTRAL AND SOUTHWESTERN MISSISSIPPI

A Progress Report

By

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

* - This is an advance release of Forest Survey data that will be included in complete reports to be published later. This information is subject to correction or amplification as computations proceed.

FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

Southern Forest Survey Staff

I. F. Eldredge	Regional Director
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SAWTIMBER AND CORDWOOD VOLUMES IN CENTRAL AND SOUTHWESTERN MISSISSIPPI

This report deals with that portion of central and southwestern Mississippi lying east of the Mississippi River and the Yazoo Delta. Including all or parts of the 28 counties shown on the accompanying map, this Survey Unit contains a land area of 10,799,500 acres, of which 56 percent is occupied by some stage of forest growth. Except for a rather extensive upland hardwood area in the western part of the unit, the principal tree species are short-leaf and loblolly pine, with an admixture of hardwoods. Stream margins and bottomlands are dominated by hardwoods, with loblolly and spruce pine occasionally admixed. The terrain ranges from gently rolling to rough, with small "mountains" in the vicinity of Meridian. The principal drainage is southward to the Gulf through the Mississippi, Pearl, Pascagoula, and Tombigbee Rivers or their tributaries.

The area is served by the lines of five major railroads: the Illinois-Central; the Gulf, Mobile & Northern; the Southern; the Mississippi Central; and the Gulf & Ship Island,as well as by several smaller railroads that serve parts of the unit. Jackson, Meridian, and Vicksburg are the principal cities. Jackson is about 740 miles by rail from Chicago and 1240 miles by rail from New York City. About 450 miles of paved highways, and a good system of improved country roads facilitate travel in all parts of the area,although during rainy weather a few of the minor country roads are difficult to travel. The recently inaugurated industrial development plan for the State includes a highway program that will result in a marked increase in the paved mileage.

Water transportation also is available. Natchez and Vicksburg on the Mississippi River are the chief ports in the region,while Gulfport and Mobile on the Gulf serve as coastal shipping points.

There is in this unit a large natural gas field in the vicinity of Jackson. Coal can be procured by rail from the Birmingham, Alabama, section; and oil, sulphur, and salt can be obtained from Louisiana.

Land Area

About 56% of the land surface of this unit is in some stage of forest growth, and the remaining 44% is in agricultural use, although about 30% of this was out of cultivation in 1934 (table 1). Cotton, of course, is the principal field crop.

Like other localities in the South, this unit includes a large area of land now bearing forest growth and well adapted to the continuous production of timber. To produce continuously timber in large quantity and of good quality there must be present at all times a large volume of vigorously growing standing timber or "growing stock". Forest owners and communities desiring continuous operations of sawmills and other wood-using plants must provide for the permanent maintenance of this growing stock by means of fire protection and conservative cutting practices. The forest land areas and timber volumes shown in the following tables constitute the capital investment indispensable for timber production.

Table 1. -- Land area classified according to use

Land-use	Acres		Percent of total area	
Forest:				
Productive	6,026,400		55.8	
Nonproductive	3,900		negl.	
Total forest		6,030,300		55.8
Agricultural:				
In cultivation:				
Old cropland 1/	3,076,600		28.5	
New cropland 2/	119,900		1.1	
Out of cultivation:				
Idle 3/	414,800		3.8	
Abandoned 4/	354,900		3.3	
Improved pasture	615,600		5.7	
Total agricultural		4,581,800		42.4
Others: 5/		187,400		1.8
Total area		10,799,500		100.0

1/ Land cultivated more than 5 years and on which a farm crop was raised within 2 years prior to the date of survey.

2/ Land converted from forest to cropland within 5 years prior to date of survey.

3/ Cultivated land that has been idle for 2 years or more, but has not reached the abandoned stage.

4/ Land once cultivated but showing distinct evidence of having been abandoned; no attempt has been made to maintain it as improved pasture.

5/ Highways, waterways, railroads, towns and villages, etc.

Forest Area

Most of the forest area (about 80 percent) is in rolling uplands, while the remainder is distributed among swamps and stream bottoms. In table 2, the forest area is classified according to forest condition and type-group. The forest type-groups are designated by the commercial species that predominate in the stands.

Table 2. -- Forest area classified according to forest condition and type-group

Forest condition 1/	Forest type-groups designated by dominant species			Total forest area	Percent of total forest area
	Pine	Pine-hardwood	Hardwood		
	- - - - - - - - - - - Acres 2/ - - - - - - - - - - -				
Old growth:					
Uncut	80,200	31,100	164,200	275,500	4.6
Partly cut	70,800	67,700	348,700	487,200	8.1
Total	151,000	98,800	512,900	762,700	12.7
Second growth:					
Sawlog size:					
Uncut	938,600	351,000	514,500	1,804,100	29.9
Partly cut	432,700	277,900	368,100	1,078,700	17.9
Under-sawlog size:					
Uncut	746,400	524,500	607,900	1,878,800	31.2
Partly cut	72,400	78,600	56,800	207,800	3.4
Total	2,190,100	1,232,000	1,547,300	4,969,400	82.4
Clear-cut and reproduction	193,800	49,900	50,600	294,300	4.9
Total forest area	2,534,900	1,380,700	2,110,800	6,026,400	100.0
Percent of total forest area	42.1	22.9	35.0	100.0	

1/ Definitions of the various forest conditions are found in the previous releases of the Survey.

2/ Since classifications totaling less than 60,000 acres may have a relatively large error, they should be considered as indicating only the comparative magnitude of the item.

The shortleaf, loblolly, and longleaf pine types are the principal pine associations. Shortleaf and loblolly occur commonly in pure and mixed stands throughout the unit; while the commercial range of longleaf pine extends a short distance into the unit from the south, it occurs only in small scattered bodies and does not dominate a sufficient area to be shown on the accompanying map of major forest types. The hardwood area is about equally divided between the upland and bottomland types. Upland hardwoods dominate the rough, loessal country bordering the Delta, reaching east to Jackson and north to Lexington. The bottomland hardwoods are found along the Big Black and Pearl Rivers, and as narrow strips bordering the smaller streams throughout the unit. A small portion of the famous Black Prairie of Alabama and Mississippi, a comparatively treeless region used mainly for farming, occupies the eastern half of Noxubee County and a corner of Kemper. As will be seen from the table, over four-fifths of the forest area is in second-growth stands, and only a third of the small amount of old growth that remains is still uncut. It will also be noted that pine types make up over 40 percent of the total forest area. On nearly 67,000 acres the forest stand was entirely removed, and restocking has not yet taken place.

Board-foot Volume

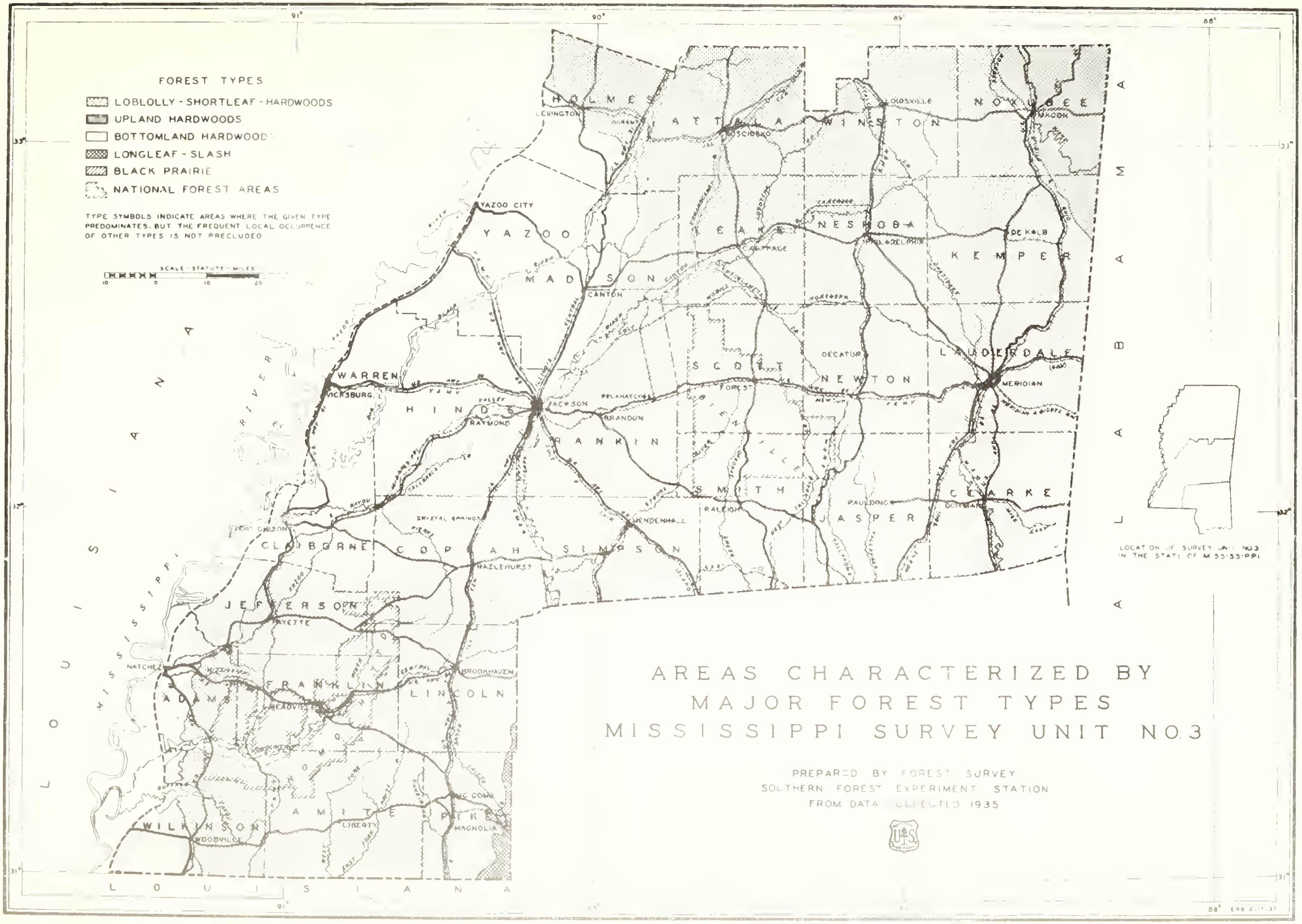
In the estimate given in table 3 the stand of sawtimber trees is expressed in terms of board feet as measured by the Doyle log-rule. The volumes are net log scale, that is, allowance has been made for material that would be left in the woods because of rot, fire-scar, crook, limbiness, and similar defects; and allowance has also made for mill cull, i.e., sweep and interior defect. Sawtimber trees are here defined as trees that contain at least one usable 12-foot log and that will yield at least 50 percent of the gross volume in sound material; in the case of hardwoods, the minimum breast-height diameter outside bark is 13 inches, and in pines, 9 inches.

Table 3. -- Net sawtimber volume (Doyle scale) classified according to species-group and forest condition

Species-group	Forest condition		Total
	Old growth	Second growth	
	Thousand feet, board measure 1/		
Longleaf pine	225,500	59,300	284,800
Loblolly and shortleaf pine	1,187,600	4,718,900	5,906,500
Gum, cottonwood, magnolia, maple, etc.	808,400	1,435,400	2,243,800
Oak, beech, hickory elm, etc.	1,298,300	1,690,100	2,988,400
Total	3,519,800	7,903,700	11,423,500

1/ Classifications totaling less than 100,000 M board feet may have a relatively large error and should be considered as indicating only the comparative magnitude of the item.

The sawtimber stand of the unit totals nearly $11\frac{1}{2}$ billion board feet (Doyle), of which less than a third is in the old-growth condition. Only in the case of the longleaf pine is there more volume in old growth than in second-growth. Such old-growth stands of longleaf pine as exist are in small scattered bodies along the southern boundary of the region. A few fairly large bodies of old-growth shortleaf pine were found in the northern part of the region. Stands of sawlog-size second-growth shortleaf and loblolly pine were found throughout the region and are particularly well represented in the


FOREST TYPES
LOBLOLLY - SHORTLEAF - HARDWOODS
UPLAND HARDWOODS
BOTTOMLAND HARDWOODS
LONGLEAF - SLASH
BLACK PRAIRIE
NATIONAL FOREST AREAS
TYPE SYMBOLS INDICATE AREAS WHERE THE GIVEN TYPE PREDOMINATES, BUT THE FREQUENT LOCAL OCCURRENCE OF OTHER TYPES IS NOT PRECLUDED
SCALE - STATUTE - MILES
HOLMES
ATTALA
WINSTON
NOXUBEE
YAZOO
MADISON
LEAKE
NESHOBA
KEMPER
WARREN
HINDS
RANKIN
SCOTT
NEWTON
LAUDERDALE
SMITH
JASPER
CLARKE
CLAIBORNE
COPIAH
SIMPSON
JEFFERSON
FRANKLIN
LINCOLN
ADAMS
AMITE
PIKE
WILKINSON
LEXINGTON
YAZOO CITY
CANTON
VICKSBURG
JACKSON
RAYMOND
BRANDON
DECATUR
MERIDIAN
DE KALB
PHILADELPHIA
LOUISVILLE
MACON
KOSCIUSKO
RALEIGH
PAULDING
MENDENHALL
HAZLEHURST
PORT GIBSON
FAYETTE
NATCHEZ
MEADVILLE
BROOKHAVEN
MAGNOLIA
LIBERTY
WOODVILLE
MISSISSIPPI RIVER
LOUISIANA
ALABAMA
LOCATION OF SURVEY UNIT NO.3 IN THE STATE OF MISSISSIPPI
AREAS CHARACTERIZED BY
MAJOR FOREST TYPES
MISSISSIPPI SURVEY UNIT NO.3
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FROM DATA COLLECTED 1935

southwestern portion. The greatest volume of high-quality hardwood is located in the bottomlands of the Pearl, the Big Black, and the Chickasawhay Rivers. The highest quality of the upland hardwoods volume in the unit is in the 5- to 10-mile strip of broken country in the "Bluffs" that border the Delta along the western boundary of the region.

As can be inferred readily from the variety of tree species and tree sizes, there is great variation in the quality of the standing timber. This permits application of selective-cutting practices designed to utilize at an early date those portions of the stands that are mature or otherwise in need of removal. At the same time, care in selecting the trees to remain standing for further growth will improve the future output of these forests both in quality and quantity.

Cordwood Volume

In estimating the cordwood volume, the entire stand of good trees 5 inches or over in diameter, outside the bark at breast height, is expressed in terms of standard (4 x 4 x 8 feet) cords. Sawtimber trees, which are covered in the estimate of board-foot volume, are also included in this estimate. In under-sawlog-size trees of all species and in sawlog-size pines, the stem is included up to a variable top-diameter, with 4 inches as a minimum; while in sawlog-size hardwoods and cypress only the sawtimber portion is included. The volume in sound and rotten cull trees is not included. Deduction from the volume of good trees is made for woods cull, that is, that part of the tree that would be left in the woods because of rot, fire-scar, crook, bad knots, or other defects; this deduction is approximately 4 percent, and might have been offset by the sound cull trees that are usable for cordwood if they had been included in the estimate.

In table 4 the cordwood volume is classified according to pulping and nonpulping species-groups, and according to the size of the trees from which it is obtained. Practically all of the pine volume consists of loblolly and shortleaf pine; about half of this is in trees less than 13 inches in diameter. The pulping hardwood species include red gum, black gum, tupelo, bay, magnolia, maple, and the other softer hardwoods. Cypress is also included with the pulping hardwoods. The nonpulping hardwoods include oak, hickory, beech, ash, elm, etc.

Table 4. -- Net cordwood volume of pulping and nonpulping species

Tree species-group	Tree diameter class	Major forest type-groups: Pines	Major forest type-groups: Pine-hardwoods	Major forest type-groups: Hardwoods	Total	Percent of total volume
	Inches	----- Thousand cords 1/			-------	
Pulping species:						
Pines	6 & 8	5,446	1,260	340	7,046	10.6
	10 & 12	8,021	1,779	312	10,112	15.3
	14,16 & 18	7,122	1,702	205	9,029	13.7
	20 +	4,603	1,296	134	6,033	9.1
Total pines		25,192	6,037	991	32,220	48.7
Hardwoods	6 & 8	864	933	1,655	3,452	5.2
	10 & 12	702	1,160	2,079	3,941	5.9
	14,16 & 18	377	1,149	3,344	4,870	7.4
	20 +	86	500	2,216	2,802	4.2
Total pulping hardwoods		2,029	3,742	9,294	15,065	22.7
Total pulping species		27,221	9,779	10,285	47,285	71.4
Nonpulping species:						
Hardwoods 2/	6 & 8	1,348	1,255	2,262	4,865	7.3
	10 & 12	842	1,247	2,556	4,645	7.0
	14,16 & 18	468	1,208	3,367	5,043	7.6
	20 +	190	732	3,486	4,408	6.7
Total nonpulping species		2,848	4,442	11,671	18,961	28.6
Total all species		30,069	14,221	21,956	66,246	100.0
Percent of total volume		45.4	21.5	33.1	100.0	

1/ Classifications less than 650,000 cords should be considered as indicating only the comparative magnitude of the item.
2/ Includes volume of sound scrub oak.

The estimate of cordwood volume, classified according to species-groups and diameters of trees, is shown graphically in figure 1.

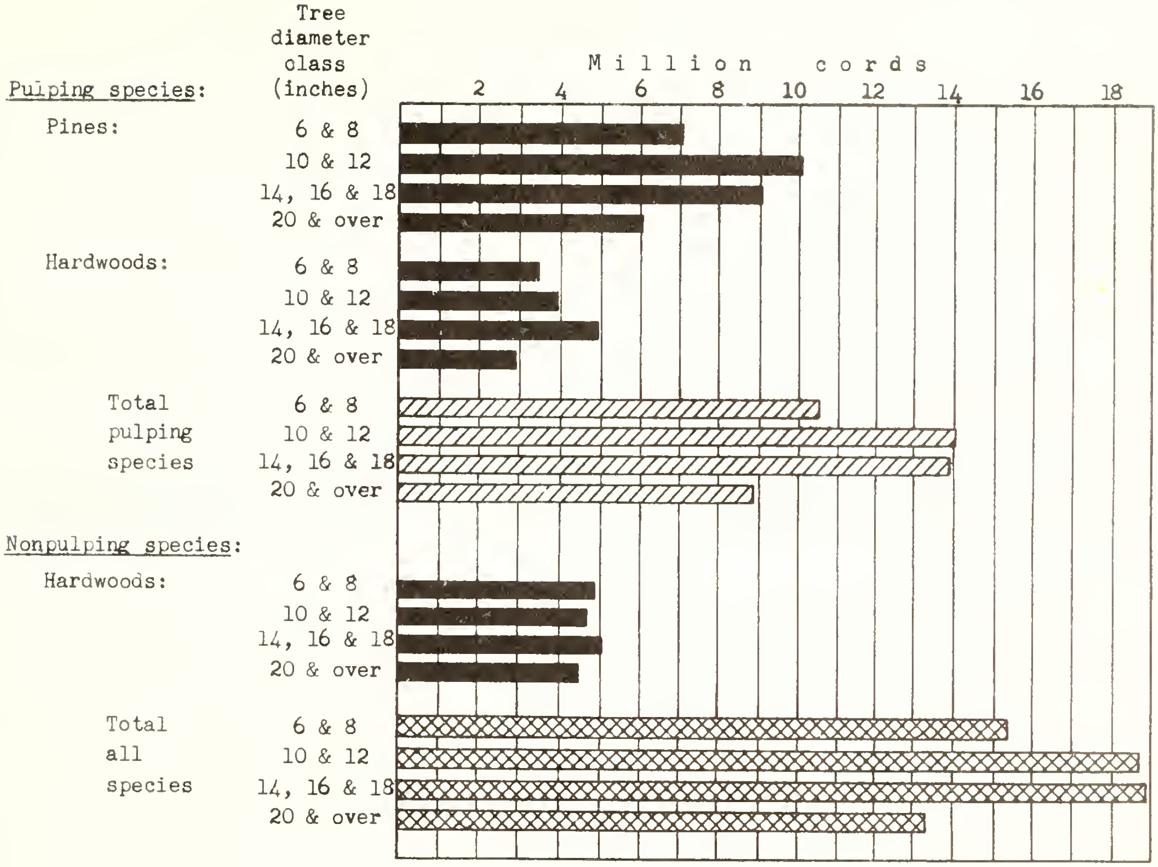


Figure 2. -- Cordwood volume of pulping and nonpulping species

The cordwood volume of pulping and nonpulping species on the average acre of each forest type-group is given in table 5 according to tree-diameter groups. This average-acre volume is a theoretical figure arrived at by dividing the cordwood volume in each type-group by the total acreage of the group. It provides a means of comparing the different type-groups with respect to species composition, diameter distribution, and density. The general average for the unit, including all types, is over 10 cords per forest acre.

From the standpoint of the most profitable returns from the investment, these stands are deficient in the larger size-classes. Gradual improvement in this respect may be brought about by preserving for further growth in sawtimber cuttings, much of the volume in smooth vigorous trees particularly in the 14- to 20-inch diameter-classes. In the smaller diameter-classes, conservative partial cuttings for pulpwood and other cordwood uses can, if properly handled, contribute greatly to future yields of valuable poles, piling, and sawtimber.

Table 5. -- Net cordwood volume of pulping and nonpulping species on the average acre of forest land (excluding clear-cut, reproduction, and fire-killed conditions)

Tree species-group	Diameter group	Major forest type-group		
		Pines	Pine-hardwoods	Hardwoods
	Inches	Cords		
Pulping species:				
Longleaf pines	6 +	.47	.06	.01
Loblolly and shortleaf pines	6 & 8	2.23	.93	.16
	10 & 12	3.32	1.32	.15
	14,16 & 18	2.93	1.26	.10
	20 +	1.79	.96	.06
Total loblolly and shortleaf pines		10.27	4.47	.47
Total pines		10.74	4.53	.48
Hardwoods	6 & 8	.36	.70	.80
	10 & 12	.30	.86	1.01
	14,16 & 18	.16	.86	1.62
	20 +	.04	.38	1.08
Total pulping hardwoods		.86	2.80	4.51
Total pulping species		11.60	7.33	4.99
Nonpulping species:				
Hardwoods	6 & 8	.56	.94	1.10
	10 & 12	.35	.93	1.24
	14,16 & 18	.19	.91	1.63
	20 +	.08	.55	1.69
Total nonpulping species		1.18	3.33	5.66
Total all species		12.78	10.66	10.65

Forest Industries

During 1934, 661 sawmills located in this unit produced a large proportion of the lumber manufactured in the State of Mississippi. Fourteen of the sawmills had a daily capacity of 40 thousand board feet or more; 65 a capacity of 20 to 39 thousand feet; and 582 were small mills with capacities of less than 20 thousand feet. Other primary wood-products establishments include 9 veneer plants, 13 cooperage plants, and 5 producing dimension stock, handle and ski stock, boat oars, shuttle blocks, or excelsior. A large amount of pulpwood is cut in this unit and shipped to the Masonite plant at Laurel, Mississippi, and to the pulpmill at Bogalusa, Louisiana. In addition a large quantity of crossties, poles, piles, and other forest products is produced in the unit.

In the final report of the Forest Survey for this unit, the available data on growth and drain will be carefully weighed to determine the prospects for stabilizing existing wood-using industries and to determine the opportunities for the new industries permissible if the standing-timber investment is maintained in a productive condition.

FOREST SURVEY RELEASE NO. 25 May 3, 1937

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

SAWMILLS IN THE LOWER SOUTH

A Progress Report

By

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

This release contains Forest Survey data that will be included in more complete reports to be published later. This publication, therefore, is to be regarded as a preliminary progress report, the data in which are subject to correction or amplification as the work of computation proceeds.

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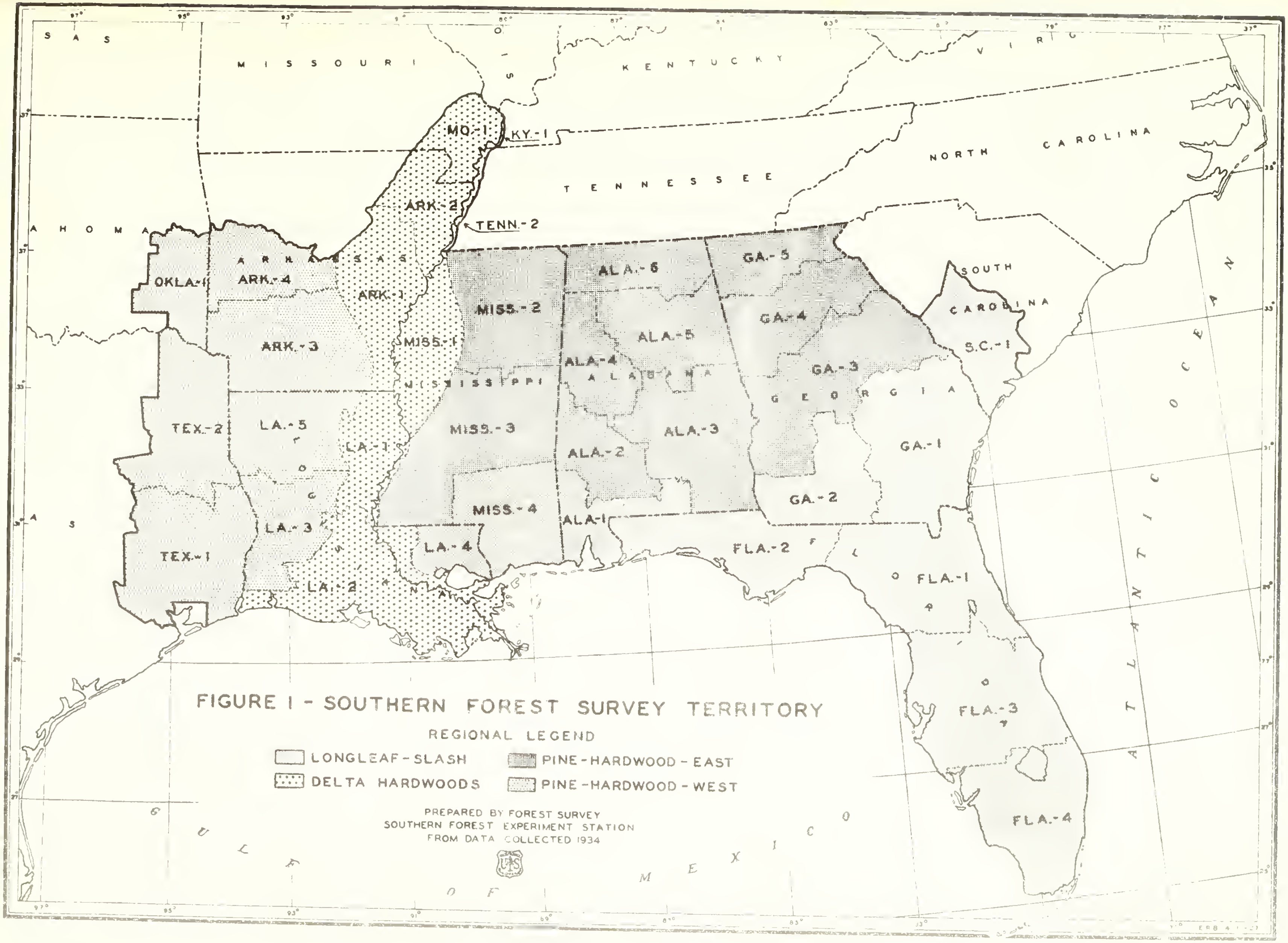

FIGURE 1 - SOUTHERN FOREST SURVEY TERRITORY

SAWMILLS IN THE LOWER SOUTH

In the [illegible] covered by the Forest Survey in the lower South, the manufacture of lumber ranks first among the forest industries. Furthermore, present indications are that sawmilling will continue to be the major forest industry in the South even with the increase in the manufacture and use of other forest products, such as pulp, paper, cellulose, and plywood. The region covered in the Survey embraces the Gulf States, Georgia, and parts of South Carolina, Arkansas, Tennessee, and Missouri. The major forest regions and the survey units into which this section of the country has been divided are shown on the map. The longleaf-slash pine region, which is the seat of the naval-stores industry, is characterized by forests of longleaf and slash pine, with a varying admixture of hardwoods, cypress, and loblolly and other pines. In the two pine-hardwood regions the forests are chiefly loblolly and shortleaf pines with a considerable volume of hardwoods, although in parts of southeastern Texas and [illegible] Louisiana longleaf pine is also important from a production standpoint. The forests of the Mississippi River Delta region are made up almost entirely of hardwoods.

The Lumber Industry

Lumbering, as an industry of the South, began in the early days, and until about 1875, except along the Atlantic Coast where an export trade had long existed, the forests were logged mainly for local consumption. In the late 80's the progressive exhaustion of northern timber supplies [illegible] larger-mill industry southward, and for the next 40 years great [illegible] virgin forest, particularly pine, throughout the South were [illegible] tracts and subjected to rapid, large-scale exploitation. Similar liquidation of the hardwood forests of the lower South did not begin as early or progress so rapidly.

As the larger pine operators, particularly those that logged their holdings less intensively, relinquished certain regions, small mills began to appear; and as the residual stands were bolstered up with second growth, the number and production of these plants increased. In the bottomland-hardwood regions, the large mills are followed more often by the manufacture of slack staves, handle stock, crossties, and other nonlumber commodities than by small sawmills.

The data on sawmills used as the basis of this release were collected by the Forest Survey in 1934 and 1935. The reports of the several Lumber Code agencies as to the number, location, and character of sawmills in the region were used as the point of departure in making the study. All of the large mills and approximately 50 percent of the medium sized mills were then visited by investigators with a questionnaire. Because of the great number of small mills, it was possible to sample only about 10 percent of them. Although this sampling was designed to cover all parts of the region and all classes of conditions, the relative accuracy of the findings is greater for the larger mills than for the smaller ones.

Type of Sawmills

In 1934-35 there were in the entire area over 8,000 sawmills of all sizes, both portable and stationary. They ranged in size from the smallest, producing a few thousand board feet per annum for local use, to the largest, cutting as much as 80 million board feet a year. The total number of sawmills shown on the map (fig. 2) is listed in table 1 by survey units in the four forest regions, which are further classified according to size and species cut. The three major species-groups into which the mills are classified on this latter basis are pine, hardwood, and cypress. All mills cutting at least 50 percent of their volume from pine species in 1934 are classified as pine mills. Similarly, to be classified as a cypress mill, a mill must cut at least 50 percent of its production in cypress lumber. Hardwood mills, on the other hand, are those that cut more than 50 percent of their total production from hardwood species. In many cases, mills manufacturing either pine, hardwood, or cypress at the time of the survey might later change to some other species.

All mills listed as having a daily capacity of 40M board feet or more are stationary mills, set up on a more or less stable basis of operation. Pine mills of 20 to 39M board feet capacity are generally kept on one location for a long time, but some of them are frequently moved. In the Delta region, hardwood mills of this size are usually stationary. Most mills of a daily capacity of 19M board feet and under are easily moved and may be considered as portable. A considerable number of this group, however, particularly among the smallest mills, are actually fixed mills, since they are operated for strictly local needs from the surplus power of cotton gins, grist mills, etc.

Table 1 gives the number of mills of the several size- and species-classes for each of the four forest regions of the lower South. Of the pine mills, 1 percent has a capacity of at least 80M board feet per day, 1 percent has a daily capacity of 40 to 79M board feet, 6 percent are in the 20 to 39M class, and 92 percent are small mills with a daily capacity less than 20M board feet. Of the hardwood mills, about 1 percent are in the 80M and up class, 6 percent in the 40 to 79M class, 10 percent in the 20 to 39M class, and 83 percent in the class with a daily capacity less than 20M board feet. In the cypress mills, the corresponding figures are 6 percent, 15 percent, 28 percent, and 51 percent, respectively.

Lumber Cut by Mills of the Various Size-Classes

The importance of the small sawmills in the total amount of lumber cut in the lower South has been recognized for many years, particularly during the past two decades, when many of the original large mills discontinued operations. The proportion of the 1934 lumber production cut by mills in the different size groups and in the different regions is shown graphically in figure 3 for the pine and in figure 4 for hardwoods. The small mills (19M and under), comprising 92 percent of all pine mills in the lower South, account for 47 percent of the total production of pine lumber. It is estimated from information procured from operators of small pine mills in Alabama and northwest Louisiana that between 40 and 50 percent of the small-

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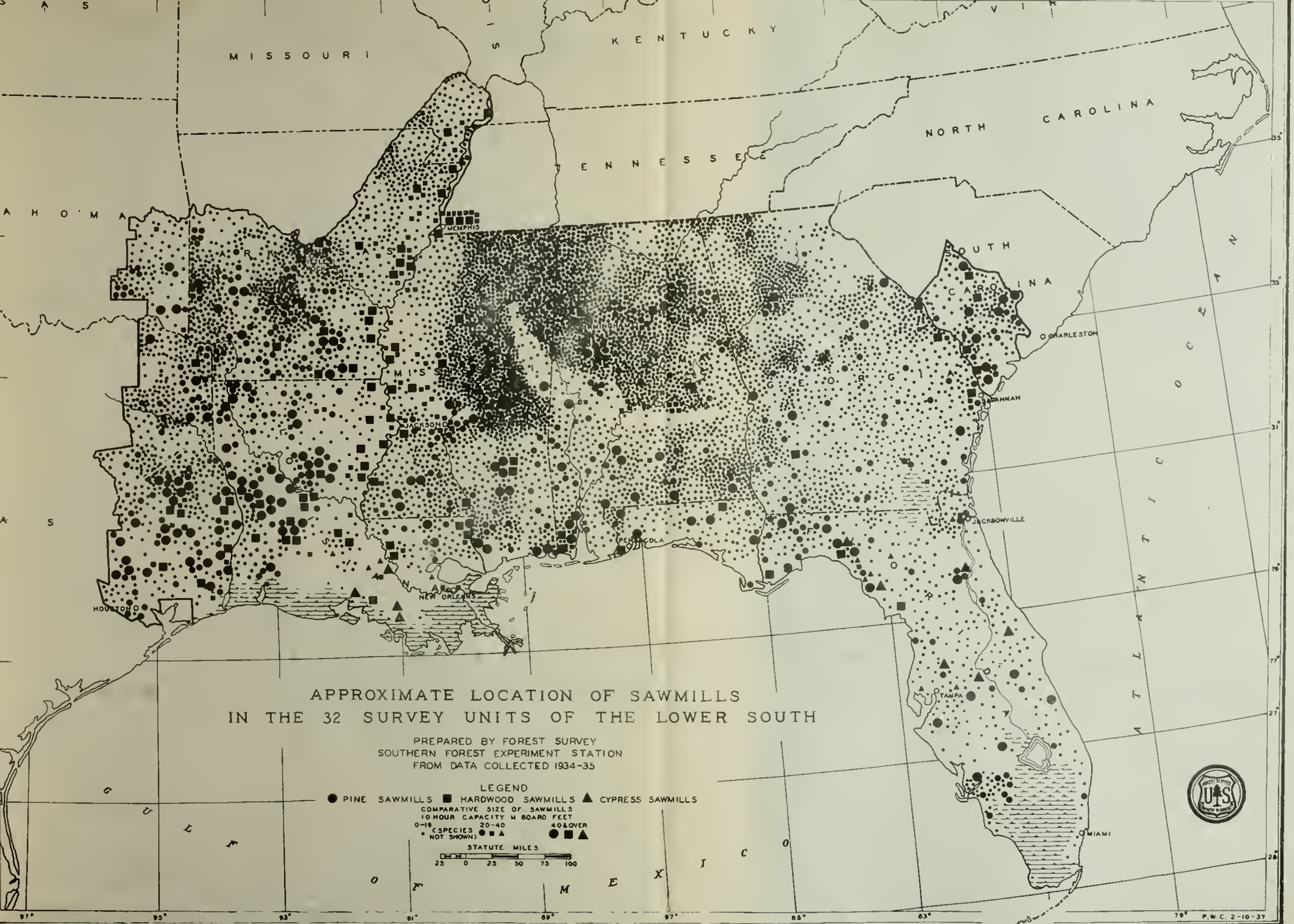
MISSOURI
KENTUCKY
NORTH CAROLINA
TENNESSEE
SOUTH CAROLINA
ARKANSAS
MEMPHIS
GEORGIA
JACKSON
CHARLESTON
SAVANNAH
JACKSONVILLE
PENSACOLA
NEW ORLEANS
HOUSTON
TAMPA
MIAMI
ATLANTIC OCEAN
GULF OF MEXICO
APPROXIMATE LOCATION OF SAWMILLS
IN THE 32 SURVEY UNITS OF THE LOWER SOUTH
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FROM DATA COLLECTED 1934-35
LEGEND
PINE SAWMILLS
HARDWOOD SAWMILLS
CYPRESS SAWMILLS
COMPARATIVE SIZE OF SAWMILLS
10 HOUR CAPACITY M BOARD FEET
0-19 (SPECIES NOT SHOWN)
20-40
40 & OVER
STATUTE MILES
25 0 25 50 75 100
P.W.C. 2-10-37

Table 1. — Number of sawmills in the Deep South in 1934 (listed by capacity classes and species cut)

Region	State and unit	Pine 80 +	Pine 40-79	Pine 20-39	Pine 1-19	Pine Total	Hardwood 80 +	Hardwood 40-79	Hardwood 20-39	Hardwood 1-19	Hardwood Total	Cypress 80 +	Cypress 40-79	Cypress 20-39	Cypress 1-19	Cypress Total	Total all mills
		Species groups and size class of mill (10-hour M.B.F. daily capacity)															
		Number of mills															
Longleaf-Slash Pine	S.C. #1	-	1	6	100	107	2	9	5	24	40	-	-	-	-	-	147
	Ga. 1	-	1	13	259	273	-	1	5	-	6	-	-	-	-	-	279
	Ga. 2	-	1	10	136	147	-	-	1	-	1	-	-	-	-		148
	Fla. 1	3	-	8	118	129	1	1	3	2	7	3	-	5	6	14	150
	Fla. 2	4	4	17	146	171	-	3	1	8	12	-	-	-	-	-	183
	Fla. 3	1	5	13	167	186	-	-	1	1	2	-	3	2	4	9	197
	Ala. 1	1	5	8	128	142	-	3	3	1	7	-	-	-	-	-	149
	Miss. 4	7	2	15	197	221	-	2	-	10	12	-	-	-	-	-	233
	La. 4	2	1	3	33	39	1	1	2	7	11	-	-	-	-	-	50
	Total	18	20	93	1,284	1,415	4	20	21	53	98	3	3	7	10	23	1,536
Percent by species group		1.3	1.4	6.6	90.7	100.0	4.1	20.4	21.4	54.1	100.0	13.0	13.0	30.5	43.5	100.0	-
Pine-Hardwood (East)	Ga. #3	-	4	12	495	511	-	3	5	15	23	-	-	-	-	-	534
	Ga. 4	-	-	2	307	309	-	1	2	2	5	-	-	-	-	-	314
	Ga. 5	-	-	2	211	213	-	-	-	2	2	-	-	-	-	-	215
	Ala. 2	1	3	10	102	116	-	-	3	11	14	-	-	-	-	-	130
	Ala. 3	1	10	27	495	533	-	-	9	16	25	-	-	-	-	-	558
	Ala. 4	2	-	25	142	169	-	-	1	17	18	-	-	-	-	-	187
	Ala. 5	-	1	22	512	535	-	-	1	10	11	-	-	-	-	-	546
	Ala. 6	-	-	-	199	199	-	-	1	94	95	-	-	-	-		294
	Miss. 2	-	1	13	802	816	-	1	7	199	207	-	-	-	-	-	1,023
	Miss. 3	8	3	44	505	560	-	3	21	77	101	-	-	-	-	-	661
	Total	12	22	157	3,770	3,961	-	8	50	443	501	-	-	-	-	-	4,462
Percent by species group		.3	.6	4.0	95.1	100.0	-	1.6	10.0	88.4	100.0	-	-	-	-	-	-
Delta Hardwood	La. #1	-	-	-	-	-	-	9	[illegible]	26	40	-	-	-	-	-	40
	La. 2	-	-	-	-	-	-	9	8	32	49	-	4	4	10	18	67
	Miss. 1	-	-	-	-	-	1	3	9	85	98	-	-	-	-	-	98
	Ark. 1	-	-	-	-	-	-	8	9	141	158	-	-	-	-	-	158
	Ark. 2	-	-	-	-	-	-	5	7	134	146	-	-	1	4	5	151
	Tenn. 2	-	-	-	-	-	-	-	-	7	7	-	-	-	-	-	7
	Ky. 1	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	1
	Mo. 1	-	-	-	-	-	-	-	2	78	80	-	-	1	-	1	81
	Total	-	-	-	-	-	1	34	41	503	579	-	4	6	14	24	603
Percent by species group		-	-	-	-	-	.1	5.9	7.1	86.9	100.0	-	16.7	25.0	58.3	100.0	-
Pine-Hardwood (West)	La. #3	17	2	13	59	91	3	5	2	11	21	-	-	-	-	-	112
	La. 5	1	5	20	77	103	-	3	4	8	15	-	-	-	-	-	118
	Ark. 3	9	2	46	354	411	-	4	4	32	40	-	-	-	-	-	451
	Ark. 4	2	-	24	177	203	-	-	-	23	23	-	-	-	-		[illegible]
	Tex. 1	13	9	26	101	149	2	5	8	11	26	-	-	-	-		[illegible]
	Tex. 2	2	5	24	255	286	-	1	3	32	36	-	-	-	-		322
	Okla. 1	2	1	10	81	94	-	-	2	11	13	-	-	-	-	-	107
	Total	46	24	163	1,104	1,327	5	18	23	128	174	-	-	-			[illegible]
Percent by species group		3.4	1.8	12.2	82.6	100.0	2.9	10.3	13.2	73.6	100.0	-	-	-	-	-	-
Grand total number of mills		76	66	413	6,158	6,713	10	80	135	1,127	1,352	3	7	13	[illegible]	47	8,112
Percent by species group		1.1	1.0	6.2	91.7	100.0	.8	5.9	10.0	83.3	100.0	6.4	14.9	27.6	51.1	100.0	-

mill pine production was cut by mills that moved at least once during 1933-1935. The large mills (40M and over), which comprise only 2 percent of the number of mills, cut 36 percent of the pine lumber. The mills in the intermediate class (20-39M) make up 6 percent of the total number of mills and account for the remaining 17 percent of the pine-lumber production. Both the absolute amount cut by small mills and also the proportion of the total cut are increasing. Although the large mills cut a little more than a third of all pine lumber, the value of their production is considerably greater than a third of the total value of pine lumber produced, because the timber cut in these mills is of a higher quality and because the material is marketed to better advantage.

Of the hardwood cut in the region, 47 percent is produced by large mills, 31 percent by the medium-sized mills, and 23 percent by small mills.

At the present time, the cypress mills are located chiefly in Florida and southern Louisiana. Sixty-eight percent of the cypress production in the longleaf-slash pine region is cut by large mills, 17 percent by medium-sized, and 15 percent by the small mills.

Sawmill Equipment

The equipment of the sawmills in the lower South varies from the completely equipped band mill, containing a resaw, gang saw, dry kiln, planer, and accessory equipment, to the portable mill with only a circular saw. Of the total number of mills, 68 percent are circular mills and 32 percent are band mills (fig. 5). Almost three-fourths of the circular mills are small (19M and under) and only 5 percent are large (40M and over).

Of the band mills, only 3 percent are small. Also it has been found that 62 percent of all mills have planers, 44 percent have dry kilns, 16 percent have resaws, and 5 percent have gang saws. Only 2 percent of all mills are completely equipped. Most of the gang saws and resaws are in the larger band mills, but planers are generally well distributed among mills of all sizes. It is estimated that over one-third of all mills (usually among the small mills) have only headsaws, with or without some accessory equipment, such as cut-off saws and edgers.

Small portable mills can be set up to cut from several thousand to several million board feet of timber at a "set", and can be operated economically from a few weeks in a season to a full working year, the length of which is determined by the weather. They cut any quality and size of timber, but usually operate on small logs and in second-growth timber. This type of mill usually does not accumulate large inventories but operates on a "hand to mouth" basis. Generally, throughout the pine regions, the pine lumber sawed by these mills is seasoned and surfaced at concentration yards or nearby planing mills. These yards can handle the rough lumber produced by a number of mills, and the equipment usually consists of dry kilns, planers, and adequate storage and shipping facilities. It is through these concentration yards that large quantities of pine lumber are dressed and marketed.

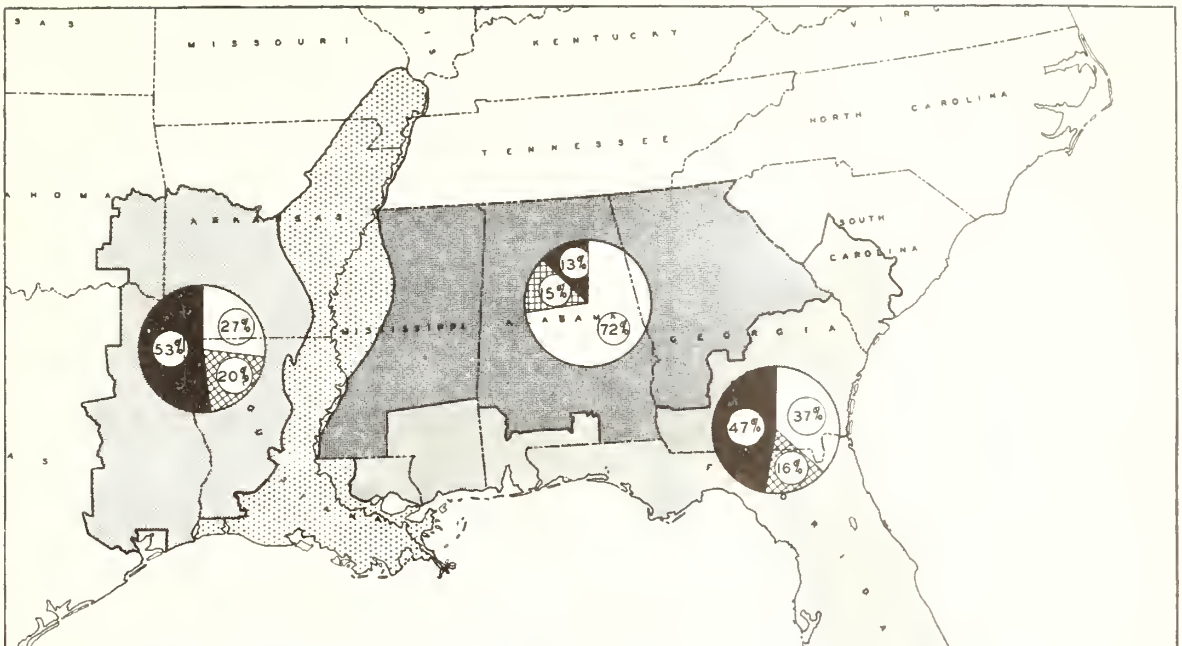

FIGURE 3.- PERCENT OF PINE LUMBER CUT BY MILLS OF DIFFERENT SIZE CLASSES - 1934

LEGEND

MILLS WITH A 10 HOUR DAILY CAPACITY OF

1-19M BD. FT. | 20-39M BD FT. | 40M BD. FT. & OVER

PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FROM DATA COLLECTED 1934

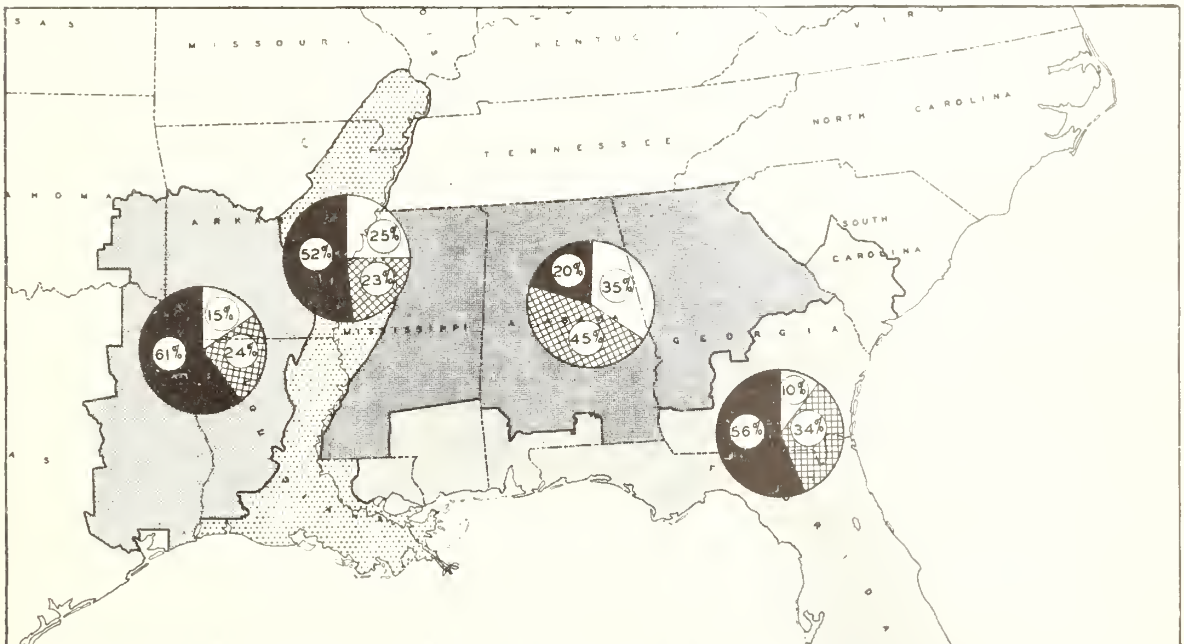

FIGURE 4.- PERCENT OF HARDWOOD LUMBER CUT BY MILLS OF DIFFERENT SIZE CLASSES - 1934.

LEGEND

MILLS WITH A 10 HOUR DAILY CAPACITY OF:

1-19M BD. FT. | 20-39M BD FT. | 40M BD. FT. & OVER

PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FROM DATA COLLECTED 1934

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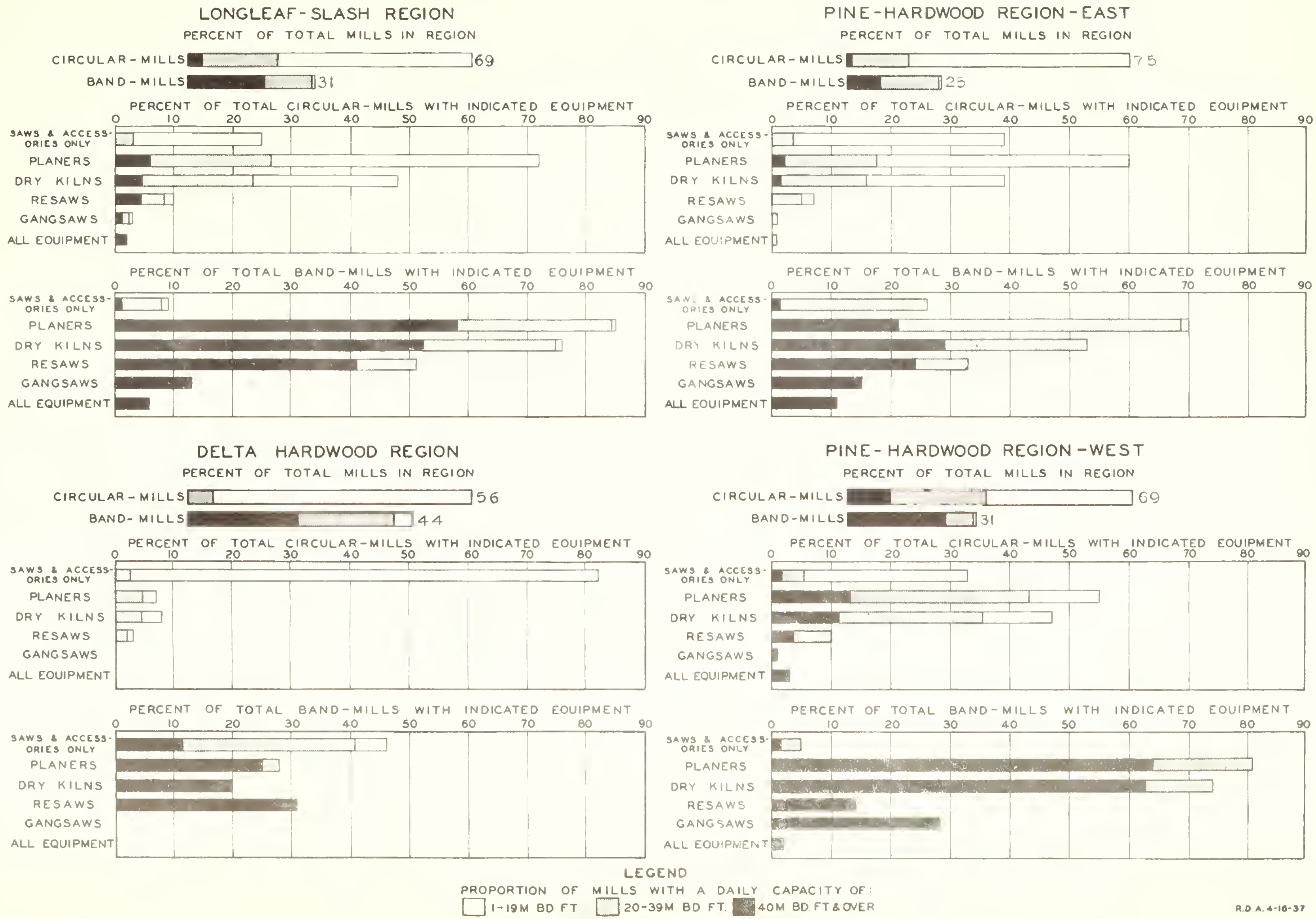
FIGURE 5 - PRINCIPAL ITEMS OF SAWMILL EQUIPMENT USED



The combination of portable mill and concentration yard represents a growing development in the manufacture and marketing of pine lumber. In the production of hardwood lumber, however, this combination will probably not become an important part of the industry, owing to the fact that rough, air-dried lumber is usually shipped for kiln-drying and fabrication directly from the mill to consumers in all parts of the country.

Also the concentration yard is associated chiefly with the small mills. In the lower South there are over 1,000 of these yards, not including large sawmills which act in this capacity while handling the output of the portable mills. Most of these yards (over 80 percent), as might be expected, are located in the pine-hardwood region (east), which is the area with the greatest number of small mills. The remaining 20 percent are divided between the [illegible] pine region and the pine-hardwood region (west). The small mills located in these latter regions cater more to local trade, and most of their product is [illegible] in the immediate vicinity.

[illegible]

[illegible]

[illegible] operations [illegible] consist generally of [illegible] : [illegible] in the woods, and the final transportation to the mill. [illegible] percent [illegible] sawmills in this area are using [illegible] skidding the logs or hauling them with high [illegible]. An additional [illegible] percent use animals in combination with tractors, [illegible] steam skidders, and similar equipment. Most of the mills use mules; [illegible] percent are using oxen.

[illegible] skidders are the principal means used by [illegible] percent of the mills (mainly in the regions east of the Mississippi); while 10 percent use tractors, 6 percent use steam skidders, and 1 percent use pull boats as their chief bunching equipment.

Figure [illegible] shows graphically in each region the percentage of the mills using specific types or combinations of equipment. Each bar represents the percentage of all mills in the region using a given type, and this bar is further subdivided to show the proportion of the mills in each of the three size classes.

Transportation to the mill

In the transportation of logs from the woods to the log pond or mill deck, over 60 percent of all the mills in the lower South use trucks alone, while an additional 25 percent use trucks in combination with other equipment. Of the mills using only trucks 24 percent are medium-sized and 6 percent are large.

Logging railroads are used by 11 percent of all mills. Most of the large mills use a combination of trucks and railroads, hauling the logs up to 40 miles by truck and up to 150 miles by common carrier.

Figure 7 shows graphically the percentage of mills in each region using specific types of equipment. Each bar represents the percentage of the mills in the region using equipment of a specific type, and the bar is further subdivided to show the proportion of mills in each size-class.

Labor Requirements

Table 2 shows the average number of man-days of labor required to produce a thousand feet board measure in the log in the woods and a thousand board feet of lumber in the mill, in the four major forest regions and in different types of mills.

Combined (woods and mill) operations for producing pine lumber require more labor per thousand board feet than do similar operations for hardwood because of the higher degree of finishing done to the former. Cypress operations require more labor than either pine or hardwood because of the greater difficulty in logging. The pine operations in the longleaf-slash region require more labor than in the other regions because of differences in logging and manufacturing conditions. The hardwood operations of the pine-hardwood region (west) require the smallest amount of labor per thousand board feet.

Table 2. Average labor required to produce one thousand board feet of lumber

Region	Woods			Mill			Combined Woods & Mill		
	Pine	Hdwd.	Cy-press	Pine	Hdwd.	Cy-press	Pine	Hdwd.	Cy-press
	Number of men working 10 hrs.								
Longleaf-Slash	1.29	1.21	1.50	2.28	1.44	2.25	3.57	2.65	3.7[illegible]
Pine-Hardwood-East	1.16	1.40	-	1.87	1.62	-	3.03	3.02	-
Pine-Hardwood-West	1.06	1.05	-	1.72	1.42		2.78	2.47	-
Delta Hardwoods	-	1.02	-	-	1.54	-	-	2.56	

Figure 8 shows the average labor requirements in mills of various sizes. Labor requirements apparently increase in both logging and milling as the mill increases in size, except for the very largest mills. These variations in labor requirements, as is well known, are due to variations in (1) type of logging, (2) proximity to the timber, (3) kind of product manufactured, and (4) amount of machinery used.

FIGURE 6.-PRINCIPAL KINDS OF MOTIVE POWER USED IN BUNCHING LOGS

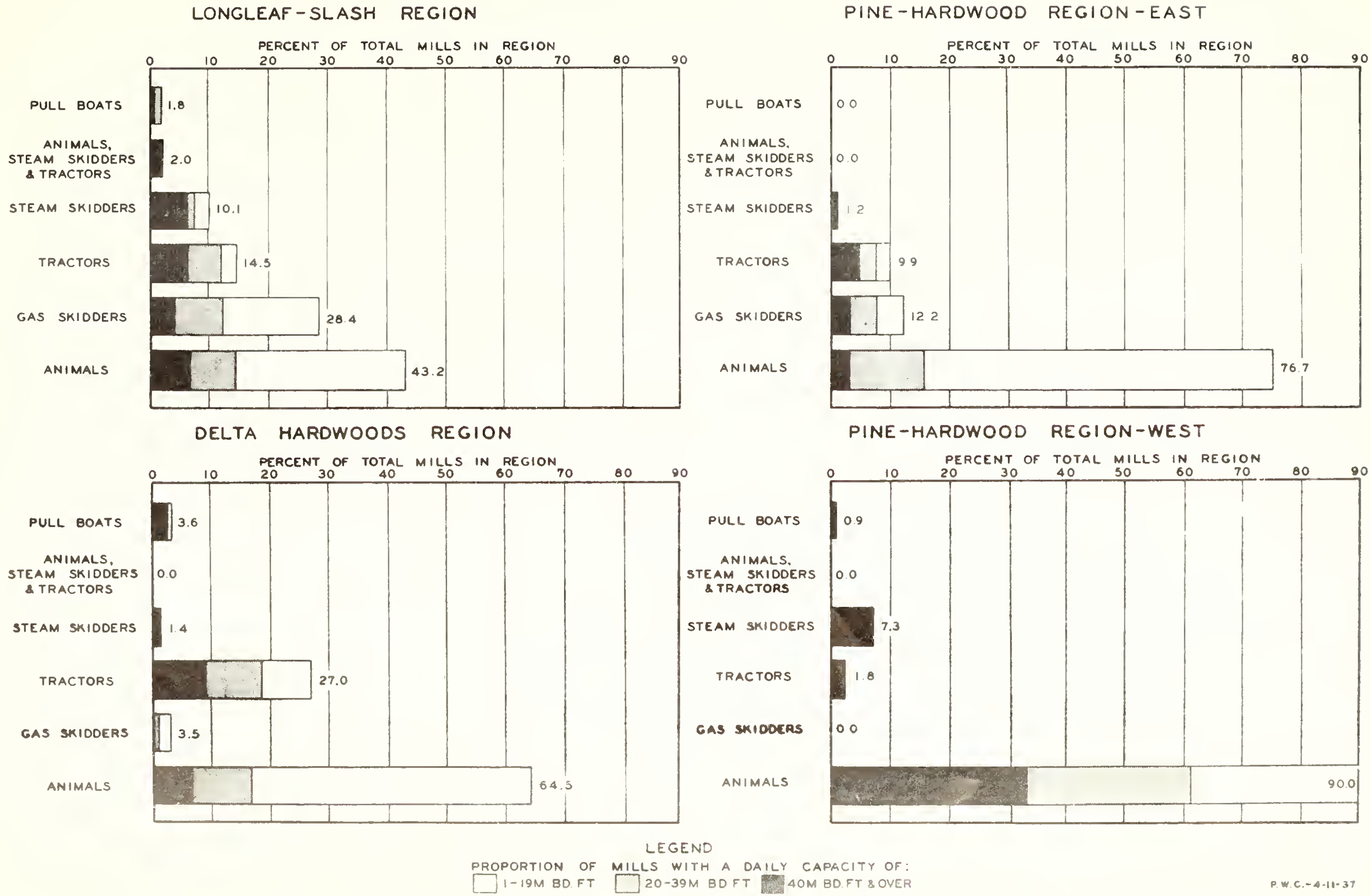


FIGURE 7.- PRINCIPAL METHODS OF TRANSPORTING LOGS FROM WOODS TO MILLS

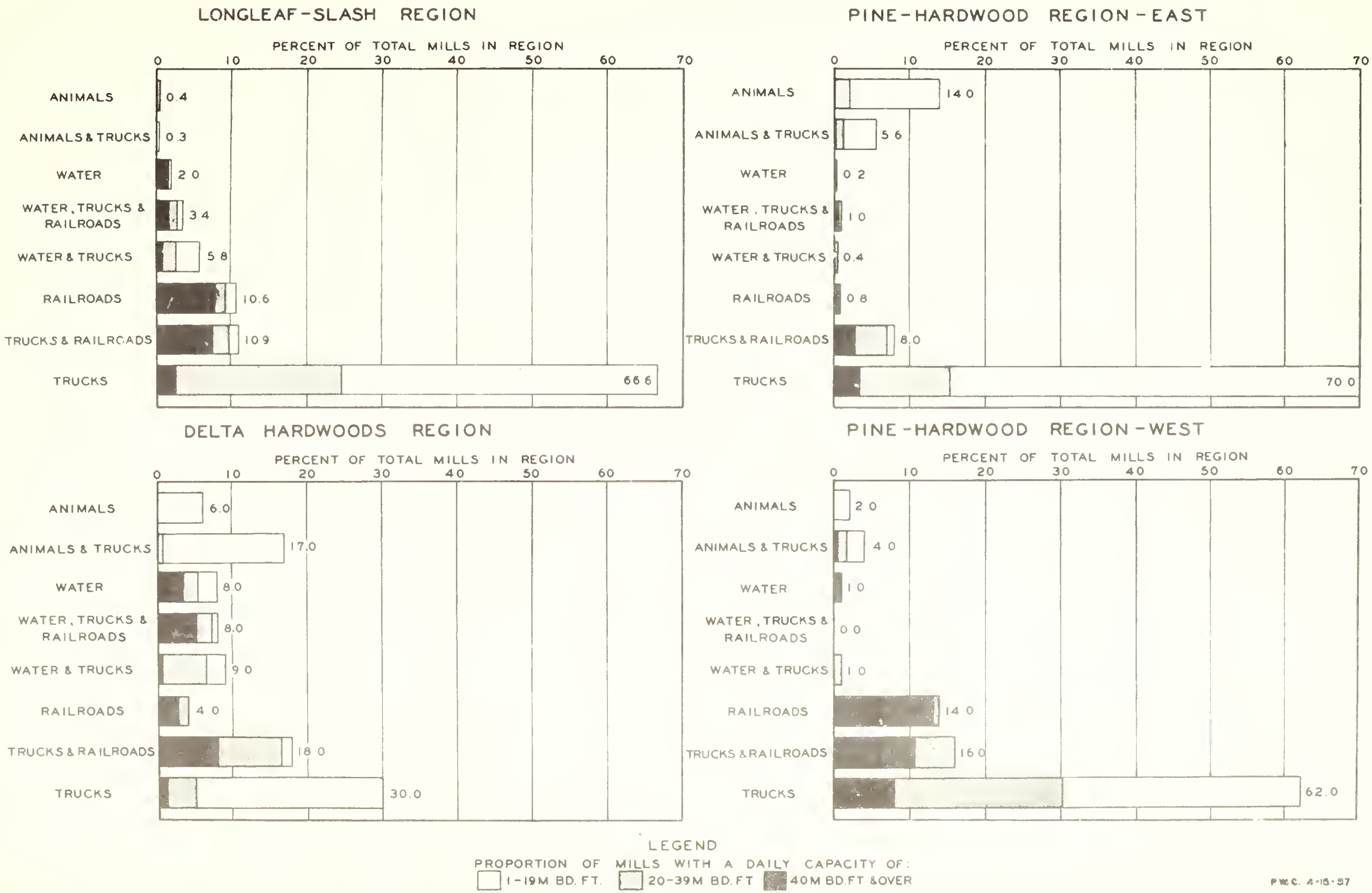
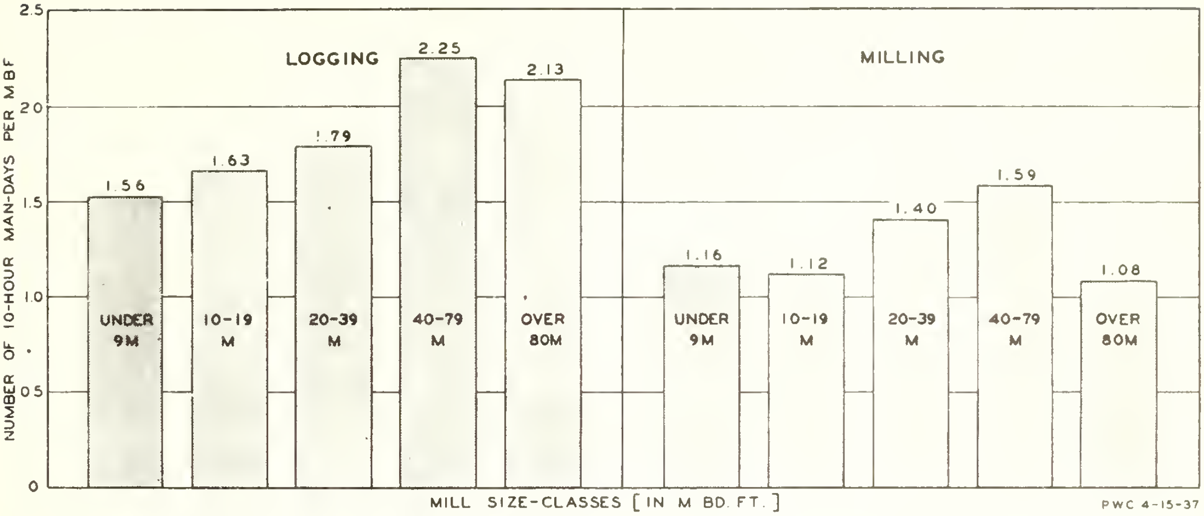


FIGURE 8.- AVERAGE LABOR REQUIREMENTS FOR LOGGING AND MILLING IN SAWMILLS OF VARIOUS SIZE-CLASSES



The information given in this release is based on data collected at a time when production of lumber was at the lowest point in several decades. Although for many years, the manufacturing and logging practices had remained of the conventional type and undergone little change, since the completion of the survey, the demand for lumber has increased, bringing about an expansion in operating capital which has consequently encouraged the introduction of more modern and efficient logging and manufacturing methods. Another generally accepted fact is that the heyday of the large mill in the lower South is past, and that the small mill is becoming an increasingly important factor in lumber production. Other pronounced changes that are occurring are the progressively diminishing use of steam skidders and logging railroads and the replacement thereof by gas skidders, tractors, and motor trucks. These trends and changes in logging and manufacturing processes and in the number and size of mills can be noted, with any degree of accuracy, only by resurveys at regular intervals.

FORREST SURVEY RELEASE NO. 26 July 12, 1937

VOLUMES ON AN AVERAGE ACRE IN THE VARIOUS UNITS OF THE PINE-HARDWOOD REGION WEST OF THE MISSISSIPPI

A Progress Report

by

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

This release contains Forest Survey data that will be included in complete reports to be published later. It should be regarded as a progress report. Although considered reliable, the data are subject to correction or amplification as the work of computation proceeds.

Staff Assignment

In Charge of Field Work and Preparation of Report
James W. Cruikshank - Associate Forest Economist

In Charge of Computations
P. R. Wheeler - Associate Forest Economist

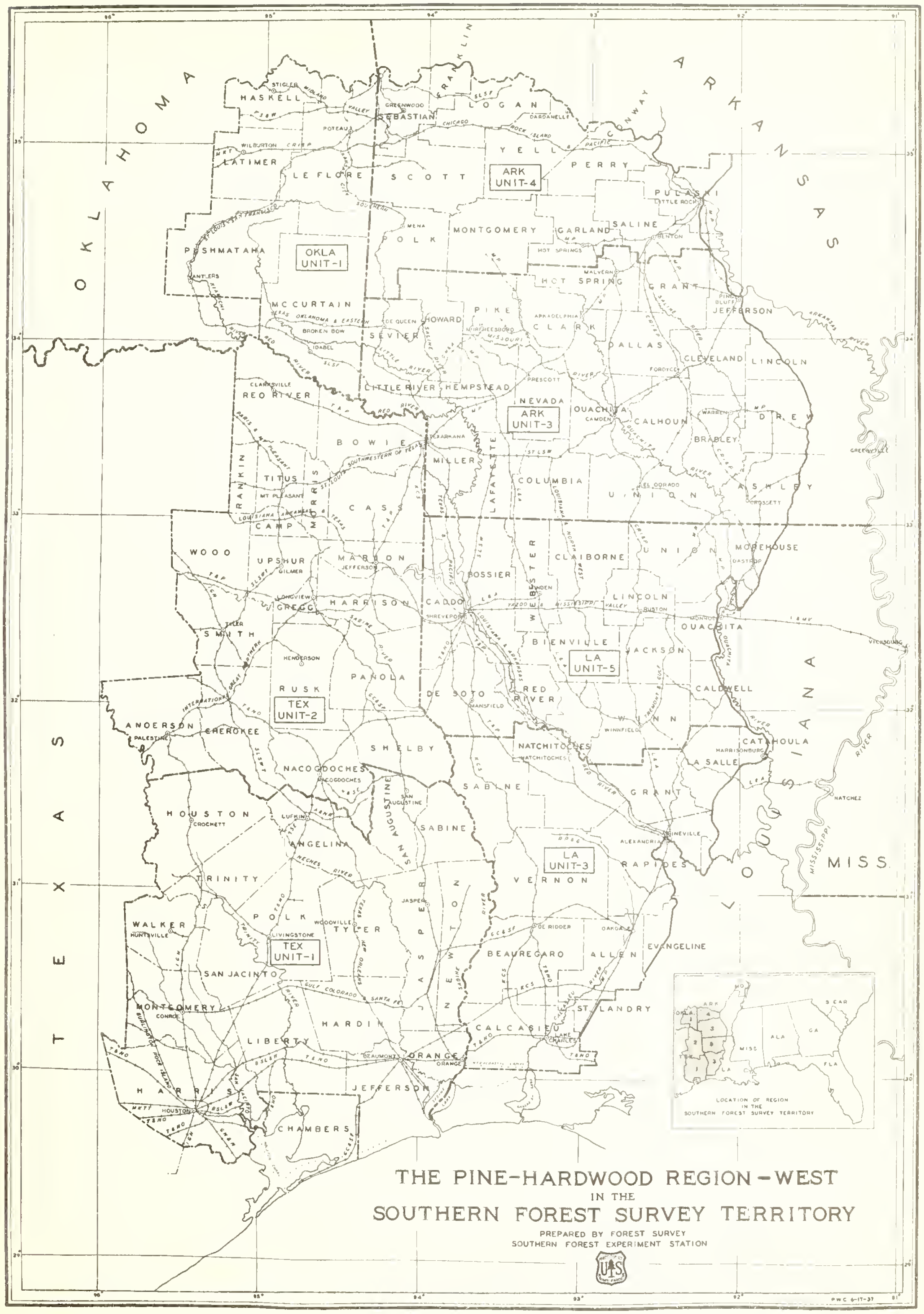

THE PINE-HARDWOOD REGION-WEST
IN THE
SOUTHERN FOREST SURVEY TERRITORY
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
OKLAHOMA
ARKANSAS
TEXAS
LOUISIANA
MISS
OKLA UNIT-1
ARK UNIT-4
ARK UNIT-3
TEX UNIT-2
TEX UNIT-1
LA UNIT-5
LA UNIT-3
LOCATION OF REGION IN THE SOUTHERN FOREST SURVEY TERRITORY

Figure 1.

Average-Acre Tables

This report includes two groups of tables that show the volume of timber per average acre in board feet (by the International $\frac{1}{4}$-inch rule) and in standard cords, for each of the units in the pine-hardwood region west of the Mississippi (fig. 1). These tables, which are a by-product of the forest survey, show the timber volumes by species group, type group, and forest condition, and can be used as an aid in estimating roughly the volume of sawtimber or cordwood in large areas of forest land in the region they cover.

The volumes for the average forest acre in a unit were obtained by dividing the total volume in a given type-group and forest condition by the area within such a classification. The average volumes, as shown in these tables, represent a combination of the many variations in site, age, density, and species that may occur in forest stands of a particular type-group and forest condition, scattered over several million acres. When applying these averages to a specific area, therefore, the variation from the average site, age class, and stocking must be considered and allowed for, if the results are to approach reasonable accuracy. With these precautions and a fairly accurate determination of the areas in the several forest-types and conditions described (in the appendix), a timber estimator can choose from the various tables of volume per acre the appropriate volume to apply to the figures for a given area. The data are the averages of very large areas and can be applied with safety only to forest tracts that approach in composition the average of the region.

The pine volume is separated into two species-groups: longleaf and shortleaf-loblolly. The hardwoods are separated into (1) pulping hardwoods, containing such species as bay, magnolia, maple, red and black gum, tupelo, cypress, cottonwood, and willow, and (2) nonpulping hardwoods, made up of such species as red and white oaks, hickory, ash, elm, locust, dogwood, and persimmon. Scrub hardwood species are not included in either the board-foot or cordwood tables.

Board-Foot Volume

The following tables give the average stand per acre, expressed in board feet according to the International $\frac{1}{4}$-inch scale, which approximates green lumber tally. The volumes given are net mill tally, that is, allowance has been made for material that would be left in the woods because of rot, fire-scar, crook, limbiness, and similar defects. Also allowance has been made for loss in sawing at the mill due to sweep and hidden defects.

To be classified as sawlog-size trees, hardwoods must have a minimum breast-height diameter outside bark of 13.0 inches, while pines must be 9.0 inches in diameter; also they must contain one sound butt log at least 12 feet long or have at least 50 percent of the gross volume of the tree in sound material. The volume of the stem is included to the upper limit of usable material in the tops rather than to a fixed top-diameter, but no pine logs less than 5.5 inches in diameter inside bark at the small end, nor any hardwood logs less than 8.5 inches, are included.

Net board-foot volume (International $\frac{1}{4}$-inch rule)
on an average acre, classified according to
type group, species group, and forest condition

Table 1: TEXAS UNIT NO. 1

Type group and species contained therein	Forest condition						Weighted average volume in each type group
	Old growth		Second growth			Clear-cut and reproduction	
	Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size		
	Board feet						
Longleaf type-group:							
Species:							
Longleaf pines	9,800	3,780	1,900	1,640	210	70	1,200
Shortleaf-loblolly pines	2,270	510	960	260	60	-	330
Pulping hardwoods	150	30	10	50	10	-	20
Nonpulping hardwoods	190	30	70	20	10	-	30
Total species	12,410	4,350	2,940	1,970	290	70	1,580
Shortleaf-loblolly type-group:							
Species:							
Longleaf pines	120	-	30	-	10	10	20
Shortleaf-loblolly pines	10,750	5,130	4,800	2,950	360	130	3,540
Pulping hardwoods	260	160	100	60	10	-	80
Nonpulping hardwoods	340	160	130	70	20	20	100
Total species	11,470	5,450	5,060	3,080	400	160	3,740
Shortleaf-loblolly-hardwood type-group:							
Species:							
Longleaf pines	-	-	-	-	10	-	-
Shortleaf-loblolly pines	4,840	2,650	2,100	1,490	210	60	1,540
Pulping hardwoods	1,320	870	600	360	60	-	430
Nonpulping hardwoods	2,130	1,320	970	680	90	-	710
Total species	8,290	4,840	3,670	2,530	370	60	2,680
Upland hardwood type-group:							
Species:							
Longleaf pines	-	-	-	10	10	-	10
Shortleaf-loblolly pines	380	170	140	190	20	-	120
Pulping hardwoods	1,120	640	440	230	10	10	350
Nonpulping hardwoods	2,790	1,570	1,200	670	70	20	900
Total species	4,290	2,380	1,780	1,100	110	30	1,380
Bottomland hardwood type-group:							
Species:							
Longleaf pines	-	-	-	-	-	-	-
Shortleaf-loblolly pines	200	130	70	40	10	-	100
Pulping hardwoods	2,660	1,610	1,100	830	130	50	1,340
Nonpulping hardwoods	3,220	2,610	1,810	1,890	190	-	1,990
Total species	6,080	4,350	2,980	2,760	330	50	3,430
Average of all type-groups:[1/]							
Species:							
Longleaf pines	520	690	150	80	40	50	180
Shortleaf-loblolly pines	2,750	960	2,970	1,730	190	20	1,700
Pulping hardwoods	1,780	940	380	280	40	-	410
Nonpulping hardwoods	2,380	1,590	630	570	60	10	650
Total species	7,430	4,180	4,130	2,660	330	80	2,940

1/ Represents the average over the total forest area.

Table 2: TEXAS UNIT NO. 2

Type group and species contained therein	Forest condition						Weighted average volume in each type group
	Old growth		Second growth			Clear-cut and reproduction	
	Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size		
	Board feet						
Shortleaf-loblolly type-group:							
Species:							
Shortleaf-loblolly pines 1/	10,590	5,680	3,830	2,540	240	20	3,060
Pulping hardwoods	70	130	60	30	-	-	50
Nonpulping hardwoods	190	220	80	40	10	30	60
Total species	10,850	6,030	3,970	2,610	250	50	3,170
Shortleaf-loblolly-hardwood type-group:							
Species:							
Shortleaf-loblolly pines	5,070	3,980	1,950	1,410	170	20	1,270
Pulping hardwoods	380	230	490	390	20	-	290
Nonpulping hardwoods	2,410	1,230	830	700	40	-	560
Total species	7,860	5,440	3,270	2,500	230	20	2,120
Upland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	170	120	80	60	10	-	40
Pulping hardwoods	450	320	530	310	20	10	160
Nonpulping hardwoods	2,410	1,850	1,100	960	80	-	540
Total species	3,030	2,290	1,710	1,330	110	10	740
Bottomland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	100	70	90	50	10	-	60
Pulping hardwoods	1,410	880	1,050	770	50	-	730
Nonpulping hardwoods	3,670	3,020	1,530	1,680	100	20	1,630
Total species	5,180	3,970	2,670	2,500	160	20	2,420
Average of all type-groups: 2/							
Species:							
Shortleaf-loblolly pines	2,600	1,130	2,630	1,600	90	10	1,450
Pulping hardwoods	820	540	320	260	20	-	240
Nonpulping hardwoods	2,590	2,120	510	550	60	10	550
Total species	6,010	3,790	3,460	2,410	170	20	2,240

1/ The shortleaf-loblolly species-group contains a small volume of longleaf.
2/ Represents the average over the total forest area.

Table 3: LOUISIANA UNIT NO. 3

Type group and species contained therein	Forest condition						Weighted average volume in each type group
	Old growth		Second growth			Clear-cut and repro-duction	
			Sawlog size		Under sawlog size		
	Uncut	Partly cut	Uncut	Partly cut			
	Board feet						
Longleaf type-group:1/							
Species:							
Longleaf pines	15,890	3,250	1,750	1,210	120	40	830
Shortleaf-loblolly pines	590	110	510	270	30	-	80
Pulping hardwoods	40	-	20	20	-	-	10
Nonpulping hardwoods	50	-	60	100	-	-	10
Total species	16,570	3,360	2,340	1,600	150	40	930
Shortleaf-loblolly-type group:							
Species:							
Longleaf pines	170	250	50	10	10	-	30
Shortleaf-loblolly pines	11,240	7,960	4,370	2,530	180	60	2,840
Pulping hardwoods	160	60	80	40	10	-	50
Nonpulping hardwoods	470	450	150	110	10	-	110
Total species	12,040	8,720	4,650	2,690	210	60	3,030
Shortleaf-loblolly-hardwood type-group:							
Species:							
Longleaf pines	-	-	10	10	10	30	10
Shortleaf-loblolly pines	6,800	1,710	1,780	1,350	170	-	1,170
Pulping hardwoods	1,840	630	660	470	70	20	420
Nonpulping hardwoods	1,830	1,450	1,270	920	100	-	790
Total species	10,470	3,790	3,720	2,750	350	50	2,390
Upland hardwood type-group:							
Species:							
Longleaf pines	10	10	-	10	-	-	-
Shortleaf-loblolly pines	120	330	150	130	10	-	100
Pulping hardwoods	760	1,400	660	550	30	-	420
Nonpulping hardwoods	2,890	2,810	2,020	1,270	60	-	1,120
Total species	3,780	4,550	2,830	1,960	100	-	1,640
Bottomland hardwood type-group:							
Species:							
Longleaf pines	-	-	-	-	-	-	-
Shortleaf-loblolly pines	90	80	100	70	10	-	70
Pulping hardwoods	4,700	2,570	1,560	1,220	120	20	1,940
Nonpulping hardwoods	3,660	2,660	2,100	1,540	150	80	2,000
Total species	8,450	5,310	3,760	2,830	280	100	4,010
Average of all type-groups:2/							
Species:							
Longleaf pines	4,310	750	320	120	50	30	370
Shortleaf-loblolly pines	730	430	2,170	1,230	80	10	760
Pulping hardwoods	2,820	1,720	490	460	30	-	430
Nonpulping hardwoods	2,460	1,950	820	750	50	-	550
Total species	10,320	4,850	3,800	2,560	210	40	2,110

1/ The weighted average is not a true picture owing to the distortion caused by over a million acres of clear-cut area.
2/ Represents the average over the total forest area.

Table 4: LOUISIANA UNIT NO. 5

Type group and species contained therein	Forest condition						Weighted average volume in each type group
	Old growth		Second growth			Clear-cut and reproduction	
			Sawlog size		Under sawlog size		
	Uncut	Partly cut	Uncut	Partly cut			
	Board feet						
Shortleaf-loblolly type-group:							
Species:							
Shortleaf-loblolly pines 1/	12,130	7,090	4,930	2,900	230	70	3,570
Pulping hardwoods	160	80	100	70	10	-	70
Nonpulping hardwoods	420	290	150	80	30	20	120
Total species	12,710	7,460	5,180	3,050	270	90	3,760
Shortleaf-loblolly-hardwood type-group:							
Species:							
Shortleaf-loblolly pine	5,390	3,510	2,180	1,440	150	20	1,500
Pulping hardwoods	1,180	680	620	490	20	20	420
Nonpulping hardwoods	2,290	1,220	1,120	790	70	-	750
Total species	8,860	5,410	3,920	2,720	240	40	2,670
Upland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	280	220	160	100	40	10	120
Pulping hardwoods	690	580	640	660	10	-	410
Nonpulping hardwoods	2,240	2,420	1,360	1,010	80	-	1,010
Total species	3,210	3,220	2,160	1,770	130	10	1,540
Bottomland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	110	90	110	70	10	-	80
Pulping hardwoods	2,730	1,670	1,580	1,450	60	30	1,350
Nonpulping hardwoods	4,040	2,940	1,620	1,310	110	20	1,750
Total species	6,880	4,700	3,310	2,830	180	50	3,180
Average of all type-groups: 2/							
Species:							
Shortleaf-loblolly pines	2,290	1,720	3,170	1,710	130	40	1,820
Pulping hardwoods	1,740	1,050	490	460	20	10	480
Nonpulping hardwoods	2,950	2,150	710	590	70	10	740
Total species	6,980	4,920	4,370	2,760	220	60	3,040

1/ The shortleaf-loblolly species-group contains a small volume of longleaf.
2/ Represents the average over the total forest area.

Table 5: ARKANSAS UNIT NO. 3

Type group and species contained therein	Forest condition						Weighted average volume in each type group
	Old growth		Second growth			Clear-cut and reproduction	
			Sawlog size		Under sawlog size		
	Uncut	Partly cut	Uncut	Partly cut			
	Board feet						
Shortleaf-loblolly type-group:							
Species:							
Shortleaf-loblolly pines	13,020	6,080	4,850	3,050	230	-	3,960
Pulping hardwoods	200	40	70	50	-	-	60
Nonpulping hardwoods	420	240	140	90	20	-	120
Total species	13,640	6,360	5,060	3,190	250	-	4,140
Shortleaf-loblolly-hardwood type-group:							
Species:							
Shortleaf-loblolly pines	6,270	3,890	2,470	1,580	140	20	1,670
Pulping hardwoods	1,100	810	470	370	20	10	340
Nonpulping hardwoods	2,530	1,360	1,090	750	60	-	730
Total species	9,900	6,060	4,030	2,700	220	30	2,740
Upland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	390	310	170	90	20	10	110
Pulping hardwoods	520	660	650	440	30	-	300
Nonpulping hardwoods	2,500	1,920	1,430	1,030	80	-	830
Total species	3,410	2,890	2,250	1,560	130	10	1,240
Bottomland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	140	120	50	60	20	-	70
Pulping hardwoods	2,660	1,590	1,390	1,030	40	-	1,310
Nonpulping hardwoods	4,480	2,580	1,940	1,440	130	60	2,040
Total species	7,280	4,290	3,380	2,530	190	60	3,420
Average of all type-groups:1/							
Species:							
Shortleaf-loblolly pines	2,660	1,110	3,190	1,810	110	10	1,930
Pulping hardwoods	1,770	1,200	410	340	20	-	440
Nonpulping hardwoods	3,340	2,120	750	610	70	10	800
Total species	7,770	4,430	4,350	2,760	200	20	3,170

1/ Represents the average over the total forest area.

Table 6: ARKANSAS UNIT NO. 4

Type group and species contained therein	Forest condition						Weighted average volume in each type group
	Old growth		Second growth			Clear-cut and reproduction	
	Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size		
	Board feet						
Shortleaf-loblolly type-group:							
Species:							
Shortleaf-loblolly pines	5,700	3,190	3,450	2,250	310	100	3,220
Pulping hardwoods	10	-	10	20	-	-	10
Nonpulping hardwoods	110	110	60	60	50	40	70
Total species	5,820	3,300	3,520	2,330	360	140	3,300
Shortleaf-loblolly-hardwood type-group:							
Species:							
Shortleaf-loblolly pines	2,240	1,510	1,510	1,090	240	80	840
Pulping hardwoods	120	210	150	130	10	-	70
Nonpulping hardwoods	1,020	870	510	420	110	-	350
Total species	3,380	2,590	2,170	1,640	360	80	1,260
Upland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	70	110	40	90	40	20	50
Pulping hardwoods	300	200	330	270	20	10	90
Nonpulping hardwoods	1,690	1,650	1,090	1,130	130	20	510
Total species	2,060	1,960	1,460	1,490	190	50	650
Bottomland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	50	100	-	20	20	-	30
Pulping hardwoods	1,120	2,430	1,250	1,380	50	-	790
Nonpulping hardwoods	3,980	1,240	1,110	910	170	230	850
Total species	5,150	3,770	2,360	2,310	240	230	1,670
Average of all type-groups: 1/							
Species:							
Shortleaf-loblolly pines	4,240	1,660	2,730	1,650	160	40	1,700
Pulping hardwoods	90	270	90	130	10	-	70
Nonpulping hardwoods	550	830	250	290	110	40	280
Total species	4,880	2,760	3,070	2,070	280	80	2,050

1/ Represents the average over the total forest area.

Table 7: OKLAHOMA UNIT NO. 1

Type group and species contained therein	Forest condition						Weighted average volume in each type group
	Old growth		Second growth			Clear-cut and reproduction	
	Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size		
	Board feet						
Shortleaf-loblolly type group:							
Species:							
Shortleaf-loblolly pines	5,500	3,200	2,720	1,590	290	80	2,830
Pulping hardwoods	10	-	-	-	-	-	-
Nonpulping hardwoods	160	90	80	20	20	-	80
Total species	5,670	3,290	2,800	1,610	310	80	2,910
Shortleaf-loblolly-hardwood type group:							
Species:							
Shortleaf loblolly pines	1,980	1,480	1,090	890	250	210	690
Pulping hardwoods	50	20	40	40	-	-	20
Nonpulping hardwoods	900	780	540	480	60	-	300
Total species	2,930	2,280	1,670	1,410	310	210	1,010
Upland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	140	50	50	40	50	30	50
Pulping hardwoods	140	260	100	80	10	-	40
Nonpulping hardwoods	1,780	1,380	910	920	70	20	330
Total species	2,060	1,690	1,060	1,040	130	50	420
Bottomland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	20	10	10	10	10	-	10
Pulping hardwoods	1,220	860	370	450	40	-	380
Nonpulping hardwoods	2,450	1,930	1,470	1,390	190	-	1,030
Total species	3,690	2,800	1,850	1,850	240	-	1,420
Average of all type-groups: 1/							
Species:							
Shortleaf-loblolly pines	3,370	1,170	1,540	920	100	50	850
Pulping hardwoods	140	260	60	70	10	-	50
Nonpulping hardwoods	800	1,020	470	450	80	10	320
Total species	4,310	2,450	2,070	1,440	190	60	1,220

1/ Represents the average over the total forest area.

Cordwood Volume

In estimating the cordwood volume, the entire stand of sound trees 5 inches or over in diameter, outside the bark at breast height, is expressed in terms of standard (4 x 4 x 8 feet) cords, containing 90 cubic feet of pine wood or 80 cubic feet of hardwood, including bark. All sawlog-size trees previously given in the average board-foot tables are included in this estimate. In under-sawlog-size trees of all species and in sawlog-size pines, the stem is included up to a variable top diameter, with 4 inches as a minimum. In sawlog-size hardwoods and in cypress, only the sawtimber portion is included. Deduction from the volume of sound trees is made for woods cull, that is, that part of the tree that would be left in the woods because of rot, fire-scar, crook, bad knots, or other defects. Neither the sound material in cull trees nor the limbs of any trees are included in these average-acre volumes.

Net cordwood volume on an average acre, classified
according to type group, species group, and forest condition

Table 8: TEXAS UNIT NO. 1

Type group and species contained therein	Forest condition						Weighted average volume in each type group
	Old growth		Second growth			Clear-cut and reproduction	
			Sawlog size		Under sawlog size		
	Uncut	Partly cut	Uncut	Partly cut			
	Cords						
Longleaf type-group:							
Species:							
Longleaf pines	21.0	8.8	6.4	5.8	1.4	0.3	3.5
Shortleaf-loblolly pines	6.2	1.9	3.5	1.2	0.4	-	1.2
Pulping hardwoods	1.0	0.2	0.4	0.1	0.1	-	0.2
Nonpulping hardwoods	1.0	0.2	0.4	0.1	0.2	-	0.2
Total species	29.2	11.1	10.7	7.2	2.1	0.3	5.1
Shortleaf-loblolly type-group:							
Species:							
Longleaf pines	0.3	-	0.1	0.1	-	-	0.1
Shortleaf-loblolly pines	26.6	14.2	16.6	11.4	3.7	0.4	12.6
Pulping hardwoods	1.8	1.2	1.0	0.7	0.2	0.1	0.7
Nonpulping hardwoods	2.3	1.2	1.4	1.1	0.4	0.1	1.1
Total species	31.0	16.6	19.1	13.3	4.3	0.6	14.5
Shortleaf-loblolly-hardwood type-group:							
Species:							
Longleaf pines	-	-	-	-	-	-	-
Shortleaf-loblolly pines	12.5	7.7	8.0	6.6	1.6	0.3	5.9
Pulping hardwoods	6.5	3.7	3.1	2.1	1.0	0.3	2.4
Nonpulping hardwoods	8.5	5.7	4.9	3.8	1.7	0.1	3.9
Total species	27.5	17.1	16.0	12.5	4.3	0.7	12.2
Upland hardwood type-group:							
Species:							
Longleaf pines	-	-	-	0.1	-	-	-
Shortleaf-loblolly pines	2.3	1.4	1.2	1.6	0.1	-	0.9
Pulping hardwoods	3.5	3.0	2.1	1.1	0.4	-	1.6
Nonpulping hardwoods	9.6	7.0	5.9	3.3	1.4	0.2	4.3
Total species	15.4	11.4	9.2	6.1	1.9	0.2	6.8
Bottomland hardwood type-group:							
Species:							
Longleaf pines	-	-	-	-	-	-	-
Shortleaf-loblolly pines	0.8	0.7	0.5	0.4	0.1	-	0.5
Pulping hardwoods	8.5	6.1	5.5	3.5	2.0	0.1	5.4
Nonpulping hardwoods	10.8	8.9	8.7	8.2	2.8	0.1	8.0
Total species	20.1	15.7	14.7	12.1	4.9	0.2	13.9
Average of all type-groups:1/							
Species:							
Longleaf pines	1.1	1.6	0.5	0.3	0.3	0.2	0.5
Shortleaf-loblolly pines	7.2	3.1	10.6	7.1	1.7	0.1	6.2
Pulping hardwoods	6.2	3.8	2.2	1.6	0.6	-	2.0
Nonpulping hardwoods	8.4	5.9	3.4	3.1	1.1	-	3.2
Total species	22.9	14.4	16.7	12.1	3.7	0.3	11.9

1/ Represents the average over the total forest area.

Table 9: TEXAS UNIT NO. 2

Type group and species contained therein	Forest condition: Old growth: Uncut	Old growth: Partly cut	Second growth: Sawlog size: Uncut	Second growth: Sawlog size: Partly cut	Second growth: Under sawlog size	Clear-cut and reproduction	Weighted average volume in each type group
	- - -	- - -	- - -	Cords	- - -	- - -	- - -
Shortleaf-loblolly type-group:							
Species:							
Shortleaf-loblolly pines1/	26.0	15.7	15.1	10.0	4.0	0.1	12.1
Pulping hardwoods	0.7	0.7	0.9	0.7	0.2	-	0.7
Nonpulping hardwoods	1.4	2.4	1.1	1.1	0.4	0.1	1.0
Total species	28.1	18.8	17.1	11.8	4.6	0.2	13.8
Shortleaf-loblolly-hardwood type-group:							
Species:							
Shortleaf-loblolly pines	12.2	10.4	7.5	5.7	1.6	0.1	5.0
Pulping hardwoods	1.4	1.5	3.2	2.3	0.7	-	2.0
Nonpulping hardwoods	8.3	6.9	4.4	3.6	1.2	-	3.1
Total species	21.9	18.8	15.1	11.6	3.5	0.1	10.1
Upland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	0.7	0.4	0.8	0.6	0.1	-	0.3
Pulping hardwoods	1.8	1.5	3.3	1.9	0.5	-	1.1
Nonpulping hardwoods	8.4	7.2	6.2	5.6	2.0	-	3.4
Total species	10.9	9.1	10.3	8.1	2.6	-	4.8
Bottomland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	0.3	0.3	0.3	0.3	-	-	0.2
Pulping hardwoods	4.7	2.8	5.2	4.2	2.5	-	3.8
Nonpulping hardwoods	11.7	9.5	7.4	6.8	2.9	0.2	6.8
Total species	16.7	12.6	12.9	11.3	5.4	0.2	10.8
Average of all type-groups:2/							
Species:							
Shortleaf-loblolly pines	6.5	3.2	10.3	6.4	1.2	-	5.8
Pulping hardwoods	2.9	2.0	2.2	1.7	0.8	-	1.6
Nonpulping hardwoods	8.6	7.6	3.0	3.1	1.6	0.1	3.0
Total species	18.0	12.8	15.5	11.2	3.6	0.1	10.4

1/ The shortleaf-loblolly species-group contains a small volume of longleaf.
2/ Represents the average over the total forest area.

Table 10: LOUISIANA UNIT NO. 3

Type group and species contained therein	Forest condition						Weighted average volume in each type group
	Old growth		Second growth			Clear-cut and repro-duction	
	Uncut	Partly cut	Sawlog size		Under sawlog size		
			Uncut	Partly cut			
	------------------	Cords	------------------				
Longleaf type-group:[1]							
Species:							
Longleaf pines	34.3	7.2	5.3	3.8	0.8	0.2	2.1
Shortleaf-loblolly pines	1.3	0.4	1.8	1.4	0.2	-	0.3
Pulping hardwoods	0.1	0.2	0.2	0.3	-	-	0.1
Nonpulping hardwoods	0.2	-	0.6	0.7	0.1	-	0.1
Total species	35.9	7.8	7.9	6.2	1.1	0.2	2.6
Shortleaf-loblolly type-group:							
Species:							
Longleaf pines	0.4	0.6	0.2	-	-	-	0.1
Shortleaf-loblolly pines	25.9	17.0	15.1	9.6	2.6	0.2	10.2
Pulping hardwoods	2.0	1.5	1.3	0.9	0.2	-	0.9
Nonpulping hardwoods	5.5	2.5	1.4	1.5	0.3	-	1.2
Total species	33.8	21.6	18.0	12.0	3.1	0.2	12.4
Shortleaf-loblolly-hardwood type-group:							
Species:							
Longleaf pines	-	-	-	-	-	0.1	-
Shortleaf-loblolly pines	15.1	4.6	7.0	5.5	1.4	-	4.7
Pulping hardwoods	5.4	2.8	3.2	2.7	1.2	0.2	2.4
Nonpulping hardwoods	7.1	7.0	5.7	5.0	2.3	0.1	4.3
Total species	27.6	14.4	15.9	13.2	4.9	0.4	11.4
Upland hardwood type-group:							
Species:							
Longleaf pines	-	-	-	-	-	-	-
Shortleaf-loblolly pines	1.2	1.8	1.3	1.1	0.1	-	0.7
Pulping hardwoods	2.6	3.5	3.3	2.5	0.4	-	1.8
Nonpulping hardwoods	8.7	8.7	7.4	6.2	1.5	0.1	4.7
Total species	12.5	14.0	12.0	9.8	2.0	0.1	7.2
Bottomland hardwood type-group:							
Species:							
Longleaf pines	-	-	-	-	-	-	-
Shortleaf-loblolly pines	0.4	0.4	0.6	0.5	0.1	-	0.4
Pulping hardwoods	13.5	8.2	6.9	5.7	3.3	0.2	7.3
Nonpulping hardwoods	10.3	8.1	7.8	6.2	2.6	0.7	6.9
Total species	24.2	16.7	15.3	12.4	6.0	0.9	14.6
Average of all type-groups:[2]							
Species:							
Longleaf pines	9.2	1.7	1.0	0.4	0.3	0.2	0.9
Shortleaf-loblolly pines	1.9	1.2	7.8	4.8	0.9	-	2.9
Pulping hardwoods	8.2	5.5	2.6	2.5	0.8	-	1.9
Nonpulping hardwoods	7.2	6.1	3.6	3.9	1.0	-	2.3
Total species	26.5	14.5	15.0	11.6	3.0	0.2	8.0

1/ The weighted average is not a true picture owing to the distortion caused by over a million acres of clear-cut area.
2/ Represents the average over the total forest area.

Table 11: LOUISIANA UNIT NO. 5

Type group and species contained therein	Forest condition						Weighted average volume in each type group
	Old growth		Second growth			Clear-cut and reproduction	
	Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size		
	Cords						
Shortleaf-loblolly type-group:							
Species:							
Shortleaf-loblolly pines 1/	28.1	17.2	17.1	10.3	3.4	0.2	12.4
Pulping hardwoods	0.9	1.2	1.4	1.1	0.2	-	1.1
Nonpulping hardwoods	2.3	2.9	1.7	1.5	0.5	0.1	1.4
Total species	31.3	21.3	20.2	12.9	4.1	0.3	14.9
Shortleaf-loblolly-hardwood type-group:							
Species:							
Shortleaf-loblolly pines	13.2	9.8	7.8	5.4	1.2	0.1	5.4
Pulping hardwoods	4.6	2.5	3.6	2.8	0.9	0.2	2.5
Nonpulping hardwoods	8.8	6.7	5.4	4.5	1.6	-	4.1
Total species	26.6	19.0	16.8	12.7	3.7	0.3	12.0
Upland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	1.8	1.6	1.1	1.0	0.2	-	0.9
Pulping hardwoods	2.4	2.6	3.1	3.6	0.6	-	2.1
Nonpulping hardwoods	8.4	8.2	6.3	5.0	2.0	0.1	4.7
Total species	12.6	12.4	10.5	9.6	2.8	0.1	7.7
Bottomland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	0.6	0.4	0.6	0.4	0.1	-	0.4
Pulping hardwoods	8.1	5.3	7.7	6.5	1.6	0.1	5.5
Nonpulping hardwoods	11.1	8.7	6.5	5.4	1.9	-	6.1
Total species	19.8	14.4	14.8	12.3	3.6	0.1	12.0
Average of all type-groups: 2/							
Species:							
Shortleaf-loblolly pines	5.8	4.7	11.2	6.3	1.4	0.1	6.5
Pulping hardwoods	5.5	3.7	3.0	2.7	0.8	-	2.5
Nonpulping hardwoods	9.1	7.4	3.7	3.4	1.5	0.1	3.6
Total species	20.4	15.8	17.9	12.4	3.7	0.2	12.6

1/ The shortleaf-loblolly species-group contains a small volume of longleaf.
2/ Represents the average over the total forest area.

Table 12: ARKANSAS UNIT NO. 3

Type group and species contained therein	Forest condition						Weighted average volume in each type group
	Old growth		Second growth			Clear-cut and reproduction	
	Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size		
	Cords						
Shortleaf-loblolly type group:							
Species:							
Shortleaf-loblolly pines	30.0	16.2	17.4	11.2	4.6	-	14.2
Pulping hardwoods	1.6	0.5	1.1	0.9	0.2	-	1.0
Nonpulping hardwoods	3.5	3.1	2.5	2.2	0.4	-	2.2
Total species	35.1	19.8	21.0	14.3	5.2	-	17.4
Shortleaf-loblolly-hardwood type-group:							
Species:							
Shortleaf-loblolly pines	15.6	10.6	9.0	6.2	1.6	0.2	6.3
Pulping hardwoods	3.6	3.0	2.9	2.4	0.7	-	2.1
Nonpulping hardwoods	8.5	6.1	5.8	4.9	1.5	-	4.4
Total species	27.7	19.7	17.7	13.5	3.8	0.2	12.8
Upland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	2.1	1.8	1.2	0.8	0.2	-	0.7
Pulping hardwoods	2.3	2.9	2.9	2.6	0.6	-	1.7
Nonpulping hardwoods	9.4	7.7	7.4	6.0	2.6	-	4.8
Total species	13.8	12.4	11.5	9.4	3.4	-	7.2
Bottomland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	0.6	0.5	0.2	0.3	0.1	-	0.3
Pulping hardwoods	7.1	5.5	6.4	5.5	2.2	-	5.3
Nonpulping hardwoods	13.3	9.5	8.5	7.1	3.4	0.2	8.3
Total species	21.0	15.5	15.1	12.9	5.7	0.2	13.9
Average of all type groups:1/							
Species:							
Shortleaf-loblolly pines	6.6	3.2	11.5	6.8	1.6	0.1	7.1
Pulping hardwoods	5.1	4.3	2.5	2.3	0.8	-	2.3
Nonpulping hardwoods	10.8	8.3	4.6	4.2	1.9	-	4.5
Total species	22.5	15.8	18.6	13.3	4.3	0.1	13.9

1/ Represents the average over the total forest area.

Table 13: ARKANSAS UNIT NO. 4

Type group and species contained therein	Forest condition: Old growth: Uncut	Old growth: Partly cut	Second growth: Sawlog size: Uncut	Second growth: Sawlog size: Partly cut	Second growth: Under sawlog size	Clear-cut and reproduction	Weighted average volume in each type group
	Cords						
Shortleaf-loblolly type-group:							
Species:							
Shortleaf-loblolly pines	14.1	9.3	13.7	9.5	5.7	0.4	11.4
Pulping hardwoods	0.1	0.1	0.2	0.4	-	-	0.2
Nonpulping hardwoods	1.2	1.4	1.5	1.6	0.6	0.5	1.3
Total species	15.4	10.8	15.4	11.5	6.3	0.9	12.9
Shortleaf-loblolly-hardwood type-group:							
Species:							
Shortleaf-loblolly pines	6.3	5.5	6.5	4.9	2.4	0.5	4.1
Pulping hardwoods	0.5	0.8	0.9	0.5	0.2	-	0.4
Nonpulping hardwoods	4.3	4.8	3.6	3.9	1.8	-	2.8
Total species	11.1	11.1	11.0	9.3	4.4	0.5	7.3
Upland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	0.8	0.7	0.5	0.7	0.2	0.1	0.3
Pulping hardwoods	1.2	0.9	1.9	1.5	0.3	-	0.6
Nonpulping hardwoods	7.2	7.4	5.9	6.4	2.2	0.2	3.5
Total species	9.2	9.0	8.3	8.6	2.7	0.3	4.4
Bottomland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	0.5	0.3	0.2	0.1	0.2	-	0.2
Pulping hardwoods	2.9	7.3	6.6	6.0	1.4	-	3.6
Nonpulping hardwoods	12.5	6.5	5.5	5.2	2.9	0.6	4.8
Total species	15.9	14.1	12.3	11.3	4.5	0.6	8.6
Average of all type-groups:1/							
Species:							
Shortleaf-loblolly pines	10.7	5.2	11.0	7.0	2.1	0.2	6.4
Pulping hardwoods	0.3	0.9	0.6	0.8	0.2	-	0.4
Nonpulping hardwoods	2.8	4.4	2.4	2.8	1.8	0.3	2.3
Total species	13.8	10.5	14.0	10.6	4.1	0.5	9.1

1/ Represents the average over the total forest area.

Table 14: OKLAHOMA UNIT NO. 1

Type group and species contained therein	Forest condition						Weighted average volume in each type group
	Old growth		Second growth			Clear-cut and reproduction	
	Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size		
	Cords						
Shortleaf-loblolly type-group:							
Species:							
Shortleaf-loblolly pines	13.3	8.0	8.6	5.5	4.0	0.3	8.3
Pulping hardwoods	0.1	0.1	0.1	0.1	-	-	0.1
Nonpulping hardwoods	1.7	1.3	1.5	1.2	0.4	-	1.3
Total species	15.1	9.4	10.2	6.8	4.4	0.3	9.7
Shortleaf-loblolly-hardwood type-group:							
Species:							
Shortleaf-loblolly pines	5.0	4.4	3.7	3.1	1.9	0.7	2.8
Pulping hardwoods	0.3	0.1	0.3	0.3	0.1	-	0.1
Nonpulping hardwoods	4.6	4.0	3.4	3.0	1.5	0.1	2.4
Total species	9.9	8.5	7.4	6.4	3.5	0.8	5.3
Upland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	0.6	0.2	0.5	0.3	0.2	0.1	0.2
Pulping hardwoods	0.6	1.1	0.5	0.3	0.1	-	0.2
Nonpulping hardwoods	7.7	6.3	5.3	4.8	1.9	0.1	2.8
Total species	8.9	7.6	6.3	5.4	2.2	0.2	3.2
Bottomland hardwood type-group:							
Species:							
Shortleaf-loblolly pines	0.1	-	-	-	0.1	-	0.1
Pulping hardwoods	4.3	3.0	2.6	1.5	1.1	-	1.9
Nonpulping hardwoods	10.2	8.9	8.5	7.7	4.5	0.2	6.6
Total species	14.6	11.9	11.1	9.2	5.7	0.2	8.6
Average of all type-groups:1/							
Species:							
Shortleaf-loblolly pines	8.2	3.1	5.0	3.2	0.7	0.2	2.7
Pulping hardwoods	0.6	1.0	0.4	0.3	0.2	-	0.3
Nonpulping hardwoods	4.1	5.0	3.3	3.0	1.9	0.1	2.6
Total species	12.9	9.1	8.7	6.5	2.8	0.3	5.6

1/ Represents the average over the total forest area.

Area Tables

An additional set of tables is included to show the forest area of each unit, classified according to forest condition and type group. Multiplying the average-acre volume by the area occurring in a particular type-group and forest condition results in a quick determination of the total volume of such stands within the unit. Furthermore, these area tables indicate to the user of the average-volume-per-acre tables the relative accuracy of the various averages, since such averages increase in accuracy as the area upon which they are based increases. The area tables may also serve as a basis for judging to what degree a given large tract of forest differs, as to relative area in forest types and forest conditions, from the average of the entire survey Unit. It may be possible to use the weighted average volumes per acre shown in the volume-per-acre tables to arrive at a rough estimate of volume, if the forest tract in question has approximately the same percentage area in types and conditions as the region from which the average-acre volume figures were derived. Otherwise, the actual areas in the several types and conditions should be determined before applying the average volumes shown in the tables.

Forest area classified according to
forest condition and type-group

Table 15:

TEXAS UNIT NO. 1

Forest condition	Forest type-group					Total all types	Percent of total
	Longleaf	Shortleaf and loblolly	Shortleaf-loblolly-hardwoods	Upland hardwoods	Bottomland hardwoods		
	Acres						
Old growth:							
Uncut	25,900	85,300	69,700	51,700	272,300	504,900	7.6
Partly cut	102,400	49,400	71,300	94,700	245,800	563,600	8.6
Second growth:							
Sawlog size:							
Uncut	175,400	1,196,000	693,400	76,000	352,200	2,493,000	37.7
Partly cut	39,800	355,500	324,000	59,500	117,400	896,200	13.6
Under sawlog size	298,300	565,900	485,300	179,900	202,000	1,731,400	26.1
Reproduction	94,000	41,400	23,500	21,100	24,300	204,300	3.1
Clear-cut	195,600	15,700	1,600	1,600	1,600	216,100	3.3
Total all conditions	931,400	2,309,200	1,668,800	484,500	1,215,600	6,609,500	100.0
Percent of total forest area	14.1	34.9	25.3	7.3	18.4	100.0	

Table 16:

TEXAS UNIT NO. 2

Forest condition	Forest type-group				Total all types	Percent of total
	Shortleaf and loblolly 1/	Shortleaf-loblolly-hardwoods	Upland hardwoods	Bottomland hardwoods		
	Acres					
Old growth:						
Uncut	33,600	21,900	44,500	85,900	185,900	4.7
Partly cut	26,500	17,200	68,700	93,700	206,100	5.2
Second growth:						
Sawlog size:						
Uncut	762,100	273,300	118,700	170,200	1,324,300	33.6
Partly cut	418,500	243,600	107,000	117,900	887,000	22.5
Under sawlog size	224,100	282,700	509,800	178,000	1,194,600	30.3
Reproduction	17,200	22,600	87,500	11,700	139,000	3.5
Clear-cut	2,300	1,500	1,600	800	6,200	.2
Total all conditions	1,484,300	862,800	937,800	658,200	3,943,100	100.0
Percent of total forest area	37.6	21.9	23.8	16.7	100.0	

1/ Includes 11,700 acres in the longleaf type-group.

Table 17:

LOUISIANA UNIT NO. 3

Forest condition	Forest type-group: Longleaf	Shortleaf and loblolly	Shortleaf-loblolly-hardwoods	Upland hardwoods	Bottomland hardwoods	Total all types	Percent of total
	Acres						
Old growth:							
Uncut	58,500	5,500	7,000	22,600	122,400	216,000	4.8
Partly cut	64,700	9,300	11,700	25,700	173,900	285,300	6.2
Second growth:							
Sawlog size:							
Uncut	187,100	416,400	231,500	51,400	194,900	1,081,300	23.8
Partly cut	59,300	198,000	167,600	60,800	134,900	620,600	13.7
Under sawlog size	383,500	194,100	199,600	111,500	134,100	1,022,800	22.5
Reproduction	153,500	34,300	15,600	18,800	10,100	232,300	5.1
Clear-cut	1,055,600	21,000	800	800	5,400	1,083,600	23.9
Total all conditions	1,962,200	878,600	633,800	291,600	775,700	4,541,900	100.0
Percent of total forest area	43.2	19.3	14.0	6.4	17.1	100.0	

Table 18:

LOUISIANA UNIT NO. 5

Forest condition	Forest type-group: Shortleaf and loblolly 1/	Shortleaf-loblolly-hardwoods 2/	Upland hardwoods	Bottomland hardwoods	Total all types	Percent of total
	Acres					
Old growth:						
Uncut	26,500	34,600	54,600	118,900	234,600	6.1
Partly cut	37,000	49,000	52,200	128,500	266,700	7.0
Second growth:						
Sawlog size:						
Uncut	663,600	365,500	76,300	184,800	1,290,200	33.7
Partly cut	431,400	343,000	118,900	141,400	1,034,700	27.0
Under sawlog size	237,800	302,900	140,700	183,100	864,500	22.7
Reproduction	18,500	30,500	32,900	18,500	100,400	2.6
Clear-cut	31,300	800	1,600	1,600	35,300	.9
Total all conditions	1,446,100	1,126,300	477,200	776,800	3,826,400	100.0
Percent of total forest area	37.8	29.4	12.5	20.3	100.0	

1/ Includes 75,500 acres in the longleaf type-group.
2/ Includes 6,400 acres in the longleaf-hardwood type-group.

Table 19:

ARKANSAS UNIT NO. 3

Forest condition	Forest type-group				Total all types	Percent of total
	Shortleaf and loblolly	Shortleaf-loblolly-hardwoods	Upland hardwoods	Bottomland hardwoods		
	Acres					
Old growth:						
Uncut	48,300	30,600	58,800	189,200	326,900	5.3
Partly cut	35,500	65,200	87,700	292,200	480,600	7.9
Second growth:						
Sawlog size:						
Uncut	1,247,100	645,700	155,400	359,900	2,408,100	39.5
Partly cut	557,900	537,000	144,900	185,200	1,425,000	23.4
Under sawlog size	289,900	463,700	336,600	237,500	1,327,700	21.8
Reproduction	5,600	29,800	82,100	12,100	129,600	2.1
Clear-cut	-	-	-	-	-	-
Total all conditions	2,184,300	1,772,000	865,500	1,276,100	6,097,900	100.0
Percent of total forest area	35.8	29.1	14.2	20.9	100.0	

Table 20:

ARKANSAS UNIT NO. 4

Forest condition	Forest type-group				Total all types	Percent of total
	Shortleaf and loblolly	Shortleaf-loblolly-hardwoods	Upland hardwoods	Bottomland hardwoods		
	Acres					
Old growth:						
Uncut	371,600	66,300	89,600	8,800	536,300	15.9
Partly cut	86,300	49,600	66,300	13,600	215,800	6.4
Second growth:						
Sawlog size:						
Uncut	598,600	171,100	64,700	16,800	851,200	25.2
Partly cut	214,200	81,500	38,400	13,600	347,700	10.3
Under sawlog size	281,400	430,800	600,200	52,800	1,365,200	40.4
Reproduction	6,400	3,200	42,400.	3,100	55,100	1.6
Clear-cut	4,800	800	-	-	5,600	.2
Total all conditions	1,563,300	803,300	901,600	108,700	3,376,900	100.0
Percent of total forest area	46.3	23.9	26.6	3.2	100.0	

Table 21: OKLAHOMA UNIT NO. 1

Forest condition	Forest type-group				Total all types	Percent of total
	Shortleaf and loblolly	Shortleaf-loblolly-hardwoods	Upland hardwoods	Bottomland hardwoods		
	Acres					
Old growth:						
Uncut	153,700	51,000	55,700	22,300	282,700	9.5
Partly cut	42,200	37,400	52,600	32,600	164,800	5.6
Second growth:						
Sawlog size:						
Uncut	237,200	128,200	113,000	34,300	512,700	17.3
Partly cut	208,600	93,200	114,600	36,600	453,000	15.3
Under sawlog size	53,400	369,400	939,500	100,300	1,462,600	49.4
Reproduction	2,400	7,100	68,500	5,600	83,600	2.8
Clear-cut	-	-	800	800	1,600	.1
Total all conditions	697,500	686,300	1,344,700	232,500	2,961,000	100.0
Percent of total forest area	23.5	23.3	45.3	7.9	100.0	

Table 22: PINE-HARDWOOD REGION-WEST

Forest condition	Forest type-group					Total all types	Percent of total
	Longleaf	Shortleaf and loblolly 1/	Shortleaf-loblolly-hardwoods 2/	Upland hardwoods	Bottomland hardwoods		
	Acres						
Old growth:							
Uncut	84,400	724,500	281,100	377,500	819,800	2,287,300	7.3
Partly cut	167,100	286,200	301,400	447,900	980,300	2,182,900	7.0
Second growth:							
Sawlog size:							
Uncut	362,500	5,121,000	2,508,700	655,500	1,313,100	9,960,800	31.7
Partly cut	99,100	2,384,100	1,789,900	644,100	747,000	5,664,200	18.1
Under sawlog size	681,800	1,846,600	2,534,400	2,818,200	1,087,800	8,968,800	28.6
Reproduction	247,500	125,800	132,300	353,300	85,400	944,300	3.0
Clear-cut	1,251,200	75,100	5,500	6,400	10,200	1,348,400	4.3
Total all conditions	2,893,600	10,563,300	7,553,300	5,302,900	5,043,600	31,356,700	100.0
Percent of total forest area	9.2	33.7	24.1	16.9	16.1	100.0	

1/ Includes 87,200 acres in the longleaf type-group in Texas #2 and Louisiana #5.
2/ Includes 6,400 acres in the longleaf-hardwood type-group in Louisiana #5.

APPENDIX

(Glossary of Terms)

Forest Conditions

Old growth:	Stands composed predominantly of sawtimber trees with the characteristics of the original mature trees of the region.
Uncut:	Old-growth stands from which less than 10 percent of the volume has been cut.
Partly cut:	Old-growth stands from which at least 10 percent of the volume has been removed, but which are still characterized by residual trees from the old-growth forest.
Second growth:	Stands that have succeeded the original forest as a result of cutting or other causes.
Sawlog size: Uncut:	Second-growth stands in which the sawlog-size trees contain at least 600 board feet per acre, and from which less than 10 percent of the board-foot volume has been cut.
Partly cut:	Second growth stands from which at least 10 percent of the board-foot volume has been cut, but which still contain at least 400 board feet per acre in sawlog-size trees.
Under-sawlog size:	Second-growth stands composed predominantly of under-sawlog-size trees.
Reproduction:	Restocking areas bearing 80 or more seedlings per acre that are less than 1 inch in diameter at breast height.
Clear-cut:	Cut-over areas on which the young growth that has come in is insufficient for them to be classified either as second growth or reproduction.

Forest Type-Groups

The forest type-groups are designated by the species that predominate in the stands; other species are associated with them in all groups. The type-groups are made up of individual types as follows:

Type-groups	Types
Longleaf:	Longleaf, longleaf-loblolly, longleaf-shortleaf, longleaf-hardwoods.
Shortleaf-loblolly:	Shortleaf, loblolly, shortleaf-loblolly.
Shortleaf-loblolly-hardwoods:	Shortleaf-hardwoods, loblolly-hardwoods, pine-mixed hardwoods.
Upland hardwoods:	Upland hardwoods, scrub hardwoods.
Bottomland hardwoods:	Bottomland hardwoods, cypress-tupelo.

FORREST SURVEY RELEASE NO. 27 July 31, 1937

FOREST RESOURCES OF SOUTHWEST ARKANSAS

A Progress Report

by

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

This release contains Forest Survey data that will be included in complete reports to be published later. It should therefore be regarded as a progress report. Although considered reliable, the data are subject to correction or amplification as the work of computation proceeds.

Staff Assignment

In Charge of Field Work and Preparation of Report
James W. Cruikshank - Associate Forest Economist

In Charge of Computations
P. R. Wheeler - Associate Forest Economist

FOREST RESOURCES OF SOUTHWEST ARKANSAS

General Description of the Unit

This report deals with the forest resources in that portion of Arkansas lying west of the alluvial delta of the Mississippi River and south of the Ouachita Mountains. This area of 8,931,900 acres comprises 18 counties and parts of 4 others. Texarkana and Pine Bluff are the two largest cities in the Unit, but much of the business activity affecting the Unit centers in Little Rock, which is a short distance northeast of the Unit boundary. Approximately 68 percent of the land surface of the Unit supports some kind of forest growth; and agriculture and forest industries are the chief activities, although the petroleum industry is important in certain localities. Shortleaf and loblolly pines in mixture with hardwoods are the predominating forest trees of the region.

The Ouachita Mountains, which occur along the northern edge of the Unit, have elevations as high as 2,340 feet. South of these mountains lies the Athens Plateau, which gradually merges into the Gulf Coastal Plain, a rolling country that slopes gently toward the South and varies in elevation from 200 to 400 feet above sea level. About 90 percent of the Unit is in this Coastal Plain. Drainage is adequate; at times, it is even excessive. The Red and the Ouachita Rivers with their tributaries drain the western and central portions of the Unit, while the extreme eastern tier of counties is drained by Bartholomew Bayou. All these streams flow south or southeast.

The Unit is covered with a network of railroads. Several main-line systems with numerous, secondary feeder roads provide adequate railroad transportation within the Unit and to outside points. Main highways are few, but many of the secondary roads are suitable for all-weather travel. Water transportation is limited to barge service on the Ouachita River as far north as Camden. Numerous pipe lines transport crude oil from the Eldorado field to refineries, while two gas companies have lines distributing natural gas to the larger towns.

In 1930 the population was 459,000, or 22.5 percent more than in 1910. Only 21 percent of the people live in towns of 2,500 or more; the remainder live on farms or in small communities adjacent to wood-working plants. Agriculture is the chief occupation of 57 percent of the people; forest industries employ 7 percent; and all other industries, 36 percent. Forest industries have a greater importance than these percentages signify, however, because a large proportion of the farm operators are employed part-time in the harvesting or manufacture of forest products.

Agriculture is the most important industry in the Unit. According to the census of 1935, there were nearly 60,000 farms in the Unit containing approximately 4 million acres of land. The average farm contains 67.2 acres, of which 27.6 acres are woodland. There has been an increase of 2.1 percent in the number of farms since 1930 and an area increase of about 400,000 acres. Most of this increased area is woodland which has not yet been cleared, as land available for crops increased only 60,000 acres. The Forest Survey shows about 274,000 acres of agricultural land standing idle and almost 150,000 acres that have been definitely abandoned for agricultural-crop production. Diversified farming is generally practiced, although specialized truck and orchard crops are important sources of income in certain localities.

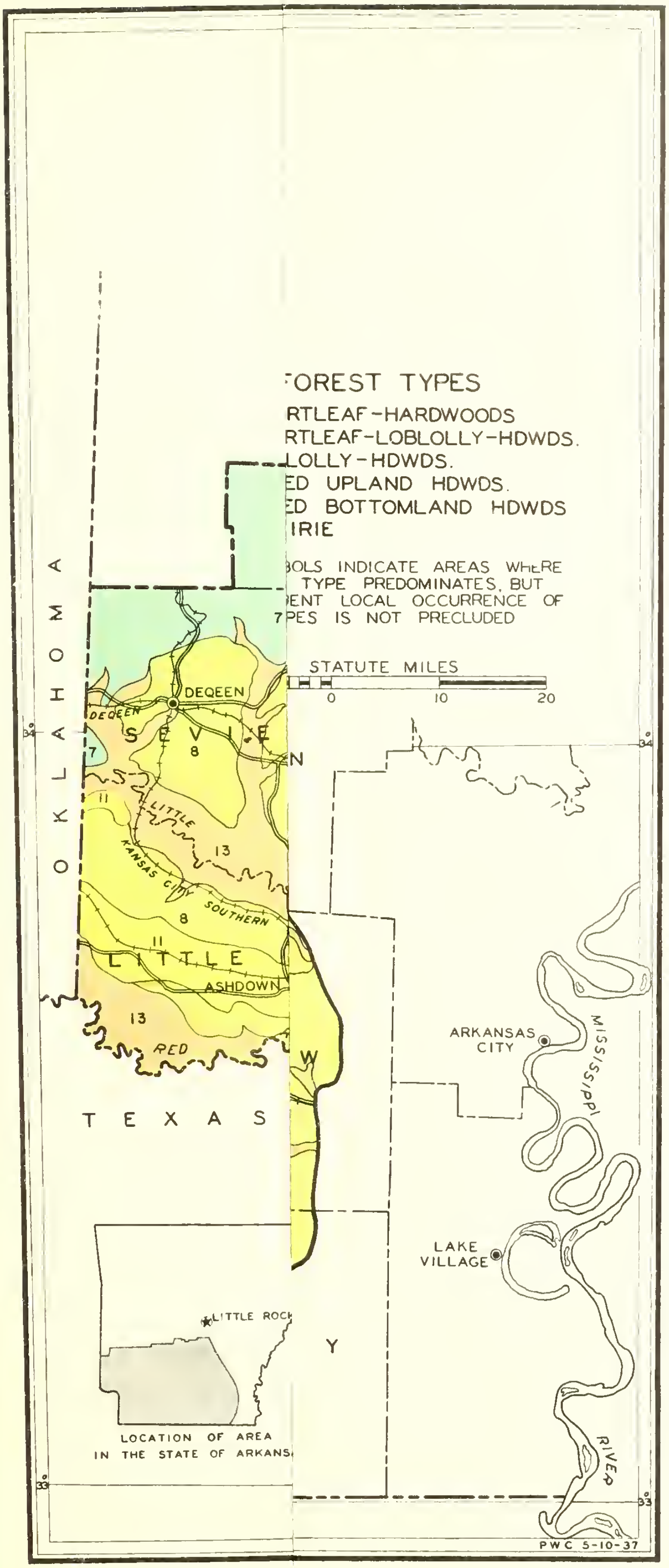
The largest proportion of land area is in farms, the combined acreage totalling about 45 percent of the Unit. This acreage is cultivated by 60,000 operators, 43 percent of whom are sole or part owners of their land, while the remainder are croppers or tenants. Available records show that 2,000,000 acres of forest land, or over 20 percent of the total area of the Unit, are owned by 20 companies, the majority of which are operating sawmills; but large acreages are controlled by a few land-holding and paper-mill companies. The largest individual ownership recorded is 560,000 acres, while there are several of over 100,000 acres.

Tax delinquency is less in this section of Arkansas than in the Delta and mountain regions of the State. Only 3.4 percent of the gross land area in the Unit had been tax delinquent for at least 3 years on July 1, 1934.

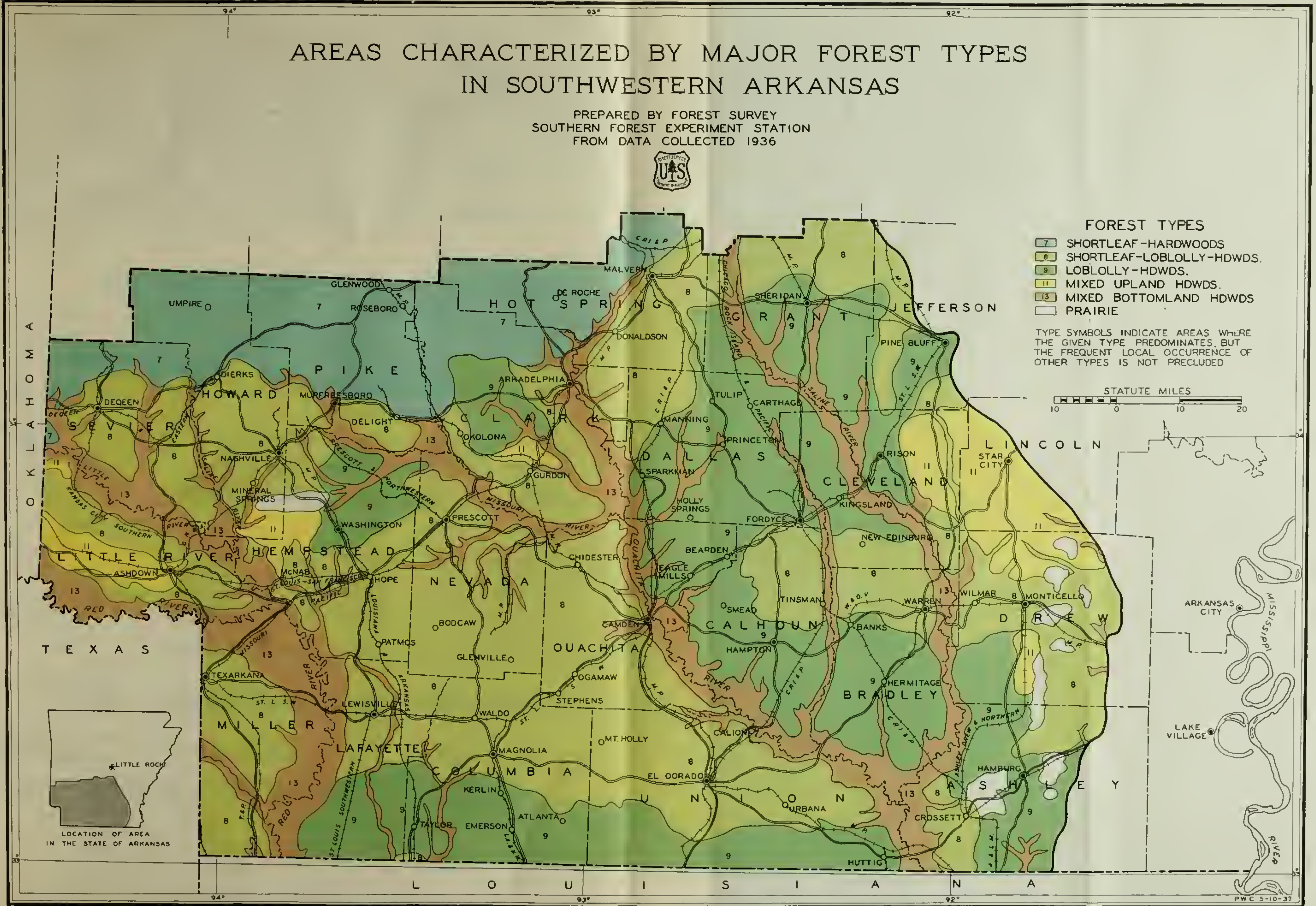
The distribution of the land area of the Unit, according to the classes of land use recognized by the Survey, is shown in table 1.

Table 1. - Land area classified according to land use

Land use	Area		Percent of total area	
	- - - - Acres - - - -			
Forest:				
Productive	6,097,900		68.3	
Nonproductive	7,300		0.1	
Total forest		6,105,200		68.4
Nonforest:				
Agricultural:				
In cultivation:				
Old cropland	1,813,900		20.3	
New cropland	59,600		0.7	
Out of cultivation:				
Idle	273,700		3.0	
Abandoned	148,900		1.7	
Pasture	329,300		3.7	
Total agricultural	2,625,400		29.4	
Other nonforest	201,300		2.2	
Total nonforest areas		2,826,700		31.6
Total forest and nonforest		8,931,900		100.0



FOREST TYPES
RTLEAF-HARDWOODS
RTLEAF-LOBLOLLY-HDWDS.
LOLLY-HDWDS.
ED UPLAND HDWDS.
ED BOTTOMLAND HDWDS
IRIE
BOLS INDICATE AREAS WHERE
TYPE PREDOMINATES, BUT
DENT LOCAL OCCURRENCE OF
7PES IS NOT PRECLUDED
STATUTE MILES
0
10
20
OKLAHOMA
DEQEEN
SEVIER
LITTLE
KANSAS CITY SOUTHERN
ASHDOWN
RED
TEXAS
ARKANSAS CITY
MISSISSIPPI
RIVER
LAKE VILLAGE
LITTLE ROCK
LOCATION OF AREA
IN THE STATE OF ARKANS
PWC 5-10-37


AREAS CHARACTERIZED BY MAJOR FOREST TYPES
IN SOUTHWESTERN ARKANSAS
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FROM DATA COLLECTED 1936
FOREST TYPES
7 SHORTLEAF-HARDWOODS
8 SHORTLEAF-LOBLOLLY-HDWDS.
9 LOBLOLLY-HDWDS.
11 MIXED UPLAND HDWDS.
13 MIXED BOTTOMLAND HDWDS
PRAIRIE
TYPE SYMBOLS INDICATE AREAS WHERE THE GIVEN TYPE PREDOMINATES, BUT THE FREQUENT LOCAL OCCURRENCE OF OTHER TYPES IS NOT PRECLUDED
STATUTE MILES
10 0 10 20
94°
93°
92°
OKLAHOMA
TEXAS
LOUISIANA
HOT SPRING
PIKE
HOWARD
SEVIER
LITTLE RIVER
HEMPSTEAD
NEVADA
CLARK
DALLAS
GRANT
JEFFERSON
LINCOLN
CLEVELAND
CALHOUN
OUACHITA
MILLER
LAFAYETTE
COLUMBIA
UNION
BRADLEY
DREW
ASHLEY
ARKANSAS CITY
LAKE VILLAGE
MISSISSIPPI RIVER
LOCATION OF AREA IN THE STATE OF ARKANSAS
LITTLE ROCK
PWC 3-10-37

Description of the Forest

Over 68 percent of the forest area is in rolling uplands; 16 percent is in river bottoms; and the remainder is distributed among swamps and poorly drained benches. Broadly speaking, the forests of the Unit can be classified either as mixed-pine-hardwoods or as pure hardwoods. Most common are the second-growth stands of shortleaf and loblolly in mixture with various hardwoods. In general there is a larger proportion of loblolly in the southern part of the Unit than along the foothills of the Ouachita Mountains, where shortleaf mixed with hardwoods is the usual association. Along the rivers and in many of the smaller stream-bottoms is found the bottomland hardwood type, made up principally of red and black gums, red and white oaks, cypress, and ash. Stands of red gum, post oak, hickory, and a few pines form the upland hardwood type, which occurs in scattered patches throughout the pine stands.

Table 2. - Forest area classified according to forest condition and forest type-group

Forest condition	Forest type-group				Total all types	Percent of total
	Pine	Pine hardwoods	Upland hardwoods	Bottomland hardwoods		
	- - - - - - - - - - - Acres 1/ - - - - - - - - - - - - -					
Old growth:						
Uncut	48,300	30,600	58,800	189,200	326,900	5.3
Partly cut	35,500	65,200	87,700	292,200	480,600	7.9
Total	83,800	95,800	146,500	481,400	807,500	13.2
Second growth:						
Sawlog size:						
Uncut	1,247,100	645,700	155,400	359,900	2,408,100	39.5
Partly cut	557,900	537,000	144,900	185,200	1,425,000	23.4
Under sawlog-size	289,900	463,700	336,600	237,500	1,327,700	21.8
Reproduction	5,600	29,800	82,100	12,100	129,600	2.1
Total	2,100,500	1,676,200	719,000	794,700	5,290,400	86.8
Total all conditions	2,184,300	1,772,000	865,500	1,276,100	6,097,900	100.0
Percent of total forest area	35.8	29.1	14.2	20.9	100.0	

1/ Area in clear-cut and fire-killed condition is negligible.

The pure pine types and the pine-hardwoods together cover 65 percent, or nearly 4 million acres, of the forest area, and collectively make up the shortleaf-loblolly-hardwood association. In the pure pine stands, the pines make up nearly 84 percent of the net cubic volume in the type, while in the pine-hardwoods, the pine component is only 52 percent of the net cubic volume. The bottomland-hardwoods are most fully developed in the bottoms along the Red, Ouachita, and Saline Rivers, although the smaller streams flowing through deposits of recent alluvium are generally bordered by this type. As a result, such stands are often widely scattered in "stringers" along the streams rather than in continuous tracts. The total acreage of bottomland hardwoods in the Unit is about $1\frac{1}{4}$ million acres, or 21 percent of the forest area. The upland hardwoods generally occur in the rolling lands and often in small, scattered patches; the most extensive area lies north of Monticello and east of Rison. In limited areas, the hardwoods are so stunted and of such poor quality that they are classified as scrub hardwoods. The total area of these scrub stands amounts to less than 30,000 acres. The combined acreage of the upland and scrub hardwoods is 865,500 acres, or 14 percent of the forest land.

As shown in table 2, about 13 percent of the total forest area is old-growth, over half of which, or 481,400 acres, is in bottomland hardwoods. The advanced stage of restocking since the removal of the original timber is indicated by the presence of sawlog-size second-growth stands averaging 35 to 45 years of age on 62.9 percent of the total forest area. Young stands under sawlog-size occur on 21.8 percent, and reproduction on 2.1 percent of the forest area, while the clear-cut acreage is negligible.

Volume Estimates

Board-foot volume

In the estimate given in table 3, the stand of sound sawlog-size trees is expressed in terms of board feet, as measured by the Doyle log-rule. The volumes are net log scale, that is, allowance has been made for material that would be left in the woods because of rot, fire-scar, crook, limbiness, and similar defects, as well as for loss in sawing at the mill due to sweep and hidden defects. Volume was included to the upper limit of usable material in the tops rather than to a fixed top diameter, but no pine logs less than 5.5 inches in diameter at the small end nor any hardwood logs less than 8.5 inches were included. The sawlog-size trees included in the volume estimate must contain at least one sound 12-foot butt log, or 50 percent of the gross volume of the tree must be sound material. In addition, hardwoods must have a minimum d.b.h. outside bark of 13 inches, and pines, of 9 inches.

Table 3 shows that the total board-foot volume by the Doyle rule is 12-1/3 billion feet. Practically all of this volume is so located as to be physically accessible for logging. Nearly 87 percent of the forest area supporting this stand is stocked with a second crop of timber standing over the stumps left in logging the original old growth. Availability for cutting, however, depends on the volume per acre and quality of the stand as well as on accessibility. Some of the stands are too light to allow immediate logging, but it must be understood that the utilization of this forest, under any circumstances, will be spread over a considerable length of time and that the natural growth of trees is continually increasing the number, size, and volume of trees in these stands. In 1936 the inventory showed that 10 of the 12-1/3 billion feet of sawtimber was located in stands that averaged 3,000 feet per acre, all of which contained more than 600 feet per acre.

Pines account for 54.6 percent of the total volume, and hardwoods for 45.4 percent. Loblolly is the leading pine component of the stand, while red oak and red gum are the most abundant hardwoods. Although the volume of hickory is small compared with that of other hardwoods, the $288\frac{1}{2}$ million board feet of hickory are the basis for an important handle industry in southwest Arkansas.

Table 3. - Net volume (Doyle) classified according to species group and forest condition

Species group	Old growth: Uncut	Old growth: Partly cut	Second growth: Sawlog size	Second growth: Under sawlog size 1/	Total	Percent of total
	- - - - - - - - - Thousand board feet - - - - - - - - -					
Pines:						
Shortleaf	193,400	145,700	2,053,100	29,600	2,421,800	19.7
Loblolly	434,600	197,800	3,632,500	33,100	4,298,000	34.9
Total pines	628,000	343,500	5,685,600	62,700	6,719,800	54.6
Pulping hardwoods:						
Red gum	346,500	231,200	742,900	10,200	1,330,800	10.8
Black gum	55,600	113,100	189,500	6,300	364,500	3.0
Others	57,800	79,800	83,300	2,500	223,400	1.8
Nonpulping hardwoods:						
Red oaks	324,500	329,200	901,000	21,300	1,576,000	12.8
White oaks	293,900	157,500	363,400	9,000	823,800	6.7
Post oak	62,300	75,800	268,900	9,500	416,500	3.4
Hickory	46,600	70,300	163,100	8,500	288,500	2.3
Ash	14,200	18,600	28,900	3,300	65,000	.5
Others	139,500	142,600	212,800	8,500	503,400	4.1
Total hardwoods	1,340,900	1,218,100	2,953,800	79,100	5,591,900	45.4
Total all species	1,968,900	1,561,600	8,639,400	141,800	12,311,700	100.0
Percent of total	16.0	12.7	70.1	1.2	100.0	

1/ Includes areas classified as reproduction; clear-cut areas are negligible.

For the Unit as a whole, 28.7 percent of the total board-foot volume occurs in the old-growth condition. Consideration of the pine and hardwood volumes separately reveals only 14.5 percent of the total pine-volume in the old-growth condition as contrasted with 45.8 percent of the hardwood volume. In the old-growth uncut pure pine types, the average stand per acre is 13,600 feet (lumber tally), of which 13,000 is pine. In the old-growth pine-hardwood types, the average stand is 9,900 feet per acre, of which 6,300 feet is pine. In the old-growth uncut bottomland hardwood type, the average stand per acre is 7,300 feet, practically all of which is in hardwoods.

Second-growth pine and pine-hardwoods are the predominating forest stands in southwestern Arkansas. Occupying 61.9 percent of the forest area, this young forest contains 63.7 percent of the total sawtimber volume. At present the second-growth uncut stands of sawlog size in the pure pine types average 5,100 feet (lumber tally) per acre, of which 4,800 feet is pine. Bottomland hardwood stands of similar forest conditions average 3,400 feet per acre, principally pure hardwoods. The upland hardwood second-growth stands of sawlog size average 2,200 feet per acre, of which 200 feet is pine.

Although the Doyle log-rule is the legal rule of Arkansas and is in general use for timber estimates in the South, its application to stands made up mainly of small trees results in a very considerable understatement of the actual recoverable volume. Since the International $\frac{1}{4}$-inch rule closely approximates green lumber tally, in the following table the volumes are measured according to it, in order to give a more accurate expression of the amount of sawtimber present.

Table 4. - Net volume by International $\frac{1}{4}$-inch rule classified according to species group and forest condition

Forest condition	Pines	Red and black gums, etc.	Red and white oaks, etc.	Total
	- - - - - - - - - -	- Thousand board feet -	- - - - - - - - - -	
Old growth:				
Uncut	870,500	577,100	1,092,600	2,540,200
Partly cut	531,500	576,200	1,019,900	2,127,600
Second growth:				
Sawlog size	10,260,200	1,467,600	2,671,600	14,399,400
Under sawlog size 1/	142,800	30,600	91,900	265,300
Total all conditions	11,805,000	2,651,500	4,876,000	19,332,500

1/ Includes reproduction; clear-cut acreage is negligible.

Cordwood volume

In estimating the cordwood volume, the entire stand of good trees at least 5 inches d.b.h., outside the bark, is expressed in terms of standard (4 x 4 x 8 feet) cords. It should be understood that sawlog-size trees which have been covered in the estimate of board-foot volume are also included in this estimate. In addition, in table 5 only, an estimate of the net sound material in cull trees is included. The volume shown in the column "Sound trees sawlog size" in this table includes only the cordwood in the merchantable sawlog portion of the stems of sound trees. That part of the stem above the sawlogs (i.e., the upper stems) taken to a variable diameter, but not to less than 4 inches, is given under "Tops of sawlog-size trees." In this volume the stem only is included in pines, but in the hardwoods the usable limbs are also included to a 4-inch diameter. In the column "Sound trees under sawlog size," the full stems of both pines and hardwoods are included to a variable usable diameter with a minimum of 4 inches. The volume shown under "Sound and rotten cull trees" includes the timber cruiser's estimate of the recoverable sound portion of such trees. Deduction from the volume is made for woods cull, that is, that part of the tree that would be left in the woods because of rot, fire-scar, crook, bad knots, or other defects. In presenting these data on the sound material in cull trees and in the top stems of sawlog trees, it should be noted that no estimate is made of the extent to which such material can or will be used for pulp, fuel, or other uses. Although the sound material is there, it may not be economically feasible to use it.

The pine volume shown is composed of loblolly and shortleaf pine; trees less than 9 inches in diameter make up a quarter of the total pine volume. The pulping hardwood species include red gum, black gum, tupelo gum, bay, and maple; red gum is by far the most important species from the standpoint of volume. Cypress is also included with the pulping hardwoods because it can be pulped, even though at present it is not generally used. Nearly 8 million cords of pulping hardwoods are in cull trees and tops of sawlog-size trees. The oaks are the most important nonpulping hardwoods, but hickory, elm, and ash are also prevalent. In the nonpulping hardwoods, 15 million cords of material in tops of sound trees and in cull trees will be available for use when suitable utilization processes are developed.

Table 5. - Net volume of all sound material, expressed in cords

Species group	Source of material				Total all classes	Percent of total
	Sound trees sawlog size	Tops of sawlog-size trees	Sound trees under sawlog size	Sound and rotten cull trees		
	- - - - - - - - - - - - - - Cords	- - - - - - - - - - - - - -				
Pines	26,851,100	4,878,300	11,620,300	483,200	43,832,900	40.6
Hardwoods:						
Pulping	6,656,500	3,432,000	7,457,400	4,407,400	21,953,300	20.3
Nonpulping	11,747,400	6,663,400	15,418,400	1/ 8,372,200	42,201,400	39.1
Total hardwoods	18,403,900	10,095,400	22,875,800	12,779,600	64,154,700	59.4
Total all species	45,255,000	14,973,700	34,496,100	13,262,800	107,987,600	100.0
Percent of total	41.9	13.9	31.9	12.3	100.0	

1/ Includes scrub oak volume.

The cordwood volume classified according to species group and diameter of trees is shown graphically in figure 2. Although the volume shown here does not include cull trees or tops and limbs of sawlog-size hardwood trees, it does include all sound trees to the limits described above.

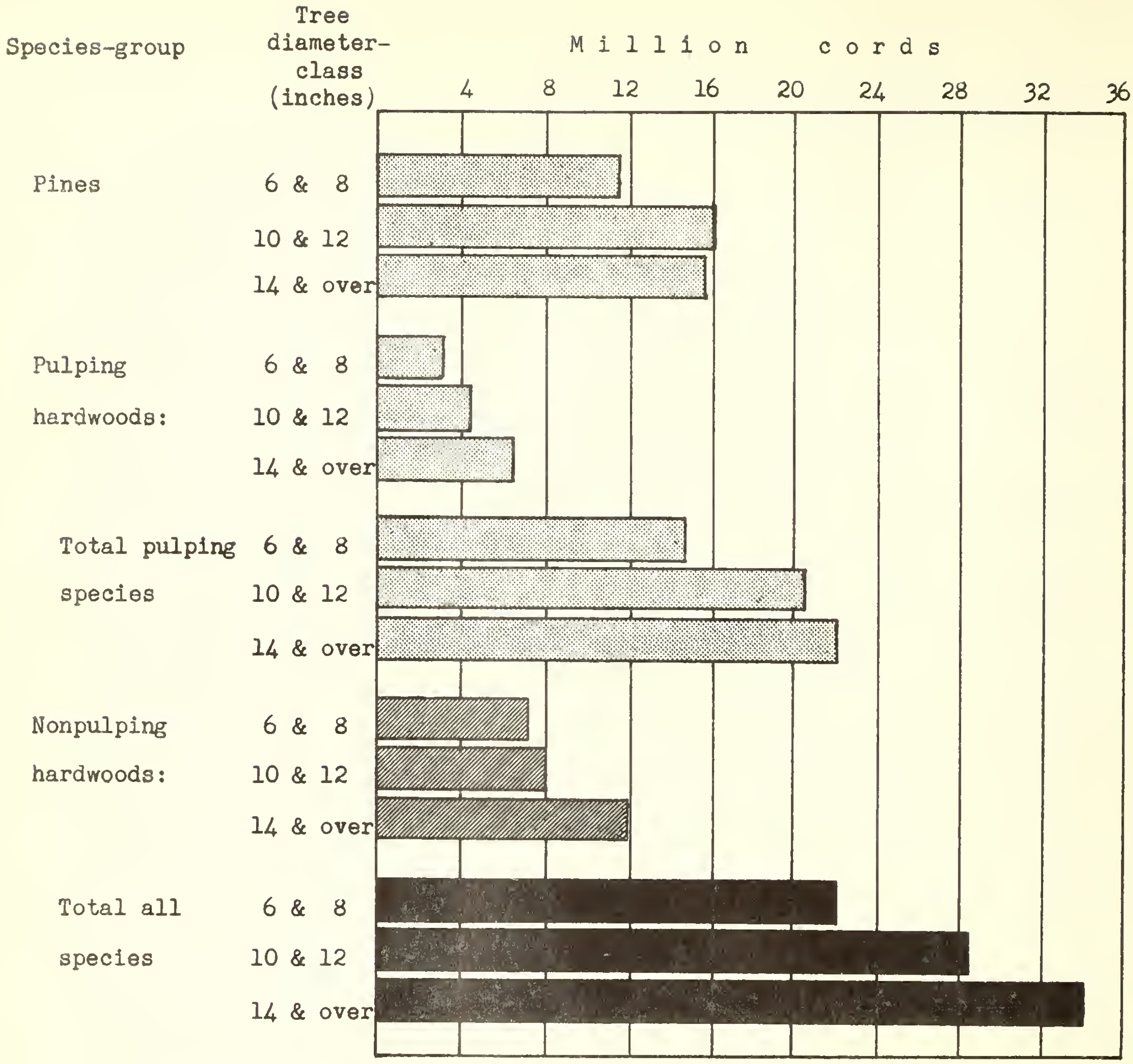


Figure 2. - Cordwood volume of pulping and nonpulping species

In table 6 is given the cordwood volume in sound trees on the average acre of the various forest conditions in each type-group. This cordwood volume, which includes only the stemwood of sound trees to a flexible 4-inch top diameter in all pines and in hardwoods under sawlog-size, and the merchantable sawtimber of sawlog-size hardwoods, is further separated into pines, pulping hardwoods, and nonpulping hardwoods. The average stands per acre were obtained by dividing the total volume of wood for a given type and forest condition by the total number of acres in that classification. The resulting values, therefore, are somewhat generalized but may be used for approximating cordwood volumes on large areas, where the areas in the various types and forest conditions have been determined.

Table 6. - Net cordwood volume on the average acre, classified according to type-group, species-group, and forest condition

Type-groups and species-groups therein	Old growth		Second growth			Clear-cut and reproduction	Weighted average
	Uncut	Partly cut	Sawlog size		Under sawlog size		
			Uncut	Partly cut			
	- - - -	- - - -	- - - -	Cords	- - - -	- - - -	- - - -
Pure pine type-group:							
Pines	30.0	16.2	17.4	11.2	4.6	-	14.2
Pulping hardwoods	1.6	0.5	1.1	0.9	0.2	-	1.0
Nonpulping hardwoods	3.5	3.1	2.5	2.2	0.4	-	2.2
Total species	35.1	19.8	21.0	14.3	5.2	-	17.4
Pine hardwood type-group:							
Pines	15.6	10.6	9.0	6.2	1.6	0.2	6.3
Pulping hardwoods	3.6	3.0	2.9	2.4	0.7	(1/)	2.1
Nonpulping hardwoods	8.5	6.1	5.8	4.9	1.5	-	4.4
Total species	27.7	19.7	17.7	13.5	3.8	0.2	12.8
Upland hardwood type-group:							
Pines	2.1	1.8	1.2	0.8	0.2	(1/)	0.7
Pulping hardwoods	2.3	2.9	2.9	2.6	0.6	(1/)	1.7
Nonpulping hardwoods	9.4	7.7	7.4	6.0	2.6	(1/)	4.8
Total species	13.8	12.4	11.5	9.4	3.4	(1/)	7.2
Bottomland hardwood type-group:							
Pines	0.6	0.5	0.2	0.3	0.1	-	0.3
Pulping hardwoods	7.1	5.5	6.4	5.5	2.2	-	5.3
Nonpulping hardwoods	13.3	9.5	8.5	7.1	3.4	0.2	8.3
Total species	21.0	15.5	15.1	12.9	5.7	0.2	13.9
Average of all type groups:2/							
Pines	6.6	3.2	11.5	6.8	1.6	0.1	7.1
Pulping hardwoods	5.1	4.3	2.5	2.3	0.8	(1/)	2.3
Nonpulping hardwoods	10.8	8.3	4.6	4.2	1.9	(1/)	4.5
Total species	22.5	15.8	18.6	13.3	4.3	0.1	13.9

1/ Negligible.
2/ Represents the average over the total forest area.

Pine poles and piles

An estimate of the number of pine poles and piles that will meet standard specifications is shown in table 7 by length and tree diameter, but because of the recognized difficulty of judging the suitability of standing trees for poles or piles, the estimate given here is conservative and likely to be short of the actual number found in the Unit. More reliable is the indication of the proportion of lengths and sizes occurring in the forest stands. It should be noted also that these poles and piles are included in the volume estimates shown in previous tables.

Table 7. - Total number of pine poles or piles, classified according to length and diameter

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Percent of total
	20	25	30	35	40	45	50 or over		
Inches	Thousand sticks								
7.0- 8.9	5,494	2,676	625	148	32	-	-	8,975	32.8
9.0-10.9	3,681	2,798	1,862	654	325	-	-	9,320	34.0
11.0-12.9	1,324	1,356	1,570	564	377	187	29	5,407	19.7
13.0-14.9	338	438	857	361	287	148	138	2,567	9.4
15.0-16.9	32	74	303	151	158	106	110	934	3.4
17.0-18.9	-	-	26	45	48	39	29	187	0.7
Total	10,869	7,342	5,243	1,923	1,227	480	306	27,390	100.0
Percent of total	39.7	26.8	19.1	7.0	4.5	1.8	1.1	100.0	

Forest Increment Within the Unit

Individual trees increase in volume from year to year only when the volume added through growth exceeds that lost through decay. The increment of a forest stand is the net volume (added periodically) due to increase in the volume of the trees in the stand (i.e., with mortality losses deducted) plus that added by the accession of new trees from the smaller diameter-classes. Forest increment, therefore, represents the cut which can be made periodically without reducing the volume represented by the original growing stock.

Current annual increment percent

In table 8 is given the increment rates of pines and hardwoods in the various forest conditions during 1936, which may not necessarily hold as the average for a given 10-year period. The increment rate in the under sawlog-size condition is exceptionally high because of the large volume of trees recruited into the stand from saplings during the year.

Table 8. - Rate of increase (current annual increment) of stands in the various forest conditions, 1936

Forest condition	Pines		Hardwoods	
	Board feet	Cubic feet	Board feet	Cubic feet
	Percent			
Old growth:				
Uncut	2.8	2.6	2.3	1.8
Partly cut	5.2	5.0	4.2	3.0
Second growth:				
Sawlog size:				
Uncut	6.8	4.9	5.8	4.2
Partly cut	6.4	4.0	6.2	3.9
Under sawlog size	57.3	15.4	24.4	7.2
Reproduction	9.2	8.9	7.7	6.4
Weighted averages	7.0	5.1	5.1	3.9

Increment per acre

The increment percents, as given in table 8, may be multiplied by the average volume per acre to arrive at the increment per average acre during 1936. In table 9 the increment per acre in the various forest conditions is expressed in board feet and cords. Since the increment shown here includes growth on that portion of the stand that would normally be removed as utilization drain, to this extent it is higher than the actual increment per acre during that year. The per-acre board-foot volumes from which increment is computed include only sawtimber material, while cordwood volumes include sawtimber, trees under sawlog-size, and upper stems of sawlog-size pine trees.

Table 9. - Increment on the average acre in the various forest conditions, 1936

Forest condition	Pines		Hardwoods	
	Board feet	Cords	Board feet	Cords
Old growth:				
Uncut	74	.17	118	.29
Partly cut	58	.16	139	.38
Second growth:				
Sawlog size:				
Uncut	217	.56	67	.30
Partly cut	116	.27	59	.25
Under sawlog size	63	.25	22	.19
Reproduction	(1/)	(1/)	(1/)	(1/)
Weighted averages	135	.36	63	.27

1/ Negligible.

Forest increment

Table 10 shows the net volume of wood added to the sound-tree inventory during 1936, expressed in board feet and in cubic feet. In arriving at this estimate, corrections were made for mortality and for growth on those trees that were removed from the stand for utilization throughout the year. The volume expressed in board feet is increment of sawtimber only, while the volume expressed in cubic feet includes increment in sawtimber, in material in trees under sawlog size, and in upper stems of sawlog-size pine trees. Increment in board-foot material is expressed in lumber tally, as measured by the International $\frac{1}{4}$-inch rule.

The increment on the 19 billion feet inventory (International $\frac{1}{4}$-inch rule) was 1,169,200,000 feet in 1936. Of this total increment, 13 percent was in old-growth stands averaging 5,780 board feet per acre and 78 percent was in second-growth sawlog-size stands that averaged 3,760 board feet per acre. Of the total increment, 103 million board feet, or 9 percent, occurred in under-sawlog-size stands with a volume of less than 400 feet per acre as of January 1, 1936.

When considering the effect of the quality of the increment on its utilization, it should be recalled that since the removal of the original timber the land has restocked to second growth on 87 percent of the forest area. The quality of this second-growth timber is obviously not as good as that of the old-growth stands, but a field canvass of the sawmills operating in the unit showed that all of the mills cutting under 20 thousand board feet per day were using second growth entirely. Mills in the 20 to 79 thousand-foot class were cutting 97 percent second growth, and mills cutting over 80 thousand feet were using 40 percent second growth. Two of the largest mills in the Unit, which are cutting 40 percent second growth, are on a recognized sustained-yield basis. One of these mills is operating on the basis that as little as 500 board feet per acre can be logged at a profit, and many other mills are logging stands as light as this where they are intermixed with better stands.

Table 10. - Forest increment in board-feet and in cubic-feet in the various forest conditions, 1936

Forest condition	Sawtimber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	- - Thousand board feet - -			- - Thousand cubic feet - -		
Old growth	48,500	103,200	151,700	11,380	21,380	32,760
Second growth:						
Sawlog size	675,400	238,700	914,100	153,590	85,060	238,650
Under sawlog size	75,800	27,400	103,200	29,270	20,480	49,750
Reproduction	100	100	200	50	20	70
Total all conditions	799,800	369,400	1,169,200	194,290	126,940	321,230

The cubic-foot increment shown in table 10 is expressed in cords in table 11.

Table 11. - Forest increment expressed in cords in the various forest conditions, 1936

Forest condition	Pine	Hardwood	Total
	- - - - - - - - - - - - - - Cords	- - - - - - - - - - - - - - -	
Old growth	126,500	267,200	393,700
Second growth:			
Sawlog size	1,706,500	1,063,300	2,769,800
Under sawlog size	325,300	256,000	581,300
Reproduction	500	300	800
Total all conditions	2,158,800	1,586,800	3,745,600

Sawmills

Table 12 shows the approximate number of sawmills in the Unit during 1936, as well as the number of man-days of labor required in logging and operating these mills. With improving conditions in the lumber industry, there has been a gradual increase in the number of sawmills operating in this area. Most noticeable is the increase in the number of pine mills cutting 20 to 39 thousand board feet per day. Equipped with machinery for manufacturing finished lumber and buying logs hauled in by truck, these mills typify the trend from operators of immobile units, dependent upon large ownerships of virgin timber, to small operators owning little, if any, timber and buying logs upon the open market.

Table 12. - Number of sawmills and extent of employment, classified according to size-class of mill, 1936

Daily (10 hrs.) rated capacity 1/ in M board feet	Number of mills 2/			Thousand man-days of employment		
	Pine	Hardwood	Total	Woods	Mill	Total
Under 20	354	32	386	172	313	485
20 - 39	50	4	54	150	242	392
40 - 79	3	2	5	61	58	119
80 and over	8	1	9	185	413	598
Total	415	39	454	568	1,026	1,594

1/ The rated capacity indicates size of mill rather than actual average daily capacity.
2/ The data given here on the number of mills in the smallest class are only estimates based upon all available records and were not checked by actual count, but the figures for the larger mills are based upon field counts as well as upon records.

Other forest industries

In addition to the 454 sawmills in the Unit during 1936, there were 2 treating plants, 2 veneer plants, 6 cooperage plants, 12 handle plants, and 17 plants producing shingles, excelsior, furniture squares, pulp, and hardwood distillation products (fig. 3). Early in 1937, a new pulp mill with a daily capacity of 150 tons of sulphate pulp began operations at Crossett. The production of crossties, poles and piles, fuelwood, and fence posts is an important activity and provides employment to many workers. A summary of the production and employment data in the various forest industries is given in table 13.

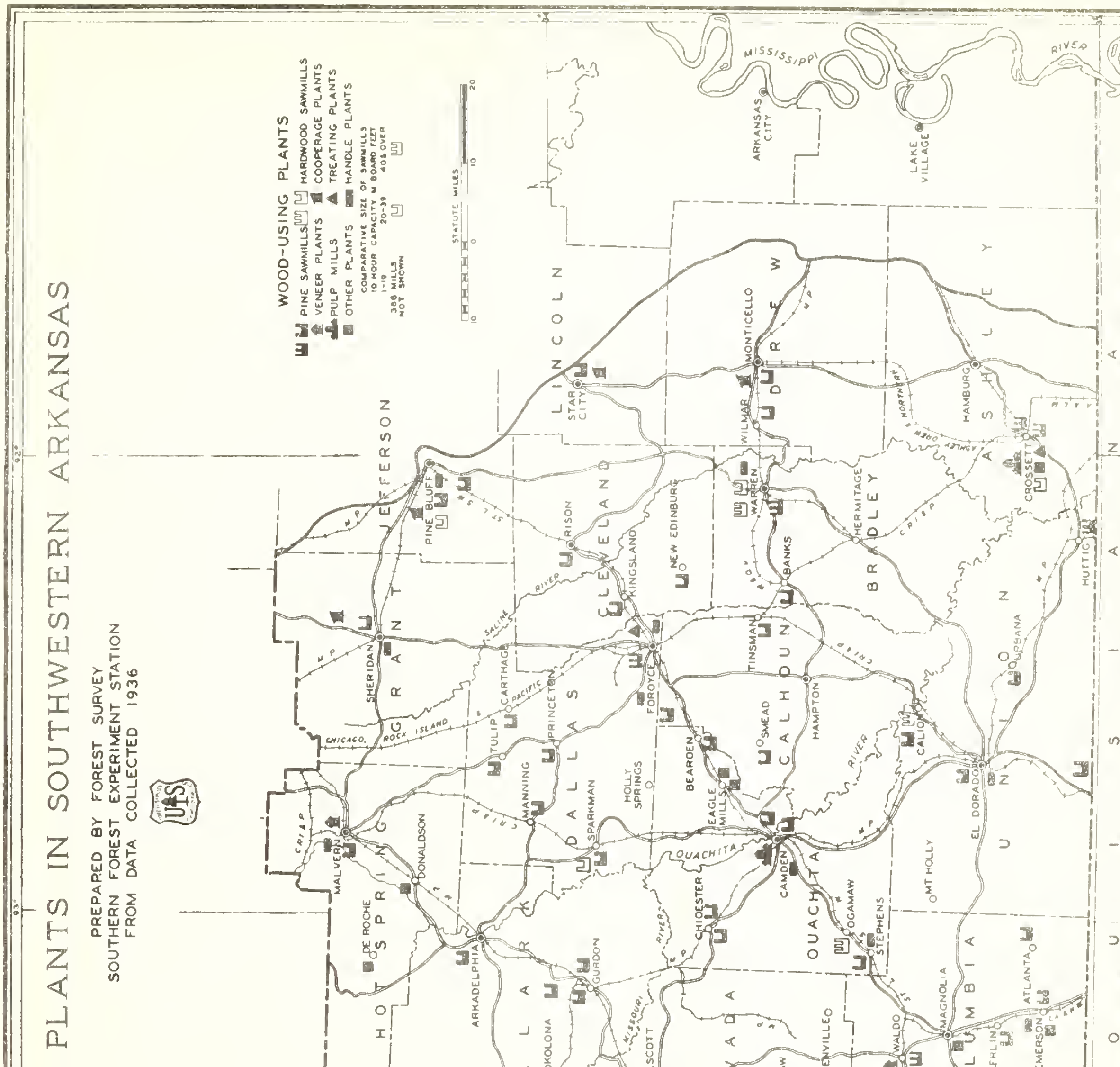

WOOD-USING PLANTS IN SOUTHWESTERN ARKANSAS
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FROM DATA COLLECTED 1936
WOOD-USING PLANTS
PINE SAWMILLS
HARDWOOD SAWMILLS
VENEER PLANTS
COOPERAGE PLANTS
PULP MILLS
TREATING PLANTS
OTHER PLANTS
HANDLE PLANTS
COMPARATIVE SIZE OF SAWMILLS
10 HOUR CAPACITY M BOARD FEET
1-19
20-39
40 & OVER
388 MILLS NOT SHOWN
STATUTE MILES
LOCATION OF AREA IN THE STATE OF ARKANSAS
LITTLE ROCK
OKLAHOMA
TEXAS
LOUISIANA
MISSISSIPPI RIVER

Figure 3

Table 13. - Production and employment data, 1936

Kind of plant or commodity	Number of plants	Amount produced or used	Employment		
			Woods	Mill	Total
			- - - - Thousand man-days - - - -		
		M bd. ft.			
Sawmills	454	563,800	568	1,026	1,594
Veneer	2	3,700	18	15	33
		M cu. ft.			
Treating plants	2	170	-	2	2
		M pieces			
Crossties	-	3,378	471	-	471
Poles and piles	-	131	35	-	35
Fence posts	-	3,898	51	-	51
		M cords			
Cooperage	6	22	43	44	87
Handles	12	9	22	22	44
Fuelwood	-	1,000	1,036	-	1,036
Miscellaneous 1/	17	149	190	152	342
Total	493	-	2,434	1,261	3,695

1/ Includes 12 shingle mills, 1 excelsior plant, 2 furniture-square mills, 1 pulp mill, and 1 hardwood-distillation plant.

Employment

As shown in table 13, the total employment furnished by forest utilization industries in 1936 amounted to 3,695,000 man-days. Forty-three percent of this was furnished by the sawmill industry, while 28 percent of the total labor was required for the production of fuelwood consumed within the Unit. Assuming a wage of $1.50 per man-day, the forest industries distributed $3,912,000 in wages to people within the area. If the fuelwood and fence posts for home consumption were produced by wage earners, an additional $1,630,500 would be earned.

Utilization Drain

In order to compare the utilization of forest commodities with the productive capacity of a forest, it is necessary to establish the annual drain on the growing stock of sound trees. This drain includes all material cut and utilized, as well as any incidental drain in sound material left in the forest as a result of cutting. It does not include material cut from limbs or from cull or dead trees. The first three columns of figures in table 14 show the drain in board feet, both direct and incidental, that came from that part of the tree classified as sawtimber. The last three columns show the drain in cubic feet on sawtimber material, on material in small trees, and in the upper stems of pine trees of sawlog size.

Table 14. - Utilization drain from sound trees, 1936

Commodity	Sawtimber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	- - Thousand board feet - -			- - Thousand cubic feet - -		
Lumber	432,100	153,200	585,300	93,760	25,790	119,550
Crossties	121,700	69,500	191,200	25,810	12,350	38,160
Poles and piles	13,900	600	14,500	3,120	150	3,270
Veneer	700	9,900	10,600	140	2,100	2,240
Cooperage	200	24,800	25,000	60	4,190	4,250
Misc. manufactures	300	7,000	7,300	260	1,580	1,840
Pulpwood	25,700	-	25,700	9,280	-	9,280
Fuelwood	50,800	51,700	102,500	24,600	19,540	44,140
Fence posts	-	7,300	7,300	160	2,100	2,260
Misc. farm use	26,200	11,400	37,600	9,450	4,750	14,200
Total	671,600	335,400	1,007,000	166,640	72,550	239,190

Comparison of Increment and Drain

To evaluate the forest situation more accurately, a comparison of forest increment and utilization drain for 1936 is given in tables 15 and 16. Table 15 compares the net sawtimber increment with the utilization drain of sawtimber, as expressed in the International $\frac{1}{4}$-inch rule, which closely approximates green lumber tally.

Table 15. - Balance between increment and drain in board feet
(International $\frac{1}{4}$-inch rule)

	Pines	Hardwoods	Total
	- - - - - Thousand board feet - - - - -		
Net growing stock, January 1, 1936	11,805,000	7,527,500	19,332,500
Growth, 1936	851,800	444,900	1,296,700
Mortality, 1936	52,000	75,500	127,500
Forest increment, 1936	799,800	369,400	1,169,200
Utilization drain, 1936	671,600	335,400	1,007,000
Net increase in growing stock, 1936	128,200	34,000	162,200
Net growing stock, January 1, 1937	11,933,200	7,561,500	19,494,700

As shown in table 15, the forest increment exceeds the utilization drain by 128 million board feet in the pines and by 34 million feet in the hardwoods. The total commodity drain on old-growth pine stands is approximately 188 million board feet, compared with an increment of 48 million; while in the hardwoods the total drain on old-growth stands is 130 million board feet, compared with an increment of 103 million. It follows that the old-growth timber is being rapidly harvested, and since the supply of old growth is definitely limited, the larger bodies of such timber soon will be exhausted and the supply reduced to scattered remnants. In the second-growth stands, however, there is an excess of board-foot increment over drain of 268 million feet in pine and of 60 million feet in hardwoods. This would seem to indicate that, while the excess of increment over drain is no more than is needed as a margin of safety to build up the growing stock, there will be an opportunity for a greater drain in the future, owing (1) to the rapid replacement of slow-growing old-growth stands with rapid-growing young timber and (2) to the annual accumulation of an uncut surplus of increment on the extensive second-growth stands in the region.

A comparison of increment and drain, with volumes expressed in cubic feet, is given in table 16. The forest increment of 321 million cubic feet exceeded the utilization drain by 82 million cubic feet. This total increment is as available for utilization as the total volume of growing stock described under "Volume estimates", with the possible exception of 20 million cubic feet of increment in the upper stems of sawlog-size pines. Rational use of the forest resource dictates, however, that the 25 million cubic feet of pine, 43 percent of which was from sawlogs, used for fuelwood in 1936, should most properly come from this class of material. In the pines, drain was 86 percent of the increment, while in the hardwoods it was only 57 percent of the increment.

Table 16. - Balance between increment and drain in cubic feet

	Pines	Hardwoods	Total
	- - - - - Thousand cubic feet - - - -		
Net growing stock, January 1, 1936	3,901,480	3,303,670	7,205,150
Growth, 1936	227,720	171,050	398,770
Mortality, 1936	33,430	44,110	77,540
Forest increment, 1936	194,290	126,940	321,230
Utilization drain, 1936	166,640	72,550	239,190
Net increase in growing stock, 1936	27,650	54,390	82,040
Net growing stock, January 1, 1937	3,929,130	3,358,060	7,287,190

Outlook for the Future

The forest resources in southwest Arkansas seem to augur a favorable future for the communities and industries dependent thereon. The forest area of the unit is extensive, covering 68 percent of the land surface, and is well stocked with stands of fast-growing trees, for the many diversified commodities of which there exists a well-established market. The forest, the terrain, the climate, and the labor conditions are such that logging and transportation costs are relatively low. The annual increment of the forest, if used with a degree of restraint and a common-sense regard for the principles of forest cropping, probably can maintain indefinitely an annual harvest of forest products fully equal in volume to the 1936 drain without reducing the basic growing stock.

The growing demand for the forest products of the region will tend to reduce the favorable margin existing in 1936 between increment and drain and will thus prevent the increase in the growing stock that is essential if the forests are to be utilized to their full producing capacity. Calculations show that at least for the next 10 years not more than 80 percent of the indicated annual increment should be harvested annually, if the growing stock is to be increased to allow an expansion of industrial development. With an addition of 20 percent of the increment each year to the growing stock, by 1946 the area should produce an increment of 1,360 million board feet as against the present annual increment of 1,170 million feet; and during the same period the annual cut could be increased from 1,010 million board feet in 1936 to an annual cut in 1947 and thereafter of 1,360 million feet if the full amount of the increment were taken.

The system of fire protection that the State Forest Service, with the cooperation of the Federal Government, has developed in recent years has already had a notably beneficial effect. It should, however, be strengthened and extended to every part of the Unit, because continued and complete prevention of fire will reduce the mortality, speed up the growth, and increase the increment per acre of practically every forest stand in the area.

The exercise of the necessary restraint in regulating the cut would be comparatively easy if the forest lands of the Unit were all under one ownership or control, but this is not the case. The timber lands are owned by many thousands of proprietors with many and diverse motives actuating their management policies, and to achieve the region-wide objective each one of these owners must act in accord with the general policy. Obviously a greatly extended campaign of education, demonstration, and perhaps actual aid is necessary, in which public and quasi-public agencies must take the field in force.

Although the existence of a good market for all classes of forest products, coupled with good growing conditions, makes this one of the most favorable regions in the South for profitable forest management under private ownership, one of the disquieting aspects of the future outlook, as small mills replace larger ones and pulp mills replace both, and as second-growth timber displaces old growth in the cut, is the marked trend to reduce the minimum diameter of the trees cut. This practice results in reducing materially the quality and consequently the unit value of the products harvested. This same trend is found throughout the South and foretells a gradual but inevitable revolution in the character of the forest industries. In other words, while the forest situation justifies the belief that the future output of wood can be maintained at least at the 1936 level, it is more than likely that the high-grade material that can come only from large trees will gradually be replaced by low-grade lumber, small poles, ties, and pulpwood. This can be prevented only through a very considerable increase in the number of acres that private owners are willing to put under long-time management for high-grade sawtimber.

FOREST SURVEY RELEASE NO. 28 SEPTEMBER 25, 1937

POLE AND PILE TIMBER IN THE PINE-HARDWOOD REGION - WEST

A Progress Report

by

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

This release contains Forest Survey data that will be included in complete reports to be published later. It should therefore be regarded as a progress report. Although considered reliable, the data are subject to correction or amplification as the work of computation proceeds.

Staff Assignment

In Charge of Field Work and Preparation of Report
James W. Cruikshank - Associate Forest Economist

In Charge of Computations
P. R. Wheeler - Associate Forest Economist

POLE AND PILE TIMBER

IN THE PINE-HARDWOOD REGION - WEST

This report gives an estimate of the quantity and sizes of pine timber that the timber estimators of the Survey considered suitable for conversion into poles and piles, in the seven Survey units of the pine-hardwood region west of the Mississippi River. The relative location and extent of these units, whose combined acreage amounts to about 48 million acres, is shown in figure 1. Over 31 million acres support some form of forest growth, mostly rapid-growing second-growth pines. Shortleaf is the most abundant pine species in the area, with loblolly a close second. Longleaf is confined almost entirely to southeast Texas and southwest Louisiana. Various species of hardwoods, chiefly oaks and red gum, are scattered throughout most of the pine stands. Along the Coast, between Houston and Lake Charles, a belt of flat and poorly drained land extends 40 to 50 miles inland. Northward from these flat lands the country becomes increasingly higher and more rolling, attaining the highest elevations and most rugged topography in the Ouachita Mountains of Arkansas and Oklahoma. About 73 percent of the area is in uplands, 15 percent in flatwoods and swamps, and 12 percent in river bottoms.

A network of railroads covers the area, with the exception of the Ouachita Mountain region, where rail facilities are more limited. Houston, Beaumont, Port Arthur, and Lake Charles have port facilities and are available to ocean-going vessels as well as to barges on the Intracoastal Canal. Roads, ranging from well paved Federal routes to Civilian Conservation Corps truck trails, form an extensive communication system that serves the entire area. Poles and piles can be transported to shipping points from all parts of the region.

In June 1937, 18 wood-preserving plants were located within the area, distributed as shown in figure 1. In addition, plants in Oklahoma at Oklahoma City and Hugo, in Texas at Denison and Somerville, and in Arkansas at North Little Rock secure a large proportion of their supplies from the pine forests adjacent to them. Considerable quantities of untreated poles and piles are also shipped from this area to treating plants in the Middle West.

The estimates given here include the total number of trees that were considered suitable for pole and pile timber, but it cannot be expected that all will be actually available for use by the pole industry. In 1934 there were about 1,500 sawmills cutting timber in the region, or one mill to every 21,000 acres of forested land. Through increased production of these mills and the addition of new mills, the lumber cut in 1936 exceeded that in 1934 by at least 60 percent. There are 9 pulp mills now operating in this area, and 3 more are proposed for construction in the immediate future. With the sawmills, pulp mills, and miscellaneous industries creating an increasing demand for raw material, it is evident that pole buyers must meet an increasing competition for their supplies. There is, however, a growing tendency for the pulp companies and larger lumber companies to segregate materials for special uses and market them where a greater profit can be obtained.

Where a relatively higher value exists for trees suited for poles or piles, pulpwood contractors and lumber operators will probably continue to reserve such trees for this market.

When using the following data, it is to be remembered that, owing to the sampling method used in collecting them, the greater the area or volume in any given classification the more accurate are the data for that classification. Figures for classes of infrequent occurrence and small quantity should be considered only as an indication of the relative abundance rather than as an accurate measure of the quantities involved.

Land Area

Of the 48 million acres included in the seven units that comprise the Pine-Hardwood Region—West, 65 percent, or over 31 million acres, are in forest land. Table 1 shows the relative proportion of forest and non-forest in the land area of each Survey unit.

Table 1. -- Land area of each Survey unit, classified according to forest and non-forest area

Unit	Total area	Non-forest area	Forest area 1/	Percent forested
	- - - - - - - - - -	Acres	- - - - - - - - - - -	
Texas #1	9,893,800	3,272,600	6,621,200	66.9
Texas #2	8,622,100	4,675,900	3,946,200	45.8
Louisiana #3	5,774,200	1,230,700	4,543,500	78.7
Louisiana #5	6,142,000	2,300,300	3,841,700	62.5
Arkansas #3	8,931,900	2,826,700	6,105,200	68.4
Arkansas #4	4,917,700	1,539,200	3,378,500	68.7
Oklahoma #1	4,026,200	1,065,200	2,961,000	73.5
Total	48,307,900	16,910,600	31,397,300	65.0

1/ Includes 40,600 acres of nonproductive forest land.

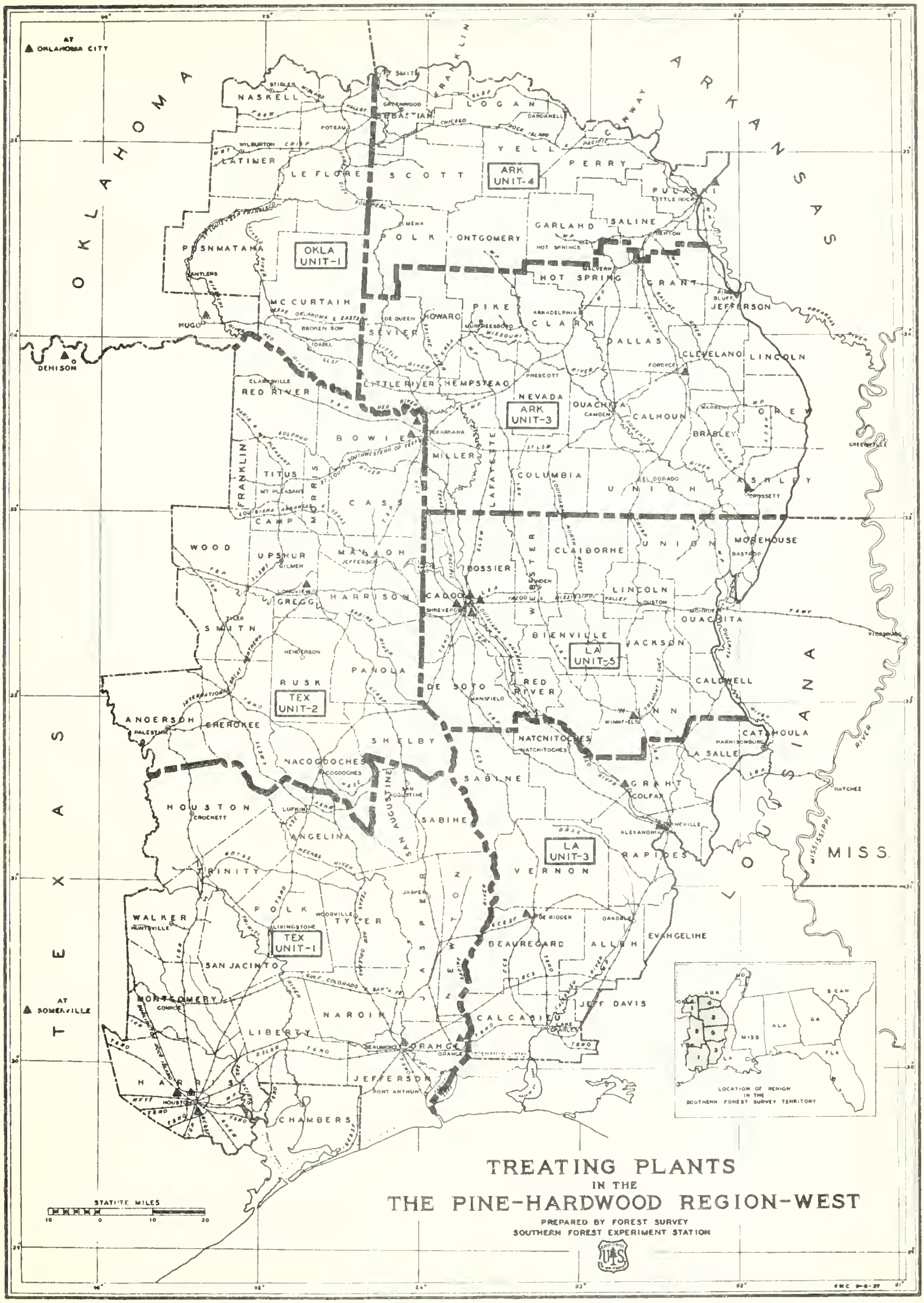

TREATING PLANTS
IN THE
THE PINE-HARDWOOD REGION-WEST
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
STATUTE MILES
OKLAHOMA
ARKANSAS
TEXAS
LOUISIANA
MISS.
OKLA UNIT-1
ARK UNIT-4
ARK UNIT-3
TEX UNIT-2
TEX UNIT-1
LA UNIT-5
LA UNIT-3
LOCATION OF REGION IN THE SOUTHERN FOREST SURVEY TERRITORY

Figure 1.

Forest Area

The productive forest area of each Survey unit is classified by forest type-groups in table 2. Each type-group is designated by the predominant species of the forest association. The longleaf type-group occurs chiefly in Texas Unit #1 and Louisiana Unit #3, but a very limited area of this type-group in Louisiana Unit #5 is included with the shortleaf-loblolly type-group. The highest proportion of pure shortleaf-loblolly stands is found in the Arkansas units.

Table 2. -- Productive forest area classified according to forest type-group 1/

Unit	Longleaf	Shortleaf-loblolly	Shortleaf-loblolly-hardwoods	Upland hardwoods	Bottomland hardwoods	Total
	Acres					
Texas #1	931,400	2,309,200	1,668,800	484,500	1,215,600	6,609,500
Texas #2	-	1,484,300	862,800	937,800	658,200	3,943,100
Louisiana #3	1,962,200	878,600	633,800	291,600	775,700	4,541,900
Louisiana #5	-	1,446,100	1,126,300	477,200	776,800	3,826,400
Arkansas #3	-	2,184,300	1,772,000	865,500	1,276,100	6,097,900
Arkansas #4	-	1,563,300	803,300	901,600	108,700	3,376,900
Oklahoma #1	-	697,500	686,300	1,344,700	232,500	2,961,000
Total	2,893,600	10,563,300	7,553,300	5,302,900	5,043,600	31,356,700
Percent of total	9.2	33.7	24.1	16.9	16.1	100.0

1/ Does not include 40,600 acres of nonproductive forest land.

Pole and Pile Estimates

The following tables show the total number of pine trees that were considered suitable for use as poles or piles. No estimate is given for cypress or for any of the hardwood species. The greatest number of these pine trees is found in the shortleaf-loblolly and shortleaf-loblolly-hardwood type-groups, since these are the most extensive type-groups in the region, but some suitable trees occur in the other type-groups, particularly in the longleaf stands. In all of the type-groups the trees occur scattered throughout the forest, either as single trees or in small groups. Although of little practical significance, an idea of the relative abundance of pole timber in the various units can be secured by dividing the total number of poles in a given unit by the total number of acres in the pine types of that unit. Such a calculation shows, for example, that Texas Unit #1 averages 7.2 poles per acre, Arkansas Unit #3 averages 6.9, and Oklahoma Unit #1 averages 2.9 trees per acre, while Louisiana Unit #3 averages only 2.6 trees per acre that can be considered suitable for poles or piles. If the extensive area of clear-cut land in Louisiana Unit #3 is excluded, there is an average of 3.9 poles per acre on the forested land of this unit.

The estimates given in these tables are believed to be conservative. It is recognized that it is exceedingly difficult to appraise accurately standing trees as to their ability to meet the pole and pile specifications. This difficulty, combined with conservatism on the part of the Survey crews, has resulted in an estimate that may be too low; but the proportion of lengths and sizes occurring in the stands, and the relative abundance of pole timber by units, is correct and has a distinct value to the pole industry.

The total number of trees suitable for poles or piles in the seven units of the Pine-Hardwood Region—West, as shown in table 3, amounts to 120,450,000. Nearly 40 percent of these trees are found in Texas Units #1 and #2, with Arkansas Units #3 and #4 containing an additional 36 percent. Louisiana Units #3 and #5 contain 21 percent, with Oklahoma Unit #1 containing the remainder, or slightly over 3 percent. A large proportion (69.1 percent) of the trees are suitable only for the 20- and 25-foot poles, 24.4 percent will produce 30- and 35-foot lengths, while 6.5 percent can be utilized for poles or piles 40 feet and over in length.

The number of trees suitable for poles and piles in each individual unit is shown in tables 4 through 10, in which the trees are classified by pole and pile length, as well as by tree d.b.h. outside bark. Among the several units there is a marked difference in the number of suitable trees, depending upon the forest area of the unit and the quality of the standing timber. Texas Unit #1 ranks highest in number of suitable trees, and Oklahoma Unit #1 lowest (figure 2). In all of the units, the proportion of trees in the various length- and d.b.h.-classes is rather uniform. The number of trees in the 20- and 25-foot length-classes varies from 61 percent in Louisiana Unit #5 to 81 percent in Arkansas Unit #4. There were no trees recorded above the 35-foot length-class in Oklahoma Unit #1, while in Louisiana Unit #5, 10 percent were above this class. The 30- and 35-foot length-classes make up from 17 percent of the pole stand in Arkansas Unit #4 to 29 percent in Louisiana Unit #5. The two mountain units, Arkansas #4 and Oklahoma #1, are characterized by a high proportion of shorter and smaller trees.

Table 3. -- Total number of pine poles or piles, classified according to length and diameter, in the Pine-Hardwood Region—West

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Percent of total
	20	25	30	35	40	45	50 or over		
	Thousand sticks								
7.0- 8.9	27,156	8,867	3,603	478	32	-	-	40,136	33.3
9.0-10.9	17,645	10,001	7,253	2,529	1,305	309	32	39,074	32.5
11.0-12.9	7,266	6,599	6,008	2,574	1,497	821	308	25,073	20.8
13.0-14.9	1,713	2,658	3,038	1,533	969	548	499	10,958	9.1
15.0-16.9	280	785	1,171	655	471	281	329	3,972	3.3
17.0-18.9	25	199	346	242	178	111	136	1,237	1.0
Total	54,085	29,109	21,419	8,011	4,452	2,070	1,304	120,450	100.0
Percent of total	44.9	24.2	17.8	6.6	3.7	1.7	1.1	100.0	

Table 4. -- Total number of pine poles or piles, classified according to length and diameter, in Texas Unit #1

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Percent of total
	20	25	30	35	40	45	50 or over		
	Thousand sticks								
7.0- 8.9	7,612	2,521	961	78	-	-	-	11,172	31.8
9.0-10.9	5,194	2,783	1,998	777	219	75	-	11,046	31.4
11.0-12.9	2,360	1,938	1,547	833	369	263	63	7,373	21.0
13.0-14.9	704	952	770	501	279	182	175	3,563	10.1
15.0-16.9	132	369	294	254	178	100	138	1,465	4.2
17.0-18.9	3	113	94	106	88	50	78	532	1.5
Total	16,005	8,676	5,664	2,549	1,133	670	454	35,151	100.0
Percent of total	45.5	24.7	16.1	7.3	3.2	1.9	1.3	100.0	

Table 5. -- Total number of pine poles or piles, classified according to length and diameter, in Texas Unit #2

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Percent of tota
	20	25	30	35	40	45	50 or over		
	Thousand sticks								
7.0- 8.9	2,758	1,083	606	81	-	-	-	4,528	35.4
9.0-10.9	1,571	1,265	871	334	306	38	-	4,385	34.2
11.0-12.9	518	725	662	331	219	106	44	2,605	20.3
13.0-14.9	91	222	315	153	128	46	38	993	7.8
15.0-16.9	3	37	94	47	44	16	12	253	2.0
17.0-18.9	-	-	22	10	9	3	-	44	.3
Total	4,941	3,332	2,570	956	706	209	94	12,808	100.0
Percent of total	38.6	26.0	20.1	7.5	5.5	1.6	0.7	100.0	

Table 6. -- Total number of pine poles or piles, classified according to length and diameter, in Louisiana Unit #3

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Percent of tota
	20	25	30	35	40	45	50 or over		
	Thousand sticks								
7.0- 8.9	1,884	542	361	20	-	-	-	2,807	30.4
9.0-10.9	1,368	616	614	150	146	-	-	2,894	31.3
11.0-12.9	728	458	508	164	97	69	28	2,052	22.2
13.0-14.9	263	228	282	86	45	39	45	988	10.7
15.0-16.9	83	91	117	43	18	11	24	387	4.2
17.0-18.9	22	27	34	16	4	3	6	112	1.2
Total	4,348	1,962	1,916	479	310	122	103	9,240	100.0
Percent of total	47.1	21.2	20.7	5.2	3.4	1.3	1.1	100.0	

Table 7. -- Total number of pine poles or piles, classified according to length and diameter, in Louisiana Unit #5

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Percent of total
	20	25	30	35	40	45	50 or over		
	Thousand sticks								
7.0- 8.9	3,782	1,073	489	87	-	-	-	5,431	33.6
9.0-10.9	1,832	1,263	1,105	479	257	196	32	5,164	31.9
11.0-12.9	623	746	932	422	241	196	144	3,304	20.4
13.0-14.9	122	289	507	219	145	102	103	1,487	9.2
15.0-16.9	10	84	235	95	61	42	45	572	3.5
17.0-18.9	-	16	103	38	29	16	23	225	1.4
Total	6,369	3,471	3,371	1,340	733	552	347	16,183	100.0
Percent of total	39.4	21.5	20.8	8.3	4.5	3.4	2.1	100.0	

Table 8. -- Total number of pine poles or piles, classified according to length and diameter, in Arkansas Unit #3

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Percent of total
	20	25	30	35	40	45	50 or over		
	Thousand sticks								
7.0- 8.9	5,494	2,676	625	148	32	-	-	8,975	32.8
9.0-10.9	3,681	2,798	1,862	654	325	-	-	9,320	34.0
11.0-12.9	1,324	1,356	1,570	564	377	187	29	5,407	19.7
13.0-14.9	338	438	857	361	287	148	138	2,567	9.4
15.0-16.9	32	74	303	151	158	106	110	934	3.4
17.0-18.9	-	-	26	45	48	39	29	187	.7
Total	10,869	7,342	5,243	1,923	1,227	480	306	27,390	100.0
Percent of total	39.7	26.8	19.1	7.0	4.5	1.8	1.1	100.0	

Table 9. -- Total number of pine poles or piles, classified according to length and diameter, in Arkansas Unit #4

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Percent of total
	20	25	30	35	40	45	50 or over		
	Thousand sticks								
7.0- 8.9	5,007	835	513	64	-	-	-	6,419	40.9
9.0-10.9	3,335	991	729	104	52	-	-	5,211	33.2
11.0-12.9	1,226	967	645	194	194	-	-	3,226	20.6
13.0-14.9	77	246	178	155	85	31	-	772	4.9
15.0-16.9	-	1	26	23	12	6	-	68	.4
17.0-18.9	-	-	-	-	-	-	-	-	-
Total	9,645	3,040	2,091	540	343	37	-	15,696	100.0
Percent of total	61.5	19.4	13.3	3.4	2.2	.2	-	100.0	

Table 10. -- Total number of pine poles or piles, classified according to length and diameter, in Oklahoma Unit #1

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Percent of total
	20	25	30	35	40	45	50 or over		
	Thousand sticks								
7.0- 8.9	619	137	48	-	-	-	-	804	20.2
9.0-10.9	664	285	74	31	-	-	-	1,054	26.5
11.0-12.9	487	409	144	66	-	-	-	1,106	27.8
13.0-14.9	118	283	129	58	-	-	-	588	14.7
15.0-16.9	20	129	102	42	-	-	-	293	7.4
17.0-18.9	-	43	67	27	-	-	-	137	3.4
Total	1,908	1,286	564	224	-	-	-	3,982	100.0
Percent of total	47.9	32.3	14.2	5.6	-	-	-	100.0	

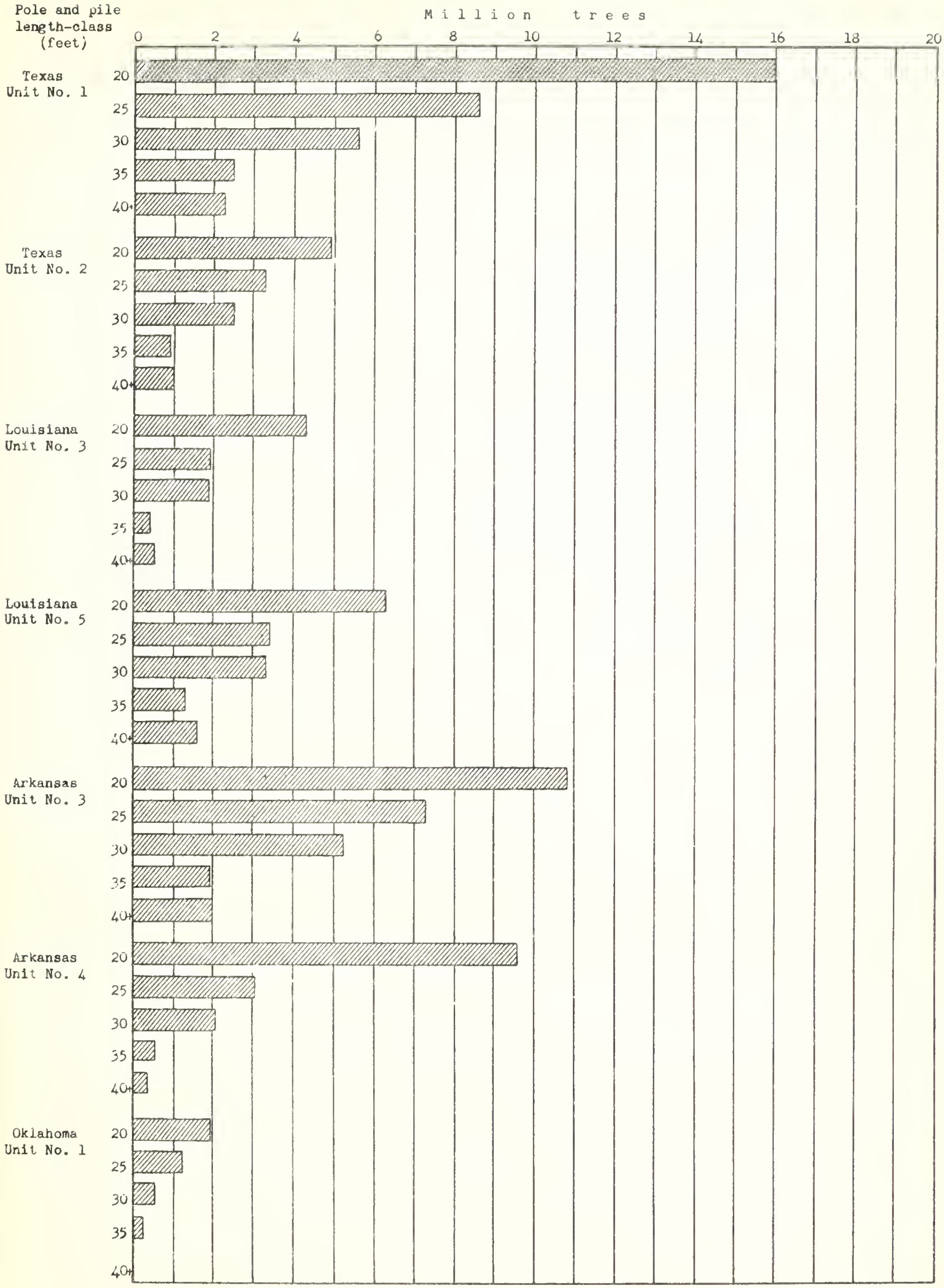


Figure 2. - Number of trees in each survey unit classified according to pole and pile length-class

Production of Poles and Piles

During 1935 in the Pine-Hardwood Region—West approximately 516,000 pine poles and piles were produced, with a total volume of 6,770,000 cubic feet, as shown in table 11. These estimates are based upon a canvass of all known users or purchasers of pine poles or piles from this area, and represent actual responses from at least 90 percent of them.

Table 11. -- Estimated production of pine poles and piles in the Pine-Hardwood Region—West, 1935

Unit	Number of poles and piles	Cubic feet (inside bark)
Texas #1	144,000	1,310,000
Texas #2	50,000	630,000
Louisiana #3	119,000	1,370,000
Louisiana #5	99,000	1,530,000
Arkansas #3	71,000	1,490,000
Arkansas #4	22,000	420,000
Oklahoma #1	11,000	20,000
Total	516,000	6,770,000

Summary

The seven Survey units which make up the Pine-Hardwood Region—West contain 48 million acres, of which 31 million are forested. Longleaf types occupy about 9 percent of the forest area, shortleaf-loblolly 34 percent, shortleaf-loblolly-hardwoods 24 percent, upland hardwoods 17 percent, and bottomland hardwoods 16 percent.

In this area occur over 120 million trees that were considered suitable for poles and piles by the Survey estimators. Sixty-nine percent of these will produce poles and piles in the 20- and 25-foot length-classes, and slightly over 24 percent will produce 30- and 35-foot lengths, while not quite 7 percent will produce poles or piles 40 feet or over in length. The number of poles per acre is greatest in Texas Unit #1 and least in Oklahoma Unit #1.

The sawmill industry is at present the chief competitor for pole and pile timber, but with the increasing development of the pulp industry more of the smaller pole trees will be converted into pulp.

To insure a continuing supply of pole and pile timber, the industry should endeavor to cooperate with the lumber companies, pulp companies, and farm owners. If the farmers, who own nearly 8 million acres of forested land in small tracts, could be convinced of the superior profits to be obtained from reserving their better trees for poles, an immense supply of pole and pile timber would be assured. Since a 12-inch pine tree (which will make a 40-foot pole) has, at prevailing prices, a stumpage value of about 40¢ as a pole, about 30¢ as lumber, and only 14¢ as pulpwood, farmers, lumber companies, and pulpwood operators should consider the financial profits to be derived from marketing each tree in its most valuable form. Also, while encouraging timberland owners to sell their better trees for poles, the pole and pile producers should continue to urge consumers to use the pole and pile lengths that more nearly correspond with those indicated by the above tables to be most prevalent.

FOREST SURVEY RELEASE NO. 29 OCTOBER 30, 1937

VOLUMES ON AVERAGE ACRES

IN THE PRINCIPAL UNITS OF THE NAVAL-STORES REGION

A Progress Report

by

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

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Staff Assignment

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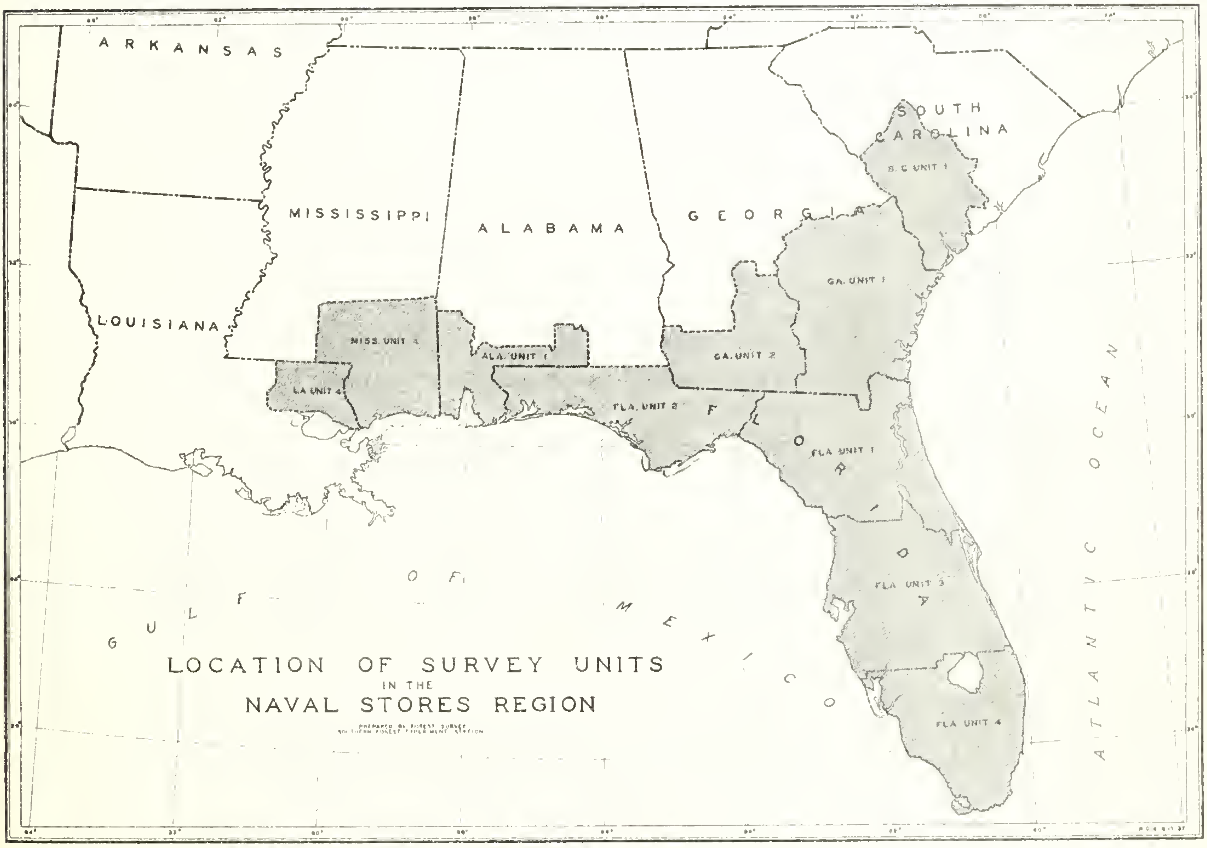
VOLUMES ON AVERAGE ACRES IN THE PRINCIPAL UNITS OF THE NAVAL-STORES REGION

To aid in understanding the forest situation in the naval-stores region, in the accompanying tables data are presented showing the board-foot and cordwood volumes on average acres in its nine principal survey units.[1] Data on average-acre volumes representative of large forest areas that are practically homogeneous have several uses. When presented by forest conditions, they indicate the relative degree of stocking and volume of each condition; when species and types are considered, they indicate the composition of each type. Such data may also be used in estimating roughly the volumes of large forest areas within the region, whenever an estimate can be made of the acreage in each forest condition and type within the area being considered.



The Forest Survey in the naval-stores region gathered data from nearly 80,000 quarter-acre plots regularly distributed (see map). The survey crews noted the class of land use; and on forest plots they recorded the forest type and condition, and tallied the trees by species and diameter-classes, in order that volumes in board feet and in cords might be computed. These records were used as a basis for figures on the forest situation within each survey unit.

1/ In the tables, La. Unit No. 4 and Miss. Unit No. 4 are combined. Also no tables are given for Florida Unit No. 4, although this unit is included in the general discussion of the region.

More than 44 million acres, or 70 percent of the total area included within the region, was found to be forest land. Twelve distinctive forest types were recognized, in which the species designating the type constituted at least 75 percent of the board-foot volume in sawlog-size stands, or 75 percent of the dominant and codominant trees in under-sawlog-size stands. In order to simplify the presentation of average-acre figures, these 12 types have been assembled into 4 groups, namely, turpentine pine, nonturpentine pine, hardwood, and cypress.[2] The species making up each type-group are shown in the tables. Turpentine pines are separated into those which are still round or unworked and those which are being or have been worked for naval stores; hardwoods are divided into two groups, pulping and nonpulping species.[2]

Stands having the characteristics of the original mature forests of the region, are called "old growth." Young stands which have come in as a result of cutting or other causes are called "second growth"; these are classified as reproduction, under-sawlog size, or sawlog size, depending upon their stage of development.[2] If 10 percent or more of the board-foot volume in sawlog-size stands has been removed, such stands are known as "partly cut." The lower limits of volume per acre of old-growth or second-growth sawlog-size stands, as here classified, represent the lightest stands generally included in commercial operations. In old-growth stands the lower limits used were 1,000 board feet of hardwood, or hardwood and pine mixed, or 600 board feet of pine alone; while in second-growth sawlog-size stands the lower limits were 600 and 400 board feet of all species for the uncut and partly-cut stands, respectively. When the stands were reduced by cutting below this minimum and failed to show a satisfactory stocking of young growth or reproduction, they were considered "clear-cut."

The volume of each species-group on an average acre shown in the tables represents a combination of the many variations in site, age, and density of stands in the respective forest type-groups and conditions in each unit. In using these data to estimate the volumes of large forest areas within the region, therefore, the variation of the area in question from the average pattern of the survey unit must be taken into consideration. Also it should be noted that the relative accuracy of these average-volume figures increases with the size of the area upon which they are based. The areas in each forest type-group and condition in each unit are given in the Appendix to aid in understanding the relative accuracy of average-acre data. Where the area of a given type-group and condition is 100,000 acres or larger, one can be assured that the volume-per-acre figures are reasonably accurate; for areas less than 100,000 acres, the per-acre figures should be used with caution. These area figures can also be used in conjunction with the average volumes to compute the total volumes in the various stands of each survey unit.

2/ See Appendix for detailed list of types within each type-group, for list of species within each species-group, and for definitions of forest conditions.

The board-foot figures are based on the International $\frac{1}{4}$-inch kerf rule, which closely approximates green lumber tally. Only sound live trees of commercial species are included. The volume of the stem is included to the upper limit of usable sawlog material rather than to a fixed top-diameter. Round pines and cypress trees 9 inches d.b.h. and larger, hardwood trees 13 inches d.b.h. and larger, and turpentined pines at least 9 inches d.b.n. (10 feet above the ground) were considered merchantable if 50 percent of their volume was sound and if they would produce one 12-foot usable log. Turpentined butts (approximately 8 feet long) are included in the figures, but all figures are net, deductions having been made for both woods and mill cull, i.e., for those portions of the tree which could not be manufactured into lumber on account of rot, fire and turpentine scars, crooks, bad knots, or other defects.

The cordwood figures are for the entire stand of sound live trees (not including culls) 5 inches d.b.h. and larger, expressed in terms of standard cords (4 x 4 x 8 feet), including bark. All of the sawlog material shown in board feet is included also in the cordwood figures. For under-sawlog-size trees of all species and for sawlog-size pines, the stem is included up to a variable top-diameter, with 4 inches as a minimum. Only the sawlog portion of hardwoods and cypress is included. Allowance has been made for woods cull, and no volume in limbs has been included for any species.

SOUTH CAROLINA UNIT NO. 1

Table 1.—Net volume on the average acre by species-group, forest type-group, and forest condition

Forest type and species-group	Board-foot volume based on International 1/4-inch rule: Old growth: Uncut	Old growth: Partly cut	Second growth: Sawlog size: Uncut	Second growth: Sawlog size: Partly cut	Second growth: Under sawlog size 1/	All conditions 2/	Cordwood volume of good trees, including bark: Old growth: Uncut	Old growth: Partly cut	Second growth: Sawlog size: Uncut	Second growth: Sawlog size: Partly cut	Second growth: Under sawlog size 1/	All conditions 2/
	Board feet						Cords					
Turpentine pine types:												
Turpentine pine:												
Round	3,776	2,220	1,406	946	152	790	9.2	5.1	6.8	5.0	1.7	3.8
Worked	1,702	1,605	872	714	86	494	4.4	4.3	3.7	2.4	0.6	2.0
Nonturpentine pines	1,404	750	510	761	45	291	3.7	2.4	1.7	2.4	0.3	1.0
Pulping hardwoods	727	170	42	171	3	45	2.5	1.4	0.7	1.0	0.2	0.5
Nonpulping hardwoods	31	108	17	91	7	19	0.2	1.7	0.2	0.4	0.1	0.2
Cypress	118	3	89	98	11	41	0.4	0.1	0.4	0.4	0.1	0.2
All species	7,758	4,856	2,936	2,781	304	1,680	20.4	15.0	13.5	11.6	3.0	7.7
Nonturpentine pine types:												
Turpentine pines	129	141	133	78	14	90	0.3	0.4	0.6	0.4	0.1	0.3
Nonturpentine pines	10,584	3,546	4,156	2,679	301	3,294	24.6	9.2	13.0	9.0	2.5	10.0
Pulping hardwoods	1,619	918	462	411	34	447	7.2	6.2	3.6	3.3	1.2	3.2
Nonpulping hardwoods	1,301	260	279	117	33	268	5.1	1.6	1.9	1.2	0.5	1.6
Cypress	253	119	28	23	4	44	0.8	0.3	0.1	0.1	negl.	0.2
All species	13,886	4,984	5,058	3,308	386	4,143	38.0	17.7	19.2	14.0	4.3	15.3
Hardwood types:												
Pines	190	98	198	161	21	116	0.6	0.3	0.6	0.5	0.1	0.4
Pulping hardwoods	4,827	3,505	2,892	2,557	133	2,053	18.2	14.9	14.2	11.5	2.2	9.6
Nonpulping hardwoods	2,158	849	923	1,153	107	728	7.4	4.1	4.6	5.8	1.3	3.4
Cypress	232	260	211	147	9	134	0.7	0.7	0.7	0.4	negl.	0.4
All species	7,407	4,712	4,226	4,018	270	3,031	26.9	20.0	20.1	18.2	3.6	13.8
Cypress types:												
Pines	316	51	552	238	7	248	0.8	0.2	1.4	0.9	0.1	0.7
Pulping hardwoods	5,373	2,894	2,738	1,943	62	2,295	20.4	14.4	15.3	11.8	3.8	12.0
Nonpulping hardwoods	808	134	231	95	-	218	3.3	1.3	1.9	0.3	0.6	1.5
Cypress	4,130	1,944	3,840	2,781	361	2,443	11.3	7.0	12.7	9.4	3.1	8.4
All species	10,627	5,023	7,361	5,057	430	5,204	35.8	22.9	31.3	22.4	7.6	22.6
All types (weighted averages):												
Turpentine pine:												
Round	314	601	460	164	74	278	0.8	1.4	2.2	0.9	0.8	1.3
Worked	155	453	279	107	41	172	0.4	1.2	1.2	0.4	0.3	0.7
Nonturpentine pines	5,232	1,247	2,175	2,014	114	1,476	12.2	3.4	6.8	6.7	0.9	4.5
Pulping hardwoods	3,042	1,828	894	708	42	763	12.0	8.3	5.3	4.4	1.0	4.2
Nonpulping hardwoods	1,483	419	325	237	35	291	5.4	2.5	1.9	1.6	0.5	1.6
Cypress	550	308	217	175	19	164	1.6	1.0	0.8	0.6	0.1	0.5
All species	10,776	4,856	4,350	3,405	325	3,144	32.4	18.3	18.2	14.6	3.6	12.8

1/ Does not include areas of reproduction or clear-cut forest conditions.
2/ Includes areas of reproduction and clear-cut forest conditions.

Table 2.—Net volume on the average acre by species-group, forest type-group, and forest condition

Forest type and species-group	Board-foot volume based on International 1/4-inch rule: Old growth: Uncut	Old growth: Partly cut	Second growth: Sawlog size: Uncut	Second growth: Sawlog size: Partly cut	Second growth: Under sawlog size 1/	All conditions 2/	Cordwood volume of good trees, including bark: Old growth: Uncut	Old growth: Partly cut	Second growth: Sawlog size: Uncut	Second growth: Sawlog size: Partly cut	Second growth: Under sawlog size 1/	All conditions 2/
	Board feet						Cords					
Turpentine pine types:												
Turpentine pine:												
Round	1,413	438	469	350	60	241	4.6	2.1	3.5	2.6	1.6	2.0
Worked	2,878	2,217	1,488	1,148	208	817	8.7	6.9	6.5	5.0	1.4	3.5
Nonturpentine pines	374	163	234	376	29	116	1.1	0.5	0.8	1.3	0.2	0.4
Pulping hardwoods	227	267	110	264	3	70	2.8	2.3	1.7	3.5	0.1	1.0
Nonpulping hardwoods	23	7	14	28	2	7	0.3	0.1	0.1	0.4	0.1	negl.
Cypress	486	291	100	148	20	78	2.1	1.3	0.5	0.7	0.2	0.4
All species	5,401	3,383	2,415	2,314	322	1,329	19.6	13.2	13.1	13.5	3.6	7.3
Nonturpentine pine types:												
Turpentine pines	157	245	236	108	31	152	0.5	0.8	1.0	0.6	0.3	0.7
Nonturpentine pines	5,196	2,491	3,592	2,242	323	2,445	13.2	6.7	11.0	7.2	2.3	7.5
Pulping hardwoods	769	797	344	493	36	348	4.0	5.8	3.2	3.7	0.7	2.8
Nonpulping hardwoods	505	284	274	288	32	220	2.4	1.5	1.7	1.7	0.5	1.3
Cypress	179	52	47	3	4	40	0.4	0.2	0.1	negl.	negl.	0.1
All species	6,806	3,869	4,493	3,134	426	3,205	20.5	15.0	17.0	13.2	3.8	12.4
Hardwood types:												
Pines	116	82	206	60	37	105	0.3	0.3	0.6	0.3	0.2	0.3
Pulping hardwoods	4,882	3,478	2,204	1,488	122	2,251	18.6	15.2	14.5	12.4	2.4	11.2
Nonpulping hardwoods	2,764	1,781	770	743	52	1,124	9.1	6.8	3.8	3.8	0.7	4.4
Cypress	281	145	123	163	22	131	0.8	0.4	0.4	0.5	0.1	0.4
All species	8,043	5,480	3,303	2,454	233	3,611	28.8	22.7	19.3	17.0	3.4	16.3
Cypress types:												
Pines	399	98	160	-	36	132	1.1	0.5	0.5	-	0.2	0.5
Pulping hardwoods	1,590	1,046	1,844	-	22	919	9.6	10.7	16.4	-	2.7	8.6
Nonpulping hardwoods	389	222	260	-	-	182	1.6	1.1	2.7	-	0.1	1.1
Cypress	2,723	2,341	1,910	-	211	1,634	8.9	7.7	6.8	-	2.3	5.9
All species	5,101	3,707	4,174	-	269	2,867	21.2	20.0	26.4	-	5.3	16.1
All types (weighted averages):												
Turpentine pine:												
Round	397	285	361	216	52	189	1.3	1.4	2.6	1.6	1.3	1.5
Worked	730	1,372	1,071	665	166	597	2.2	4.2	4.7	2.9	1.2	2.6
Nonturpentine pines	1,182	458	829	946	53	426	3.0	1.3	2.6	3.1	0.3	1.3
Pulping hardwoods	2,677	913	386	475	18	392	11.1	5.7	3.4	4.6	0.4	2.6
Nonpulping hardwoods	1,468	340	140	192	9	174	5.1	1.4	0.8	1.2	0.2	0.8
Cypress	480	439	118	102	23	121	1.6	1.6	0.5	0.4	0.2	0.5
All species	6,934	3,807	2,905	2,596	321	1,899	24.3	15.6	14.6	13.8	3.6	9.3

1/ Does not include areas of reproduction or clear-cut forest conditions.
2/ Includes areas of reproduction and clear-cut forest conditions.

Table 3.—Net volume on the average acre by species-group, forest type-group, and forest condition

Forest type and species-group	Board-foot volume based on International 1/4-inch rule						Cordwood volume of good trees, including bark					
	Old growth		Second growth			All conditions 2/	Old growth		Second growth			All conditions 2/
	Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size 1/		Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size 1/	
	Board feet						Cords					
Turpentine pine types:												
Turpentine pine:												
Round	4,096	574	790	404	110	389	10.8	2.1	4.4	2.3	1.9	2.5
Worked	2,620	2,075	1,415	1,325	215	807	6.8	6.1	5.7	5.8	1.3	3.1
Nonturpentine pines	212	145	204	233	32	97	0.6	0.4	0.7	0.8	0.2	0.3
Pulping hardwoods	274	90	57	58	3	33	2.8	0.9	0.5	0.9	0.1	0.3
Nonpulping hardwoods	38	37	17	9	3	10	0.5	0.2	0.1	negl.	negl.	0.1
Cypress	169	84	16	72	8	22	0.4	0.4	0.1	0.3	0.1	0.1
All species	7,409	3,005	2,499	2,101	371	1,358	21.9	10.1	11.5	10.1	3.6	6.4
Nonturpentine pine types:												
Turpentine pines	282	276	337	271	57	214	0.7	1.0	1.4	1.0	0.3	0.9
Nonturpentine pines	8,027	2,907	3,564	2,845	363	2,517	18.6	7.5	11.2	8.6	2.9	7.8
Pulping hardwoods	1,278	564	211	244	40	258	5.5	3.9	1.9	1.4	0.6	1.8
Nonpulping hardwoods	895	378	154	113	47	184	3.4	1.5	1.0	0.8	0.4	1.0
Cypress	10	-	4	-	-	2	negl.	negl.	negl.	-	negl.	negl.
All species	10,492	4,125	4,270	3,473	507	3,175	28.2	13.9	15.5	11.8	4.2	11.5
Hardwood types:												
Pines	202	189	279	134	64	139	0.7	0.6	0.8	0.5	0.3	0.5
Pulping hardwoods	3,296	1,733	2,306	428	84	1,134	13.7	8.1	12.5	4.0	1.8	6.1
Nonpulping hardwoods	1,368	731	769	429	41	454	4.8	3.3	3.7	2.1	0.7	2.1
Cypress	96	258	129	71	5	91	0.2	0.6	0.4	0.2	negl.	0.2
All species	4,962	2,911	3,483	1,062	194	1,818	19.4	12.6	17.4	6.8	2.8	8.9
Cypress types:												
Pines	229	250	312	-	-	130	0.7	0.8	1.2	-	negl.	0.5
Pulping hardwoods	1,542	399	63	-	-	259	9.5	1.8	0.5	-	0.8	1.6
Nonpulping hardwoods	104	-	-	-	-	7	1.5	negl.	-	-	-	0.1
Cypress	2,979	2,295	3,417	2,625	130	1,486	8.5	9.5	11.5	13.4	3.2	6.6
All species	4,854	2,944	3,792	2,625	130	1,882	20.2	12.1	13.2	13.4	4.0	8.8
All types (weighted averages):												
Turpentine pine:												
Round	967	379	596	302	84	291	2.5	1.4	3.2	1.6	1.5	1.8
Worked	568	1,286	1,062	884	160	588	1.5	3.8	4.3	3.9	0.9	2.3
Nonturpentine pines	2,588	481	900	846	72	456	6.1	1.3	2.8	2.6	0.5	1.4
Pulping hardwoods	1,943	512	245	132	19	211	8.7	2.8	1.6	1.2	0.4	1.3
Nonpulping hardwoods	875	223	97	68	14	93	3.3	1.0	0.6	0.4	0.2	0.5
Cypress	229	244	41	130	9	60	0.6	0.9	0.2	0.6	0.1	0.3
All species	7,170	3,125	2,941	2,362	358	1,699	22.7	11.2	12.7	10.3	3.6	7.6

1/ Does not include areas of reproduction or clear-cut forest conditions.
2/ Includes areas of reproduction and clear-cut forest conditions.

Table 4.—Net volume on the average acre by species-group, forest type-group, and forest condition

Forest type and species-group	Board-foot volume based on International 1/4-inch rule: Old growth, Uncut	Old growth, Partly cut	Second growth, Sawlog size, Uncut	Second growth, Sawlog size, Partly cut	Second growth, Under sawlog size 1/	All conditions 2/	Cordwood volume of good trees, including bark: Old growth, Uncut	Old growth, Partly cut	Second growth, Sawlog size, Uncut	Second growth, Sawlog size, Partly cut	Second growth, Under sawlog size 1/	All conditions 2/
	Board feet						Cords					
Turpentine pine types:												
Turpentine pine:												
Round	4,108	706	811	717	111	461	10.9	2.3	4.9	3.6	2.1	2.7
Worked	1,459	1,497	1,036	1,058	130	508	3.8	4.3	4.5	4.7	0.9	2.1
Nonturpentine pines	100	51	90	133	13	38	0.4	0.2	0.3	0.4	0.1	0.1
Pulping hardwoods	249	44	12	56	3	18	2.0	0.7	0.4	1.0	0.1	0.3
Nonpulping hardwoods	46	34	16	19	1	9	0.5	0.2	0.1	0.1	-	0.1
Cypress	864	287	124	188	15	94	3.2	1.2	0.7	1.0	0.1	0.4
All species	6,826	2,619	2,089	2,171	273	1,128	20.8	8.9	10.9	10.8	3.3	5.7
Nonturpentine pine types:												
Turpentine pines	238	298	243	180	48	161	0.7	0.9	1.0	0.6	0.3	0.6
Nonturpentine pines	4,596	2,313	3,046	2,409	307	2,054	11.5	6.4	10.4	7.6	2.4	6.6
Pulping hardwoods	554	351	245	312	6	206	3.1	1.9	1.8	2.3	0.4	1.4
Nonpulping hardwoods	611	298	216	221	22	197	2.8	1.8	1.5	1.3	0.3	1.2
Cypress	35	147	6	5	-	20	0.1	0.4	negl.	negl.	negl.	0.1
All species	6,034	3,407	3,756	3,127	383	2,638	18.2	11.4	14.7	11.8	3.4	9.9
Hardwood types:												
Pines	240	106	57	51	43	93	0.7	0.3	0.3	0.7	0.2	0.3
Pulping hardwoods	2,723	2,402	902	772	35	1,038	11.1	11.5	6.5	3.6	0.6	4.9
Nonpulping hardwoods	1,857	1,001	438	468	22	582	7.0	5.4	2.8	2.3	0.5	2.8
Cypress	630	536	92	89	13	232	1.4	1.5	0.3	0.2	negl.	0.6
All species	5,450	4,045	1,489	1,380	113	1,945	20.2	18.7	9.9	6.8	1.3	8.6
Cypress types:												
Pines	373	207	161	63	95	222	1.4	1.0	0.9	0.2	0.7	1.0
Pulping hardwoods	250	171	132	241	16	158	2.4	2.5	2.6	0.7	0.6	2.0
Nonpulping hardwoods	100	46	25	-	3	50	0.6	0.2	0.4	-	negl.	0.3
Cypress	4,818	3,204	2,452	1,607	376	2,966	16.2	11.8	12.8	7.7	3.6	11.3
All species	5,541	3,628	2,770	1,911	490	3,396	20.6	15.5	16.7	8.6	4.9	14.6
All types (weighted averages):												
Turpentine pine:												
Round	1,216	379	657	473	82	332	3.3	1.3	3.9	2.4	1.5	1.9
Worked	439	771	825	685	96	358	1.2	2.2	3.6	3.0	0.6	1.4
Nonturpentine pines	652	177	458	734	28	200	1.7	0.5	1.6	2.3	0.2	0.7
Pulping hardwoods	1,303	735	101	173	10	230	5.9	4.1	1.0	1.4	0.2	1.3
Nonpulping hardwoods	869	318	68	96	8	133	3.5	1.7	0.5	0.6	0.2	0.7
Cypress	1,436	853	174	220	23	276	4.6	3.1	0.3	1.0	0.2	1.1
All species	5,915	3,233	2,283	2,371	247	1,529	20.2	12.9	11.5	10.7	2.9	7.1

1/ Does not include areas of reproduction or clear-cut forest conditions.
2/ Includes areas of reproduction and clear-cut forest conditions.

FLORIDA UNIT NO. 2

Table 5.--Net volume on the average acre by species-group, forest type-group, and forest condition

Forest type and species-group	Board-foot volume based on International 1/4-inch rule						Cordwood volume of good trees, including bark					
	Old growth		Second growth			All conditions 2/	Old growth		Second growth			All conditions 2/
	Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size 1/		Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size 1/	
	Board feet						Cords					
Turpentine pine types:												
Turpentine pine:												
Round	1,965	852	813	499	65	273	5.4	2.6	4.0	2.6	1.2	1.5
Worked	1,826	1,363	1,046	803	130	375	4.9	4.0	4.4	3.4	0.9	1.5
Nonturpentine pines	97	44	122	69	8	27	0.3	0.1	0.4	0.2	negl.	0.1
Pulping hardwoods	70	44	40	23	1	12	1.4	0.7	0.7	0.6	0.1	0.2
Nonpulping hardwoods	11	22	15	19	5	6	0.1	0.2	0.1	0.2	0.1	0.1
Cypress	321	178	60	130	7	38	1.0	0.7	0.2	0.6	negl.	0.1
All species	4,290	2,503	2,096	1,598	216	731	13.1	8.3	9.8	7.6	2.3	3.5
Nonturpentine pine types:												
Turpentine pines	330	270	188	201	37	135	0.8	0.7	0.7	0.7	0.2	[illegible]
Nonturpentine pines	4,810	2,543	3,795	2,638	240	2,031	12.4	6.9	11.9	8.0	2.2	6.5
Pulping hardwoods	769	431	228	161	32	183	4.7	2.8	2.4	1.9	0.6	1.6
Nonpulping hardwoods	296	542	133	142	33	132	2.2	2.0	1.2	1.0	0.5	1.0
Cypress	184	49	6	11	1	19	0.5	0.2	negl.	negl.	negl.	0.1
All species	6,389	3,835	4,350	3,153	343	2,500	20.5	12.6	16.2	11.6	3.5	9.7
Hardwood types:												
Pines	164	120	163	127	34	71	0.5	0.4	0.5	0.9	0.2	0.3
Pulping hardwoods	3,185	2,316	1,388	1,137	52	926	14.5	10.9	9.4	5.3	1.3	5.0
Nonpulping hardwoods	1,993	1,244	1,282	628	21	556	6.8	5.0	6.8	4.0	0.5	2.4
Cypress	156	211	146	-	10	72	0.4	0.5	0.5	-	negl.	0.2
All species	5,498	3,891	2,979	1,892	117	1,625	22.2	16.8	17.2	10.2	2.0	7.9
Cypress types:												
Pines	116	46	175	-	63	73	0.5	0.3	0.7	-	0.2	0.3
Pulping hardwoods	997	1,990	456	412	348	1,223	5.1	10.0	4.5	5.8	5.2	6.9
Nonpulping hardwoods	257	151	-	-	19	129	1.7	1.1	1.2	-	0.4	1.0
Cypress	3,314	1,900	2,194	1,294	214	1,831	11.6	5.5	11.6	6.1	2.0	6.4
All species	4,684	4,087	2,825	1,706	644	3,256	18.9	16.9	18.0	11.9	7.8	14.6
All types (weighted averages):												
Turpentine pine:												
Round	848	393	577	311	47	197	2.3	1.2	2.8	1.6	0.8	1.1
Worked	763	614	743	469	92	265	2.0	1.8	3.1	1.9	0.6	1.0
Nonturpentine pines	514	225	876	1,011	25	200	1.4	0.6	2.8	3.1	0.2	0.6
Pulping hardwoods	1,418	1,144	206	170	20	247	7.1	5.8	1.9	1.5	0.4	1.5
Nonpulping hardwoods	812	503	151	111	11	129	3.0	2.1	1.0	0.8	0.2	0.6
Cypress	624	428	101	118	9	103	2.1	1.3	0.4	0.4	0.1	0.4
All species	4,979	3,307	2,654	2,190	204	1,141	17.9	12.8	12.0	9.3	2.3	5.2

1/ Does not include areas of reproduction or clear-cut forest conditions.
2/ Includes areas of reproduction and clear-cut forest conditions.

Table 6.--Net volume on the average acre by species-group, forest type-group, and forest condition

Board-foot volume based on International 1/4-inch rule — Cordwood volume of good trees, including bark

Forest type and species-group	Old growth		Second growth			All conditions 2/	Old growth		Second growth			All conditions 2/
			Sawlog size		Under sawlog size 1/				Sawlog size		Under sawlog size 1/	
	Uncut	Partly cut	Uncut	Partly cut			Uncut	Partly cut	Uncut	Partly cut		
	Board feet						Cords					
Turpentine pine types:												
Turpentine pine:												
Round	2,386	1,187	1,648	1,033	149	332	6.1	3.3	6.7	4.1	1.7	1.4
Worked	1,273	659	481	393	63	140	3.1	1.8	1.8	1.4	0.3	0.5
Nonturpentine pines	4	1	22	23	2	3	negl.	negl.	0.1	0.1	negl.	negl.
Pulping hardwoods	30	8	25	9	-	4	0.1	0.1	0.4	0.2	negl.	0.1
Nonpulping hardwoods	4	10	13	1	negl.	2	0.1	0.1	0.1	negl.	negl.	negl.
Cypress	80	25	33	42	1	7	0.3	0.1	0.3	0.2	negl.	negl.
All species	3,782	1,390	2,222	1,501	215	488	9.7	5.4	9.4	6.0	2.0	2.0
Nonturpentine pine types:												
Turpentine pines	184	-	110	131	17	44	0.4	-	0.4	0.5	0.1	0.1
Nonturpentine pines	6,224	1,960	2,129	1,533	115	852	15.2	4.6	7.1	4.6	1.3	3.0
Pulping hardwoods	225	-	181	56	-	52	2.8	-	1.6	0.6	-	0.5
Nonpulping hardwoods	61	-	52	-	-	14	0.7	-	0.2	0.4	-	0.1
Cypress	-	-	7	-	-	2	-	-	negl.	-	-	negl.
All species	6,694	1,960	2,479	1,720	132	964	19.1	4.6	9.3	6.1	1.4	3.7
Hardwood types:												
Pines	10	17	61	67	12	29	0.1	0.1	0.3	0.2	negl.	0.1
Pulping hardwoods	2,777	2,172	666	834	45	441	12.0	8.3	4.3	6.1	1.4	3.0
Nonpulping hardwoods	1,825	1,094	448	940	32	293	6.0	4.9	2.3	4.0	0.7	1.6
Cypress	-	57	11	9	4	8	-	0.1	0.1	0.1	negl.	negl.
All species	4,612	[illegible]	1,186	1,870	93	771	18.1	13.4	7.0	10.4	2.1	4.7
Cypress types:												
Pines	49	7	57	39	6	31	0.2	0.2	0.3	0.3	negl.	0.2
Pulping hardwoods	985	666	278	195	17	337	5.9	4.2	2.4	1.6	0.9	2.5
Nonpulping hardwoods	68	118	66	43	-	49	0.7	0.9	0.8	0.6	0.3	0.6
Cypress	3,911	2,510	1,925	1,700	182	1,644	14.4	9.7	12.2	11.4	4.2	9.1
All species	5,013	3,301	2,326	1,977	205	2,061	21.2	15.0	15.7	13.9	5.4	12.4
All types (weighted averages):												
Turpentine pine:												
Round	1,676	740	930	728	107	273	4.3	2.1	3.7	2.9	1.2	1.2
Worked	891	409	268	288	45	115	2.2	1.1	1.0	1.0	0.2	0.4
Nonturpentine pines	131	24	138	103	6	28	0.3	0.1	0.5	0.3	0.1	0.1
Pulping hardwoods	458	441	235	130	10	69	2.3	2.1	1.8	1.0	0.3	0.5
Nonpulping hardwoods	175	174	137	116	6	35	0.7	0.9	0.8	0.6	0.2	0.2
Cypress	824	626	209	253	14	100	3.1	2.4	1.8	1.7	0.3	0.6
All species	4,155	2,414	1,977	1,618	188	620	12.9	8.7	9.5	7.5	2.3	3.0

1/ Does not include areas of reproduction or clear-cut forest conditions.
2/ Includes areas of reproduction and clear-cut forest conditions.

Table 7.--Net volume on the average acre by species-group, forest type-group, and forest condition

Forest type and species-group	Board-foot volume based on International 1/4-inch rule						Cordwood volume of good trees, including bark					
	Old growth		Second growth			All conditions 2/	Old growth		Second growth			All conditions 2/
			Sawlog size		Under sawlog size 1/				Sawlog size		Under sawlog size 1/	
	Uncut	Partly cut	Uncut	Partly cut			Uncut	Partly cut	Uncut	Partly cut		
	Board feet						Cords					
Turpentine pine types:												
Turpentine pine:												
Round	4,014	1,482	1,162	1,093	113	587	11.3	4.5	5.7	4.7	1.7	2.7
Worked	4,381	1,679	948	549	95	562	10.2	4.1	3.7	1.8	0.6	1.8
Nonturpentine pines	261	129	111	52	11	49	0.8	0.5	0.4	0.2	0.1	0.2
Pulping hardwoods	648	126	72	83	7	51	7.9	1.2	1.1	0.9	0.1	0.6
Nonpulping hardwoods	126	64	14	37	6	19	0.5	0.3	0.2	0.4	0.1	0.2
Cypress	98	14	7	14	4	8	0.3	0.1	negl.	0.1	negl.	negl.
All species	9,528	3,494	2,314	1,828	236	1,276	31.0	10.7	11.1	8.1	2.6	5.5
Nonturpentine pine types:												
Turpentine pines	40	294	308	173	57	182	0.1	0.8	1.1	0.7	0.3	0.7
Nonturpentine pines	4,528	2,980	3,346	3,549	255	2,302	11.2	8.5	11.3	10.7	2.1	7.5
Pulping hardwoods	1,384	310	264	313	72	263	7.7	2.9	2.2	2.2	0.9	2.0
Nonpulping hardwoods	1,056	339	187	194	45	197	3.1	2.4	1.5	1.0	0.8	1.4
Cypress	-	-	-	-	8	2	-	-	negl.	-	negl.	negl.
All species	7,008	3,923	4,105	4,229	437	2,946	22.1	14.6	16.1	14.6	4.1	11.6
Hardwood types:												
Pines	464	128	170	70	63	141	1.2	0.4	0.8	0.3	0.2	0.4
Pulping hardwoods	3,138	1,979	1,281	901	75	972	13.6	8.4	9.1	6.3	1.4	5.1
Nonpulping hardwoods	1,452	1,379	566	761	51	543	5.2	4.7	2.9	6.2	0.6	2.3
Cypress	86	176	5	-	8	48	0.3	0.5	negl.	-	negl.	0.2
All species	5,140	3,662	2,022	1,732	197	1,704	20.3	14.0	12.8	12.8	2.2	8.0
Cypress types:												
Pines	-	23	-	-	12	14	-	0.4	-	-	negl.	0.2
Pulping hardwoods	5,286	1,645	-	-	424	2,106	17.6	9.7	-	-	9.1	11.1
Nonpulping hardwoods	250	207	-	-	-	152	1.2	1.3	-	-	0.5	1.0
Cypress	3,914	819	-	-	198	1,347	8.6	2.5	-	-	0.8	3.4
All species	9,450	2,694	-	-	634	3,619	27.4	13.9	-	-	10.4	15.7
All types (weighted averages):												
Turpentine pine:												
Round	1,565	1,026	917	599	84	448	4.4	3.1	4.4	2.5	1.2	2.1
Worked	1,689	1,156	741	300	76	427	3.9	2.9	2.9	1.0	0.5	1.4
Nonturpentine pines	624	321	634	1,532	30	249	1.6	1.0	2.2	4.7	0.2	0.8
Pulping hardwoods	2,245	576	197	241	30	251	11.3	3.2	1.9	1.9	0.5	1.6
Nonpulping hardwoods	803	336	86	157	18	117	2.9	1.3	0.6	1.1	0.3	0.6
Cypress	441	92	6	7	8	40	1.1	0.3	negl.	negl.	negl.	0.1
All species	7,367	3,507	2,581	2,836	246	1,532	25.2	11.8	12.0	11.2	2.7	6.6

1/ Does not include areas of reproduction or clear-cut forest conditions.
2/ Includes areas of reproduction and clear-cut forest conditions.

Table 8.--Net volume on the average acre by species-group, forest type-group, and forest condition

Forest type and species-group	Board-foot volume based on International 1/4-inch rule						Cordwood volume of good trees, including bark					
	Old growth		Second growth			All conditions 2/	Old growth		Second growth			All conditions 2/
	Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size 1/		Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size 1/	
	Board feet						Cords					
Turpentine pine types:												
Turpentine pine:												
Round	5,850	1,430	1,304	901	148	391	14.3	4.0	5.2	4.4	1.2	1.6
Worked	8,028	1,254	537	548	34	271	16.9	2.8	1.8	1.9	0.2	0.7
Nonturpentine pines	62	105	155	116	22	35	0.2	0.4	0.6	0.4	0.1	0.1
Pulping hardwoods	739	305	179	123	9	55	6.7	2.7	2.1	2.1	0.2	0.6
Nonpulping hardwoods	44	24	38	59	8	11	0.3	0.4	0.3	0.4	0.2	0.2
Cypress	312	20	24	69	5	12	1.2	0.1	0.1	0.2	negl.	0.1
All species	15,035	3,138	2,237	1,816	226	775	39.6	10.4	10.1	9.4	1.9	3.3
Nonturpentine pine types:												
Turpentine pines	232	70	93	51	21	60	0.7	0.2	0.3	0.2	0.1	0.2
Nonturpentine pines	6,768	2,885	3,390	2,972	270	2,046	16.6	7.7	11.4	9.7	2.4	7.2
Pulping hardwoods	1,799	1,415	415	353	76	329	7.9	7.0	3.0	2.5	1.1	2.4
Nonpulping hardwoods	687	797	226	248	81	195	3.3	3.0	1.7	2.2	1.0	1.5
Cypress	-	6	7	-	-	3	-	negl.	negl.	-	negl.	negl.
All species	9,486	5,173	4,131	3,624	448	2,633	28.5	17.9	16.4	14.6	4.6	11.3
Hardwood types:												
Pines	211	162	201	180	19	105	0.7	0.8	0.9	0.8	0.1	0.4
Pulping hardwoods	4,852	2,183	2,006	1,856	81	1,443	16.7	8.7	11.6	9.1	1.2	6.4
Nonpulping hardwoods	1,561	1,512	759	635	91	689	5.5	5.4	3.8	3.5	1.4	3.1
Cypress	259	65	28	57	6	53	0.7	0.2	0.1	0.2	negl.	0.2
All species	6,883	3,922	2,994	2,728	197	2,290	23.6	15.1	16.4	13.6	2.7	10.1
Cypress types:												
Pines	22	210	-	250	-	86	0.1	0.5	0.1	0.8	-	0.2
Pulping hardwoods	8,563	2,921	1,963	1,344	150	4,049	29.6	12.0	7.3	7.2	5.5	15.3
Nonpulping hardwoods	304	351	389	500	-	291	1.8	1.7	2.8	2.2	0.4	1.7
Cypress	5,963	3,193	926	1,594	200	3,153	11.8	8.4	3.3	5.6	3.9	7.6
All species	14,852	6,675	3,278	3,688	350	7,579	43.3	22.6	13.5	15.8	9.8	24.8
All types (weighted averages):												
Turpentine pine:												
Round	1,150	570	380	370	80	223	2.8	1.6	1.5	1.8	0.7	0.9
Worked	1,520	435	146	213	19	147	3.2	1.1	0.5	0.7	0.1	0.4
Nonturpentine pines	972	486	2,068	1,456	88	586	2.5	1.5	6.9	4.8	0.7	2.1
Pulping hardwoods	3,913	1,373	602	487	43	423	14.5	6.2	4.1	3.3	0.7	2.3
Nonpulping hardwoods	1,091	822	259	233	46	194	4.0	3.1	1.7	1.7	0.7	1.1
Cypress	574	100	18	52	4	38	1.4	0.3	0.1	0.2	negl.	0.1
All species	9,220	3,836	3,473	2,811	280	1,611	28.4	13.8	14.8	12.5	2.9	6.9

1/ Does not include areas of reproduction or clear-cut forest conditions.
2/ Includes areas of reproduction and clear-cut forest conditions.

APPENDIX

Forest area classified according to forest type-group and condition

Table 1.--SOUTH CAROLINA UNIT NO. 1

Forest condition		Forest type-group: Turpentine pine	Nonturpentine pine	Hardwood	Cypress	All type-groups	
		Acres					Percent
Old growth:	Uncut	16,100	103,600	80,400	17,700	217,800	7.3
	Partly cut	61,800	66,800	83,600	21,700	233,900	7.8
Second growth:							
Sawlog size:	Uncut	327,100	524,100	216,200	39,300	1,106,700	37.0
	Partly cut	29,700	159,900	27,300	10,500	227,400	7.6
Under sawlog size		461,500	293,300	210,500	30,500	995,800	33.2
Reproduction		53,800	73,100	65,100	2,500	194,500	6.5
Clear-cut		8,900	3,200	1,600	3,200	16,900	0.6
All conditions		958,900	1,224,000	684,700	125,400	2,993,000	100.0
Percent of total forest area		32.0	40.9	22.9	4.2	100.0	

Table 2.--GEORGIA UNIT NO. 1

Forest condition		Forest type-group: Turpentine pine	Nonturpentine pine	Hardwood	Cypress	All type-groups	
		Acres					Percent
Old growth:	Uncut	105,100	82,500	202,300	28,800	418,700	5.9
	Partly cut	420,300	98,100	106,600	69,300	694,300	9.9
Second growth:							
Sawlog size:	Uncut	1,461,600	375,900	207,100	28,800	2,073,400	29.4
	Partly cut	192,300	111,300	38,100	-	341,700	4.8
Under sawlog size		2,015,100	226,500	250,500	50,600	2,542,700	36.0
Reproduction		418,000	60,700	36,600	6,200	521,500	7.4
Clear-cut		448,200	7,800	4,000	3,900	463,900	6.6
All conditions		5,060,600	962,800	845,200	187,600	7,056,200	100.0
Percent of total forest area		71.7	13.6	12.0	2.7	100.0	

Forest area classified according to forest type-group and condition

Table 3.--GEORGIA UNIT NO. 2

Forest condition		Forest type-group: Turpentine pine	Nonturpentine pine	Hardwood	Cypress	All type-groups	
		- - - - - -	- - - - - -	A c r e s	- - - - - -	- - - - - -	Percent
Old growth:	Uncut	20,800	29,500	41,600	4,800	96,700	3.2
	Partly cut	245,300	51,800	84,700	24,800	406,600	13.5
Second growth:							
Sawlog size:	Uncut	579,900	167,000	55,900	4,800	807,600	26.8
	Partly cut	87,800	32,800	11,200	4,000	135,800	4.5
Under sawlog size		815,700	144,700	166,800	21,500	1,148,700	38.1
Reproduction		131,900	18,300	17,600	1,600	169,400	5.6
Clear-cut		234,000	4,800	4,000	6,400	249,200	8.3
All conditions		2,115,400	448,900	381,800	67,900	3,014,000	100.0
Percent of total forest area		70.2	14.9	12.6	2.3	100.0	

Table 4.--FLORIDA UNIT NO. 1

Forest condition		Forest type-group: Turpentine pine	Nonturpentine pine	Hardwood	Cypress	All type-groups	
		- - - - - -	- - - - - -	A c r e s	- - - - - -	- - - - - -	Percent
Old growth:	Uncut	174,200	77,300	261,800	123,800	637,100	8.7
	Partly cut	429,700	49,600	240,500	150,600	870,400	12.0
Second growth:							
Sawlog size:	Uncut	1,183,400	191,600	94,600	43,400	1,513,000	20.7
	Partly cut	91,400	39,400	7,900	7,900	146,600	2.0
Under sawlog size		1,849,600	149,000	622,900	68,600	2,690,100	36.9
Reproduction		217,700	44,900	102,500	8,600	373,700	5.1
Clear-cut		1,001,400	33,200	22,000	10,200	1,066,800	14.6
All conditions		4,947,400	585,000	1,352,200	413,100	7,297,700	100.0
Percent of total forest area		67.8	8.0	18.5	5.7	100.0	

Forest area classified according to forest type-group and condition

Table 5.—FLORIDA UNIT NO. 2

Forest condition		Forest type-group				All type-groups	
		Turpentine pine	Nonturpentine pine	Hardwood	Cypress		
		Acres					Percent
Old growth:	Uncut	148,500	32,100	136,000	45,600	362,200	6.0
	Partly cut	283,700	44,800	226,200	92,900	647,600	10.8
Second growth:							
Sawlog size:	Uncut	524,300	157,900	67,600	16,000	765,800	12.7
	Partly cut	70,100	47,200	10,200	1,700	129,200	2.1
Under sawlog size		1,697,000	168,100	632,400	27,000	2,524,500	42.0
Reproduction		552,300	44,700	101,300	12,600	710,900	11.8
Clear-cut		846,100	14,300	10,100	6,800	877,300	14.6
All conditions		4,122,000	509,100	1,183,800	202,600	6,017,500	100.0
Percent of total forest area		68.5	8.5	19.6	3.4	100.0	

Table 6.—FLORIDA UNIT NO. 3

Forest condition		Forest type-group				All type-groups	
		Turpentine pine	Nonturpentine pine	Hardwood	Cypress		
		Acres					Percent
Old growth:	Uncut	166,600	4,900	20,600	47,000	239,100	3.9
	Partly cut	145,000	2,500	29,700	56,100	233,300	3.8
Second growth:							
Sawlog size:	Uncut	402,400	42,000	192,900	94,000	731,300	11.9
	Partly cut	136,800	10,700	22,300	25,600	195,400	3.2
Under sawlog size		1,190,500	63,500	318,200	117,800	1,690,000	27.3
Reproduction		278,600	19,000	56,900	3,300	357,800	5.8
Clear-cut		2,681,900	36,300	1,600	3,300	2,723,100	44.1
All conditions		5,001,800	178,900	642,200	347,100	6,170,000	100.0
Percent of total forest area		81.1	2.9	10.4	5.6	100.0	

Forest area classified according to forest type-group and condition

Table 7.--ALABAMA UNIT NO. 1

Forest condition		Forest type-group				All type-groups	
		Turpentine pine	Nonturpentine pine	Hardwood	Cypress		
		- - - - - -	- - - - - -	Acres	- - - - - -	- - - - - -	Percent
Old growth:	Uncut	57,000	12,500	66,400	14,000	149,900	5.0
	Partly cut	292,700	31,300	79,600	26,500	430,100	14.4
Second growth:							
Sawlog size:	Uncut	391,900	83,500	40,600	-	516,000	17.3
	Partly cut	48,300	40,600	7,100	-	96,000	3.2
Under sawlog size		912,700	77,200	252,900	17,200	1,260,000	42.2
Reproduction		207,700	12,500	8,500	800	229,500	7.7
Clear-cut		302,800	-	800	800	304,400	10.2
All conditions		2,213,100	257,600	455,900	59,300	2,985,900	100.0
Percent of total forest area		74.1	8.6	15.3	2.0	100.0	

Table 8.--MISSISSIPPI UNIT NO. 4 AND LOUISIANA UNIT NO. 4

Forest condition		Forest type-group				All type-groups	
		Turpentine pine	Nonturpentine pine	Hardwood	Cypress		
		- - - - - -	- - - - - -	Acres	- - - - - -	- - - - - -	Percent
Old growth:	Uncut	43,300	28,400	143,500	13,500	228,700	3.6
	Partly cut	228,900	77,300	275,500	11,400	593,100	9.2
Second growth:							
Sawlog size:	Uncut	322,200	746,900	190,800	5,400	1,265,300	19.7
	Partly cut	106,100	130,400	38,900	3,200	278,600	4.3
Under sawlog size		1,210,500	654,000	522,000	4,000	2,390,500	37.3
Reproduction		632,400	60,100	64,400	-	756,900	11.8
Clear-cut		865,700	23,400	9,400	3,100	901,600	14.1
All conditions		3,409,100	1,720,500	1,244,500	40,600	6,414,700	100.0
Percent of total forest area		53.2	26.8	19.4	0.6	100.0	

Types in the forest type-groups

Type-groups	Types
Turpentine pine:	longleaf pine, longleaf-slash pine, slash pine, slash pine-cypress, turpentine pine-hardwood
Nonturpentine pine:	nonturpentine pine, scrub pine, nonturpentine pine-hardwood
Hardwood:	bottomland and swamp hardwood, upland hardwood, scrub oak-scrub hardwoods
Cypress:	cypress-gum

Species in the species-groups

Species-groups	Species
Pines:	
Turpentine pine:	longleaf and slash pines
Round - not yet worked for naval stores	
Worked - working, resting, or worked out for naval stores	
Nonturpentine pine:	loblolly, shortleaf, pond, sand, and spruce pines
Hardwoods:	
Pulping hardwoods:	red gum, black gum, bay, soft maple, magnolia, and associated minor species
Nonpulping hardwoods:	red oaks, white oaks, ash, elm, hickory, holly, persimmon, and associated minor species
Cypress:	cypress only.

Forest conditions defined

Old-growth uncut.--Old growth stands from which less than 10 percent of the volume has been cut.

Old-growth partly cut:--Old growth stands from which 10 percent or more of the volume has been cut, but in which the remaining old-growth sawtimber contains per acre at least 1,000 board feet of hardwood or hardwood and pine mixed, or 600 board feet of pine.

Second-growth sawlog-size uncut.--Second-growth stands from which less than 10 percent of the sawlog-size trees have been cut, and in which the remaining sawtimber contains at least 600 board feet per acre.

Second-growth sawlog-size partly cut.--Second-growth stands from which 10 percent or more of the sawlog-size trees have been cut, but in which the remaining sawtimber contains at least 400 board feet per acre.

Second-growth under-sawlog-size.--Second-growth stands composed predominantly of under-sawlog-size trees at least 1.0 inch d.b.h., and with less than 600 board feet of sawtimber per acre.

Reproduction.--Areas not falling into any of the other classifications and bearing per acre more than 80 seedlings less than 1 inch d.b.h.

Clear-cut.--Cut-over areas on which an insufficient quantity of young growth has come in to classify them either as second growth or as reproduction.

FORFOREST SURVEY RELEASE NO. 30 FEBRUARY 10, 1938

SAWTIMBER AND CORDWOOD VOLUMES IN NORTH GEORGIA

A Progress Report

by

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

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This release contains Forest Survey data that will be included in complete reports to be published later. It should therefore be regarded as a progress report. Although considered reliable, the data are subject to correction or amplification as the work of computation proceeds.

Staff Assignment

Preparation of Report
W. S. Stover - Assistant Forest Economist

In Charge of Field Work
E. B. Faulks - Associate Forest Economist
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In Charge of Computations
P. R. Wheeler - Associate Forest Economist

SAWTIMBER AND CORDWOOD VOLUMES IN NORTH GEORGIA

This report deals with a group of 21 counties in north Georgia with a total land area of 4,267,500 acres (see accompanying map). The land-use and forest data given in this release were obtained by the Forest Survey in its forest inventory made the latter part of 1935, but the information concerning forest industries was obtained as recently as 1937.

Into the northeast corner of this Survey unit extends the southern end of the Appalachian Mountains, which rise sharply from the valleys on the west and from the Piedmont Plateau on the southeast. The highest point, Brasstown Bald, on the boundary between Union and Towns Counties, is 4,768 feet above sea level; and a number of other peaks rise above 4,000 feet. The Piedmont varies from rugged at the foot of the mountains to broadly rolling in the southeastern and south-central parts of the unit. The "Valley," as it is called locally, occupies most of the western part of the unit, and although it lies at a lower elevation than the surrounding country, it is composed of a succession of minor valleys separated by ridges or low mountains. In the northwest corner, in Dade County and parts of Walker and Chattooga, are two broad, flat-topped ranges that form part of the Lookout Plateau.

The greater part of the highlands is included in the Chattahoochee National Forest. This national forest includes within its boundaries 1,165,000 acres, of which 514,777 are under Federal ownership and administration or in process of acquisition. It was organized out of those parts of the Cherokee and Nantahala National Forests which lay in Georgia and which were established for watershed-protection purposes under the Weeks Law of 1911; these areas were subsequently extended under the Clarke-McNary Law of 1924, which authorizes the purchase of land by the Federal Government for purposes of timber production as well as for watershed protection. Two additional national-forest purchase areas, totaling 393,000 acres have been located in this portion of the State, one east and northeast of Summerville in the Valley, and the other on Lookout Plateau.

The climate in this portion of Georgia is characterized by moderate summers and mild winters. The sweep of moisture-laden winds from the Gulf of Mexico and from the Atlantic Ocean against the mountains is the cause of a large annual rainfall — upward from 60 inches at Dahlonega, Rabun, and Clayton. Drainage is through the Tennessee, Coosa, Chattahoochee, and Savannah Rivers or their tributaries.

Most of the principal cities and towns, of which Rome is the largest (1930 pop. 21,843), are situated in or near the Valley. The principal activities are agriculture, textile manufacture, mining, and the production of lumber and other wood products. This section is served by the lines of seven railroads: the Louisville and Nashville; the Southern; the Nashville, Chattanooga, and St. Louis; the Central of Georgia; the Tennessee, Alabama, and Georgia; the Tallulah Falls; and the Seaboard Air Line. There are approximately 500 miles of paved or surface-treated highways in the unit, as well as a much greater mileage of secondary roads.

As shown in table 1, two-thirds of the land area in this portion of the State is given over to forest growth, which in general, occupies the steeper slopes; while practically all of the agricultural land is in the valleys or on the gentle or moderate slopes. Of the 34 percent of the combined forest and agricultural area that is level or has a gentle slope, only slightly more than one-third is in forest; of the 38 percent that has a moderate slope, three-quarters is in forest; and of the 28 percent that has steep slopes, 98 percent is occupied by forest growth.

Table 1. -- Land area classified according to use

Land use	Area		Portion of total area	
	- - - - - Acres - - - -		Percent	
Forest		2,835,300		66.4
Agriculture:				
In cultivation:				
Old cropland	932,100		21.8	
New cropland	22,700		.5	
Out of cultivation:				
Idle	156,400		3.7	
Abandoned	84,400		2.0	
Improved pasture	152,500		3.6	
Total agriculture		1,348,100		31.6
Other areas		84,100		2.0
Total land area		4,267,500		100.0

Description of the Forest

The pines and hardwoods are represented almost equally in the forests of north Georgia. As shown on the map, pine and mixed pine-hardwood forests are more or less characteristic of the entire area. Pure hardwood stands are confined largely to the upper slopes of the higher mountains and to stream bottoms. Shortleaf pine is the most common coniferous species, but loblolly pine and Virginia pine are also widely distributed. Less common conifers here are longleaf pine, northern white pine, mountain pine, pitch pine, hemlock, and cedars.

Of the hardwoods, oaks and hickories occur generally, while yellow poplar, gums, and maple are common in stream bottoms, on lower slopes, and in sheltered coves. Less frequently found hardwoods include black locust, elm, ash, basswood, and beech. Most of the chestnut trees, formerly common in the mountains, have been killed out by the chestnut-blight disease. The best stands of hardwood timber usually occur in coves on the north sides of ridges, where moisture, temperature, and soil conditions are more favorable to growth; while the tops of the higher ridges are often occupied by more or less stunted stands of hardwoods of low economic value.

In table 2, in which the forest area of the region is classified according to forest type-group and forest condition, it will be observed that second growth occupies by far the largest part of the forest area--87 percent.

Table 2. -- Forest area classified according to forest condition and forest type-group

Forest condition	Forest type-group			Total all types	Percent of total
	Pine	Pine-hardwoods	Hardwoods		
	Acres				
Old growth:					
Uncut	36,800	23,400	138,400	198,600	7.0
Partly cut	36,700	20,400	94,600	151,700	5.4
Total	73,500	43,800	233,000	350,300	12.4
Second growth:					
Sawlog size:					
Uncut	510,600	192,400	331,500	1,034,500	36.5
Partly cut	165,800	71,100	82,900	319,800	11.3
Under sawlog size:					
Uncut	252,500	282,300	355,000	889,800	31.3
Partly cut	43,000	49,300	57,100	149,400	5.3
Reproduction	47,000	25,800	10,900	83,700	2.9
Total	1,018,900	620,900	837,400	2,477,200	87.3
Clear-cut	4,700	1,500	1,600	7,800	.3
Total all conditions	1,097,100	666,200	1,072,000	2,835,300	100.0
Percent of total	38.7	23.5	37.8	100.0	

Volume Estimates

In showing the volume of the forest inventory in this Survey unit, two estimates are given: (1) the board-foot contents of the stand of sound sawlog-size trees, as measured by the Doyle log rule; and (2) the cubic volume of all trees 5.0 inches or more in diameter at breast height (d.b.h.) outside bark, including the trees covered in the board-foot estimate. 1/ Both estimates are net, that is, allowance has been made for material that would be left in the woods because of rot, fire-scar, crook, limbiness, and similar defects. In the sawtimber estimates, allowance has also been made for mill cull. Because the chestnut has been ravaged by the blight and very few trees of this species remain alive, chestnut is not included in either the board-foot or cordwood estimates, but a rough estimate of its sound volume is given in the discussion on cordwood.

The sawtimber stand of the unit, shown in table 3, totals over $3\frac{1}{4}$ billion board feet (Doyle), of which about 2 billion feet is pine and $1\frac{1}{4}$ billion feet is hardwood. Second-growth stands contain 81 percent of the pine and 55 percent of the hardwood sawtimber.

Table 4 shows the total volume of sound material in both sound and cull trees, expressed in standard (4 x 4 x 8 feet) cords. Of the total (35 million cords), 28 million cords are in good trees, almost equally divided between the pines and hardwoods. Oaks and hickories make up a large portion of the hardwood volume, while less than one-sixth is in species considered suitable for pulping (i.e., yellow poplar, gums, maple, basswood, etc.). Of the 7 million cords of sound material in cull trees, the greater portion is in hardwood species. In addition to the volume shown in table 4, it is estimated that there are 2-3/4 million cords of sound chestnut in this unit, the major portion of which is in dead trees.

Average-Acre Volumes

Table 5 shows the cordwood volume on the average acre of each forest type-group and forest condition. This volume is a mathematical average derived by dividing the volume in the forest stands in each classification by the total number of acres. This table thus provides a means of comparing the different type-groups with respect to species composition, diameter distribution, and average density. It consequently offers a means of determining the approximate cordwood volumes on large areas in this unit, if the areas in the various type-groups and forest conditions have been determined.

1/ In arriving at the above estimates, four general classes of live trees were recognized: (1) sound sawlog-size trees, (2) sound under-sawlog-size trees, (3) sound cull trees, and (4) rotten cull trees. Only the first group is included in the sawtimber estimate. A sound sawlog-size tree is defined as a pine 9.0 or more inches, or a hardwood 13.0 or more inches d.b.h. (outside bark) that contains at least one usable 12-foot log and that will yield at least 50 percent of its gross volume in sound material; a sound under-sawlog-size tree is one that gives promise of becoming a sawtimber tree; a sound cull tree is one that is not, or will not become, a sawtimber tree, owing to poor form, crook, knots, extreme limbiness, or other similar defects; while a rotten cull tree is one not sufficiently sound for it to be placed in any of the other classifications.

Table 3. -- Net sawtimber volume (Doyle scale)

Species-group	Forest condition		Total
	Old growth	Second growth	
	- - - Thousand feet board measure - - -		
Shortleaf pine[1/]	223,000	960,600	1,183,600
Loblolly and longleaf pines	48,100	424,800	472,900
Virginia pine	28,900	190,100	219,000
White pine	23,900	106,500	130,400
Hemlock and cedars	74,200	9,300	83,500
Total conifers	398,100	1,691,300	2,089,400
Yellow poplar	78,200	78,400	156,600
Gums, red maple, basswood, cucumber magnolia, etc.	35,700	54,200	89,900
Northern red oak	74,300	44,100	118,400
Other red oaks	103,900	271,000	374,900
White oak	83,900	73,700	157,600
Chestnut oak	99,800	79,200	179,000
Hickory	62,500	58,900	121,400
Elm, hard maple, ash, beech, etc.	17,700	21,100	38,800
Total hardwoods	556,000	680,600	1,236,600
Total all species	954,100	2,371,900	3,326,000

1/ Includes mountain and pitch pine.

Table 4. -- Net cordwood volume of pulping and nonpulping species

Species-group	Good trees			Sound and rotten culls	Total	Percent of total
	Under 13 inches d.b.h.	13 inches and larger d.b.h.				
		Sawlog material	Tops and limbs 1/			
	Cords					
Conifers:						
Shortleaf pine	6,768,700	1,795,500	166,800	252,200	8,983,200	25.5
Longleaf & loblolly pines	1,474,000	1,060,900	88,300	209,800	2,833,000	8.0
Virginia pine	1,377,200	395,700	58,200	433,200	2,264,300	6.4
White pine, hemlock & cedar	196,600	520,700	42,300	19,400	779,000	2.2
Total conifers	9,816,500	3,772,800	355,600	914,600	14,859,500	42.1
Pulping hardwoods:						
Yellow poplar	458,600	514,500	300,900	142,000	1,416,000	4.0
Gums, red maple, basswood, cucumber magnolia, etc.	503,400	326,800	182,600	686,100	1,698,900	4.8
Total pulping hdwds.	962,000	841,300	483,500	828,100	3,114,900	8.8
Nonpulping hardwoods:						
Oak, hickory, elm, hard maple, ash, beech, etc.	6,291,400	3,601,000	2,091,100	5,330,700	17,314,200	49.1
Total all hardwoods	7,253,400	4,442,300	2,574,600	6,158,800	20,429,100	57.9
Total all species	17,069,900	8,215,100	2,930,200	7,073,400	35,288,600	100.0
Percent of total	48.4	23.3	8.3	20.0	100.0	

1/ Includes tops only of pines but tops and limbs of hardwoods.

Table 5. -- Net cordwood volume on an average acre, classified by forest type-group, species-group, and forest condition

Forest type- and species-group	Old growth		Second growth					Clear-cut	All conditions (weighted averages)
			Sawlog size		Under sawlog size		Reproduction		
	Uncut	Partly cut	Uncut	Partly cut	Uncut	Partly cut			
	Cords								
Pine type-group:									
Pines	14.0	10.9	13.9	10.8	4.0	3.7	.1	.4	10.0
Pulping hardwoods	.2	.1	.3	.2	-	-	-	.2	.2
Nonpulping hardwoods	1.5	1.7	1.7	1.2	.2	.5	.1	.1	1.1
All species	15.7	12.7	15.9	12.2	4.2	4.2	.2	.7	11.3
Pine-hardwood type-group:									
Pines	8.7	6.4	6.3	4.6	1.9	1.6	.1	-	3.8
Pulping hardwoods	.6	.7	.8	1.2	.4	.3	-	.6	.6
Nonpulping hardwoods	4.5	4.7	4.2	4.6	1.9	1.6	.1	.4	2.9
All species	13.8	11.8	11.3	10.4	4.2	3.5	.2	1.0	7.3
Upland hardwood type-group:									
Pines	.6	.6	.4	.5	.3	.3	-	-	.4
Pulping hardwoods	1.4	1.1	.7	.6	.4	.2	.2	-	.7
Nonpulping hardwoods	8.8	8.0	7.1	6.4	4.5	4.8	.2	-	6.2
All species	10.8	9.7	8.2	7.5	5.2	5.3	.4	-	7.3
Bottomland hardwood type-group:									
Pines	3.8	1.0	.6	.9	.2	.2	-	-	1.1
Pulping hardwoods	8.0	6.5	7.8	3.2	3.2	.6	-	-	5.7
Nonpulping hardwoods	8.0	8.5	7.5	4.1	2.8	7.5	-	-	6.1
All species	19.8	16.0	15.9	8.2	6.2	8.3	-	-	12.9
All types (weighted averages):									
Pines	4.3	3.9	8.2	6.8	1.8	1.7	.1	.3	4.9
Pulping hardwoods	1.6	1.2	.7	.6	.4	.2	-	.2	.6
Nonpulping hardwoods	6.9	6.1	3.9	3.2	2.4	2.5	.1	.1	3.5
All species	12.8	11.2	12.8	10.6	4.6	4.4	.2	.6	9.0

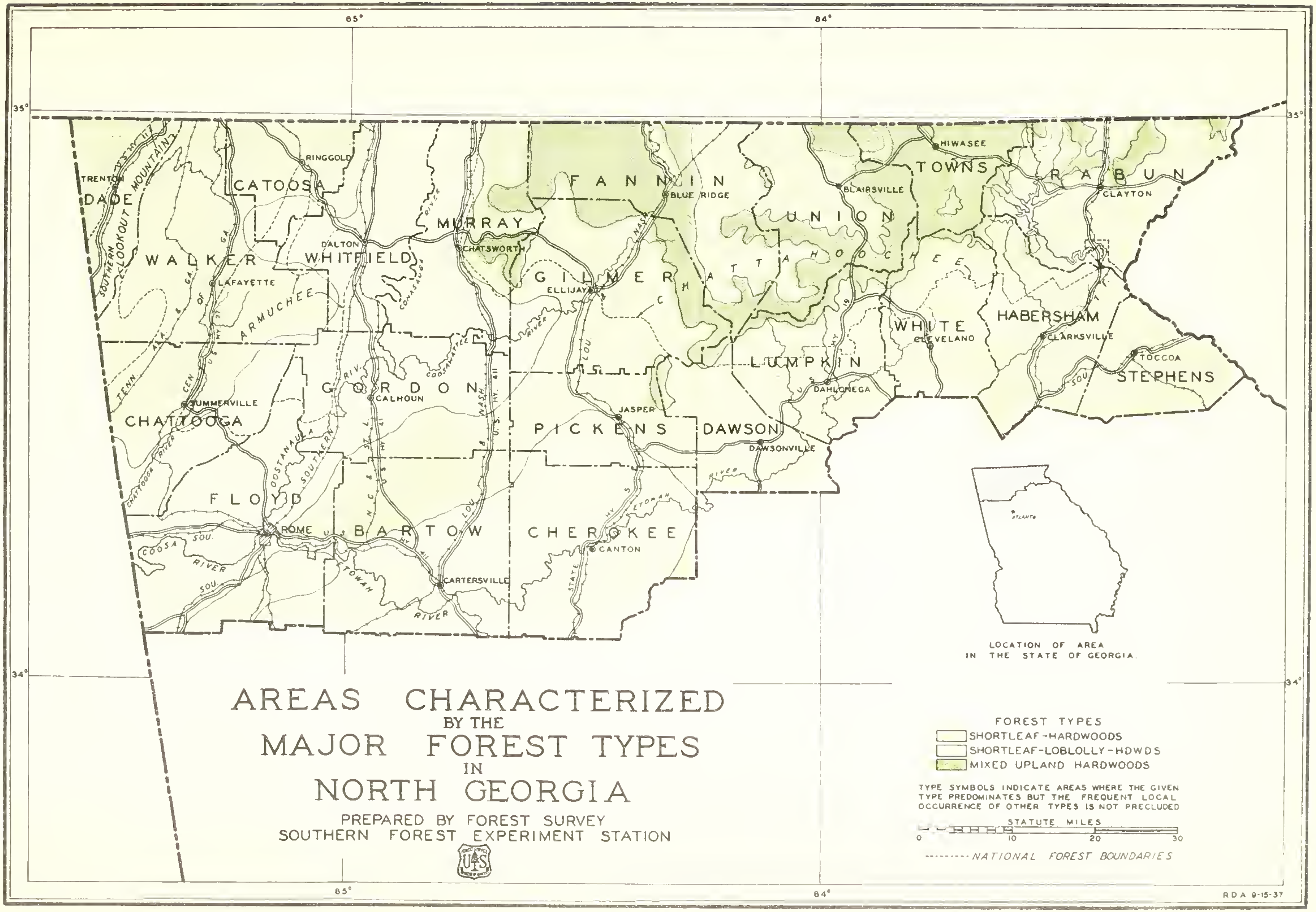
Forest Industries

In the early part of 1937, the forest industries in this portion of the State included 345 small sawmills and 11 establishments producing staves, heading, package veneer, or shuttle-blocks. In addition, a pulp mill at Canton, North Carolina, draws pulpwood from the area. A fairly large volume of logs goes into the production of railroad cross ties within the area, while a smaller volume of logs, bolts, and tan-bark is produced for nearby plants in Tennessee and North Carolina. The sawmills were cutting principally pine, which is also used for pulpwood, heading, veneer, and cross ties. The hardwoods, principally oak and poplar, with lesser amounts of gum, hickory, ash, and dogwood, are cut for lumber, cross ties, veneer, handle stock, and cooperage. The use of wood for fuel and for farm purposes also accounts for a considerable consumption of wood in this section.

The activities of individual forest-products establishments or timber operators in north Georgia are usually on a comparatively small scale. Many of the operations are intermittent and designed to utilize slack periods in farming, which is frequently on a subsistence basis. Since many farmers are dependent upon such work for supplementary income, this is one of many reasons why it is important that the forest lands of this section be maintained in a productive condition. Also on a considerable portion of these forest lands, the establishment and maintenance of a full cover of vegetation for the protection of water sheds, for the prevention of erosion, and for the regulation of stream-flow is fully as important as (or even more important than) the production of timber.

That there is a general need for improvement in the forest stands in this portion of the State is indicated by the fact that most of the present stands include a high proportion of material that is suited only for low-grade lumber, cross ties, and fuelwood, or for similar products of low value. The prevailing cutting practices usually give little or no thought to maintaining the growing stock, much less to increasing it, and have even reduced the volume per acre as well as the average size and quality of the trees available for cutting. What is most needed in this section, as in most parts of the Lower South, is better woodland management, in which the owner will improve his stands by the removal of cull trees, slow-growing trees, and trees of inferior species, and will practice good business judgment in holding his sound trees of good species to grow to sizes that produce higher values. Better fire protection is also much needed. All these measures together would gradually and appreciably increase the sustained-yield possibilities of the area in regard to both the volume and the quality of material that might be cut.

On the Chattahoochee National Forest these improved management and cutting practices have already produced excellent results, but on the majority of privately owned forest lands comparatively little has yet been done to make the continuous production of forest crops the profitable business it might be. With their favorable natural conditions and proximity to the growing industrial regions of the Southeast, there is no reason why the forest lands of north Georgia should not repay the intensive efforts necessary to develop their full possibilities.


AREAS CHARACTERIZED
BY THE
MAJOR FOREST TYPES
IN
NORTH GEORGIA
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FOREST TYPES
SHORTLEAF-HARDWOODS
SHORTLEAF-LOBLOLLY-HDWDS
MIXED UPLAND HARDWOODS
TYPE SYMBOLS INDICATE AREAS WHERE THE GIVEN TYPE PREDOMINATES BUT THE FREQUENT LOCAL OCCURRENCE OF OTHER TYPES IS NOT PRECLUDED
STATUTE MILES
0
10
20
30
NATIONAL FOREST BOUNDARIES
LOCATION OF AREA IN THE STATE OF GEORGIA
ATLANTA
85°
84°
35°
34°
DADE
WALKER
CATOOSA
WHITFIELD
MURRAY
FANNIN
UNION
TOWNS
RABUN
GILMER
CHATTAHOOCHEE
WHITE
HABERSHAM
STEPHENS
LUMPKIN
DAWSON
PICKENS
GORDON
CHATTOOGA
FLOYD
BARTOW
CHEROKEE
TRENTON
RINGGOLD
DALTON
LAFAYETTE
CHATSWORTH
ELLIJAY
BLUE RIDGE
BLAIRSVILLE
HIWASEE
CLAYTON
CLEVELAND
CLARKSVILLE
TOCCOA
DAHLONEGA
DAWSONVILLE
JASPER
CALHOUN
SUMMERVILLE
ROME
CARTERSVILLE
CANTON
LOOKOUT MOUNTAIN
ARMUCHEE
RDA 9-15-37

FOREST SURVEY RELEASE NO. 31 MARCH 12, 1938

FOREST RESOURCES OF NORTHWEST LOUISIANA

A Progress Report

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Staff Assignment

In Charge of Field Work and Preparation of Report
James W. Cruikshank - Associate Forest Economist

In Charge of Computations
P. R. Wheeler - Associate Forest Economist

FOREST RESOURCES OF NORTHWEST LOUISIANA

General Description of the Unit

The production of forest commodities is a leading factor in the land economy of northwest Louisiana, where over 62 percent of the area is classified as forest. The forests of the uplands are a mixture of shortleaf and loblolly pines with hardwoods, while the bottomlands along the rivers and larger bayous support a mixture of oaks, gums, cypress, and other species. Including a large proportion of the "hill parishes" of Louisiana, the territory covered in this report consists of 11 complete and 4 partial parishes in the northwest corner of the State, totaling 6,142,000 acres (map, fig. 3). The alluvial delta of the Mississippi borders the unit on the east, while the southern boundaries of DeSoto, Red River, Winn, and Caldwell Parishes mark its southern limits. Shreveport, the largest city of the unit, is an important trading and manufacturing center, as is Monroe, on the Ouachita River just outside the eastern boundary of the unit. Agriculture and forest industries are the chief activities of the rural population. Development of new oil fields, like the one at Rodessa, has caused marked increases in the industrial activity of certain localities.

The unit, which is entirely within the Gulf Coastal Plain, consists of rolling country sloping slightly toward the southeast. Elevations range from 50 to 400 feet above sea level. The Red River with its tributaries drains the western and southern parts of the unit, while several large bayous flowing into the Ouachita River drain the northern and eastern portions. All of these streams flow south or southeastward. Owing to the nature of the soil, the rolling topography, and the abundant rainfall, sheet erosion is a serious problem on much of the agricultural upland. Rainfall averages about 50 inches per year, with the wettest months in the winter season. The winters are short and mild, the summers long and warm.

Seven main railroad systems cross the area, and several secondary lines connect these with outlying points. In recent years paved highways have been constructed throughout the area, so that at present few points exist that are not readily available to motor transportation. Barges operate on the Ouachita River along the eastern boundary of the unit, and the Red River is classified by the U. S. Engineers as navigable, during the first 6 months of the year, to small craft drawing less than 4 feet of water.

The population, which was 394,000 in 1930, has increased 62 percent since 1900. Seventy-two percent of the population live on farms or in small towns. Of the people employed 51 percent are in agriculture, a large proportion of whom are also employed in the forest industries. Caddo Parish has the largest population and has shown the most rapid increase in recent years.

Agriculture is conducted in this unit on many small farms, scattered throughout the second-growth forest stands. The chief exception is in the Red River bottom, where there are several cotton plantations each of which is a few thousand acres in extent. In 1935 there was in the unit a total of 50,000 farms, containing approximately 3,200,000 acres. The average farm contains 33 acres available for crops, 24 acres of forest land, and 7 acres of nonforested pasture. The number of farms decreased by 1.4 percent between 1930 and 1935, but the area in farms increased nearly 300,000 acres during the same period. Apparently most of this increase in farm area remained in forest, since land available for crops increased less than 10,000 acres. On the basis of the Forest Survey classification, 178,300 acres of agricultural land were standing idle, and 57,000 were definitely abandoned. General crops are grown, such as cotton, corn, hay, sweet and Irish potatoes, sugar cane, and oats. Cattle are produced on practically every farm. The average value of the individual farm in 1935 was $1,344; and the average value per acre, including both forested and cleared land, ranged from $47.64 in Caddo Parish to $11.88 in Union Parish.

Farms, with their included forest land, occupy 52 percent of the area of the unit. These farms are in the hands of 50,000 operators, 33 percent of whom are full or part owners, while 67 percent are tenants. Large land holdings by lumber and paper companies are common in this unit, where at least 12 individual companies hold more than 100,000 acres each.

Tax delinquency is not as serious a problem in this unit as in some other sections of Louisiana. Data collected by the State Land Planning Consultant of the National Resources Board show that, as of November 1934, the State held lien to 9.0 percent of the area for non-payment of taxes. Since new oil discoveries are being made in the unit, it can be expected that delinquency will be even further reduced, as anticipated oil production and revenue from leases furnish an incentive to retain the land with a clear title. In general, cut-over forest land stocked to second growth is assessed for taxes at $2.00 to $9.00 per acre, with tax rates varying from about 15 to 45 mills.

Table 1. - Land area classified according to land use

Land use	Area		Proportion of total area	
	Acres		Percent	
Forest:				
Productive	3,826,400		62.3	
Nonproductive	15,300		0.2	
Total forest		3,841,700		62.5
Nonforest:				
Agricultural:				
In cultivation:				
Old cropland	1,532,000		25.0	
New cropland	111,700		1.8	
Out of cultivation:				
Idle	178,300		2.9	
Abandoned	57,000		0.9	
Pasture	226,600		3.7	
Total agricultural	2,105,600		34.3	
Other nonforest	194,700		3.2	
Total nonforest areas		2,300,300		37.5
Total forest and nonforest		6,142,000		100.0

Description of the Forest

A large proportion of the forest area is in a hilly or rolling region, characterized by the reddish brown soils of the Orangeburg and Ruston series. Nearly 72 percent of the forest area is in rolling uplands, 11 percent in river bottoms, and 17 percent in swamps and low flats along the streams. The main forest stands, occupying 63 percent of the forest area, are second growth of the usual pure pine and pine-mixed hardwood association of the Upper Coastal Plain, with loblolly and shortleaf the predominant pines. Extending about 40 miles northwest from Winnfield (see fig. 3) is a narrow belt of longleaf pine, most of which has been cut over recently and has not restocked entirely. The bottomland hardwood types, also largely second growth, which occur along the Red and the Ouachita Rivers as well as along many of the smaller streams and bayous, occupy 20 percent of the forest area. Red gum, red and white oaks, black gum, and cypress, are the characteristic species of this type-group. The upland hardwood types, found on approximately 12 percent of the forest area, are closely intermingled with the pine-hardwood stands and seldom occur unbroken over any extensive area. Red and white oaks, red gum, and hickory, which are the common species in this type-group, are generally of much poorer quality than when found in the bottomlands.

Table 2. - Forest area classified according to forest condition and forest type-group

Forest condition	Shortleaf and loblolly 1/	Shortleaf-loblolly-hdwds. 2/	Upland hardwoods	Bottom-land hardwoods	Total all types	Proportion of total
	Acres					Percent
Old growth:						
Uncut	26,500	34,600	54,600	118,900	234,600	6.1
Partly cut	37,000	49,000	52,200	128,500	266,700	7.0
Total	63,500	83,600	106,800	247,400	501,300	13.1
Second growth:						
Sawlog size:						
Uncut	663,600	365,500	76,300	184,800	1,290,200	33.7
Partly cut	431,400	343,000	118,900	141,400	1,034,700	27.1
Under sawlog size	237,800	302,900	140,700	183,100	864,500	22.6
Reproduction	18,500	30,500	32,900	18,500	100,400	2.6
Total	1,351,300	1,041,900	368,800	527,800	3,289,800	86.0
Clear-cut	31,300	800	1,600	1,600	35,300	0.9
Total all conditions	1,446,100	1,126,300	477,200	776,800	3,826,400	100.0
Percent of total forest area	37.8	29.4	12.5	20.3	100.0	

1/ Includes 75,500 acres of longleaf types.
2/ Includes 6,400 acres of longleaf-hardwood type.

In "pure" pine types, the pine component makes up 85 percent of the net cubic volume of the stand, while in the pine-mixed hardwood types the pine is only 48 percent of the total. Red gum and red and white oaks account for 58 percent of the net cubic volume in the bottomland hardwood types, but black gum, cypress, ash, hickory, and some loblolly pine are also found. An analysis of the net cubic volume on the total forest area reveals that loblolly pine, accounting for 30 percent of the total, is the leading species. Other important species rank as follows: shortleaf, 23 percent; red gum, 12 percent; red oaks, 9 percent; white oaks, exclusive of post oaks, 6 percent.

As shown in table 2, forest stands classified as old growth occupy 13.1 percent of the total forest area. As in many other Survey units, a large portion of the old-growth area is in the bottomland hardwood types; and of the total area in bottomland hardwoods, 31.8 percent is in the old-growth condition. That the forest is predominately young is evidenced by the fact that 86.0 percent of the forest area, all types included, bears second-growth timber, of which nearly one-third is in the under-sawlog and reproduction conditions. Clear-cut forest land, found chiefly in the pure pine types, occurs on less than 1 percent of the forest area.

The basal area of the average acre in the pine-hardwood association is shown by diameter-classes in figure 1. It is apparent that the 8- and 10-inch

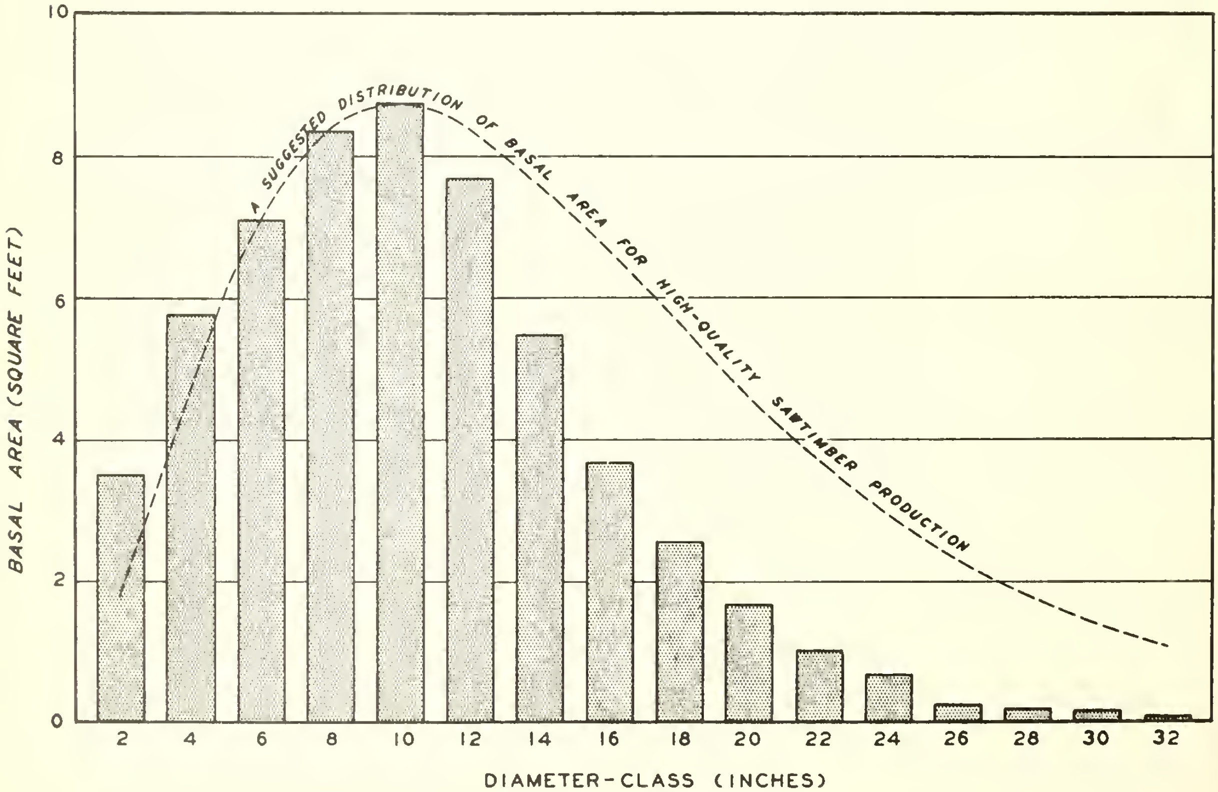


FIGURE 1.- PRESENT BASAL AREA ON THE AVERAGE ACRE IN THE PINE AND PINE-HARDWOOD TYPES WITH A SUGGESTED DISTRIBUTION FOR HIGH-QUALITY TIMBER PRODUCTION

trees make up a high proportion of the basal area on the acre, while trees in the larger diameter-classes, where quality and volume produce greater financial returns, are relatively scarce. This deficiency in larger trees is brought out by the curved line in the chart which represents a suggested desirable distribution of basal area, assuming that high-grade sawtimber is to be the object of management. This suggested curve does not attempt to represent the maximum basal area obtainable but rather indicates a forest stand well within the possibilities of the present forest, if it were given reasonably good management for the next 30 to 40 years.

A summation of the number of trees by diameters, all species combined, shows that about 52 percent of the stems are in the 2-inch diameter-class, and that 88 percent are less than 9 inches in diameter. Only 8 percent of the trees are large enough for sawtimber, if 13.0 inches for hardwood and 9.0 inches for pine are considered as minimum diameters.

Figure 2 is a graphic representation of the age-classes in the forest stand in the pine and pine-hardwood types. In this figure the horizontal axis at the bottom represents the total area in these types, divided to represent the proportionate area in the various age-classes. Predominant in area are the stands between 20 and 60 years of age, while stands over 70 years old are found on only a little more than 5 percent of the pine and pine-hardwood areas. The line formed by the upper limit of the shaded area represents the volumes per acre of average stands of various ages. The declining volume from 40 to 60 years is believed to be a result of partial cutting in the past and probably does not truly delineate the volume possibilities of an undisturbed stand. The shaded area denotes the cubic volume in stands within a

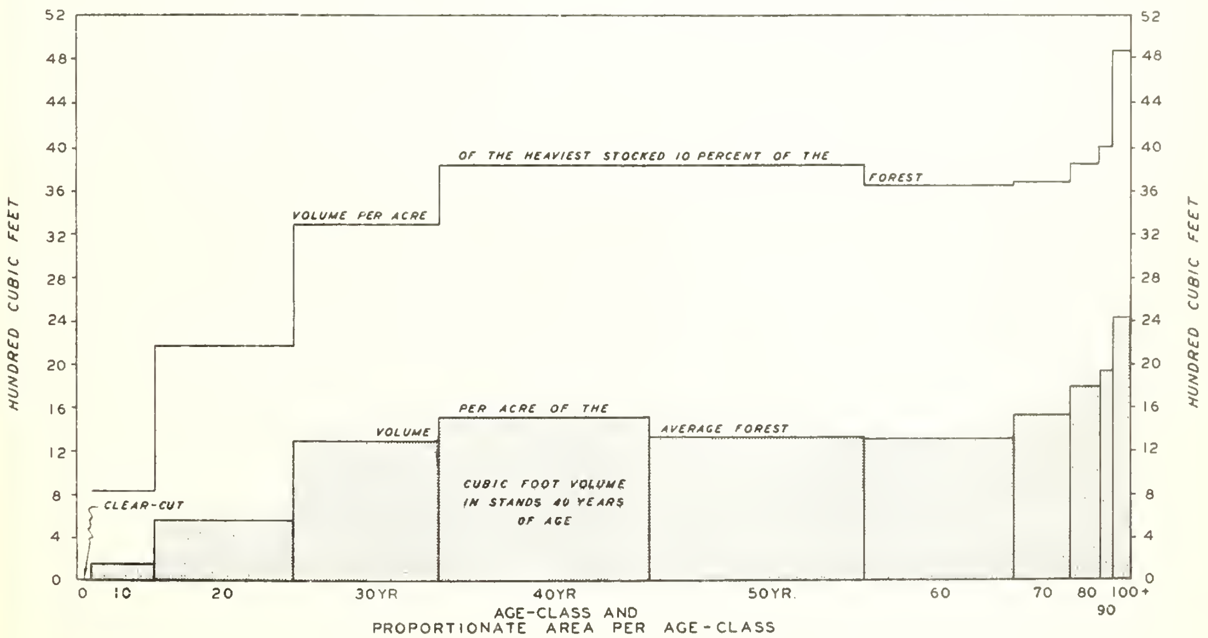


FIGURE 2.- AREA DISTRIBUTION OF AGE-CLASSES AND COMPARISON OF THE VOLUMES IN AVERAGE AND HEAVIEST STOCKED STANDS IN THE VARIOUS AGE-CLASSES

given age-class; and it is significant that a very minor proportion of the total cubic volume on the area is in stands above 70 years of age. The upper line represents the volume per acre attained at various ages by the best 10 percent of the stand and affords some measure of the wide field for improvement in stocking to be obtained by bringing the present under-stocked average stands up to the stocking achieved by the better stands. If it is assumed that the best 10 percent of the stand represents normal stocking, the average stand in the pine and pine-hardwood types is only 40 percent stocked.

Volume Estimates

Board-foot volume

In the estimates given in table 3, the stand of sound sawlog-size trees is expressed in terms of board feet as measured by the Doyle log rule. The volumes are net log scale, that is, allowance has been made for material that would be left in the woods because of rot, fire scar, crook, limbiness, and similar defects, as well as for loss in sawing at the mill due to sweep and hidden defects.

To be classified as sawlog-size trees, hardwoods must have a minimum d.b.h. (diameter at breast height) of 13 inches, and pines of 9 inches; also they must contain one sound butt log at least 12 feet long, or have at least 50 percent of their gross volume in sound material. The volume of the stem is included to the upper limit of usable material in the tops rather than to a fixed top-diameter, but no pine logs less than 5.5 inches in diameter, inside bark at the small end, or any hardwood logs less than 8.5 inches, are included.

The total board-foot volume by the Doyle rule is 7½ billion feet, nearly 99 percent of which is found in sufficient volume per acre (at least 400 board feet) to be classified as sawtimber stands. These stands occupy 74 percent of the forest area and average 2,600 board feet per acre.

Accessibility, as related to transportation and logging conditions, is not a restricting factor in utilization of the forest stands in this unit, as indicated by the fact that 94 percent of the forest area has already been logged over with varying degrees of intensity. With the rapid liquidation of the present old-growth stands, in only a few years the accessibility of all parts of the area will have been demonstrated.

About 30 percent of the total sawtimber volume is found in the old-growth condition. Only 17 percent of the pine volume occurs in this condition, however, as compared with 45 percent of the hardwood volume. In the old-growth uncut condition, the average stand per acre in the pure pine types is 12,700 board feet (lumber tally), in the shortleaf-loblolly-hardwood types 8,900 feet, in the upland hardwood types 3,200 feet, and in the bottomland hardwood types 6,900 feet.

The second-growth stands occupy 86 percent of the forest area and contain about 70 percent of the total sawtimber volume. In the second-growth sawlog-size uncut stands, the pure pine types average 5,200 board feet per acre (lumber tally), while the shortleaf-loblolly-hardwood types average 3,900 feet. The upland hardwood types of a similar condition average 2,200 feet, and the bottomland hardwood 3,300 feet.

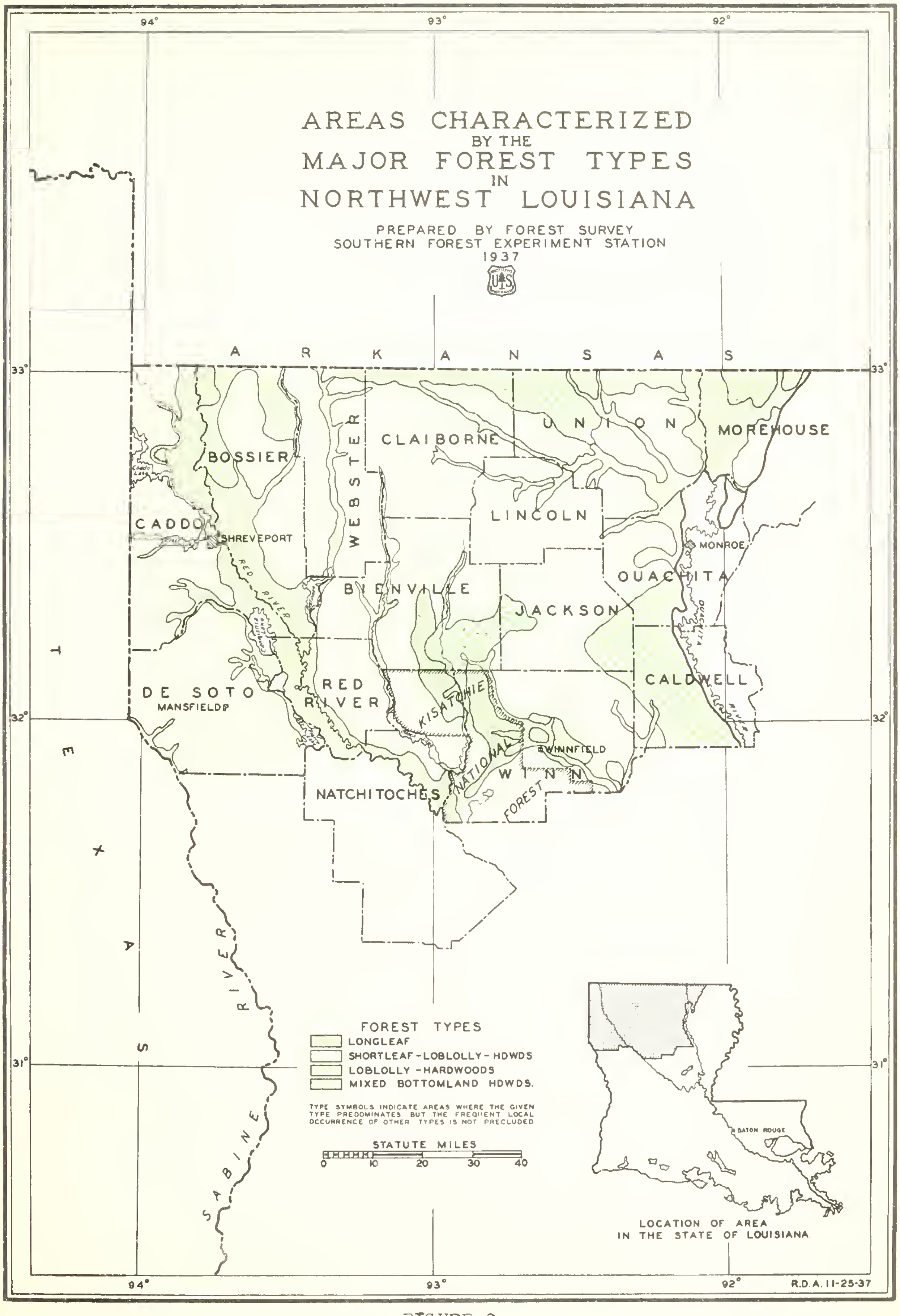

AREAS CHARACTERIZED
BY THE
MAJOR FOREST TYPES
IN
NORTHWEST LOUISIANA
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
1937
94°
93°
92°
33°
32°
31°
ARKANSAS
TEXAS
BOSSIER
CADDO
SHREVEPORT
WEBSTER
CLAIBORNE
UNION
MOREHOUSE
LINCOLN
MONROE
OUACHITA
BIENVILLE
JACKSON
RED RIVER
DE SOTO
MANSFIELD
CALDWELL
KISATCHIE NATIONAL FOREST
WINNFIELD
WINN
NATCHITOCHES
SABINE RIVER
FOREST TYPES
LONGLEAF
SHORTLEAF-LOBLOLLY-HDWDS
LOBLOLLY-HARDWOODS
MIXED BOTTOMLAND HDWDS.
TYPE SYMBOLS INDICATE AREAS WHERE THE GIVEN TYPE PREDOMINATES BUT THE FREQUENT LOCAL OCCURRENCE OF OTHER TYPES IS NOT PRECLUDED
STATUTE MILES
0 10 20 30 40
BATON ROUGE
LOCATION OF AREA
IN THE STATE OF LOUISIANA
R.D.A. 11-25-37

FIGURE 3.

An analysis of the upland hardwood types, all forest conditions combined, shows that stands containing 1,000 or more board feet per acre are found in 53 percent of the type area. In the bottomland hardwood types, however, the stands are heavier; here 71 percent of the total area has a volume of at least 1,000 feet per acre.

Table 3. - Net volume (Doyle) classified according to species-group and forest condition

Species-group	Old growth: Uncut	Old growth: Partly cut	Second growth: Sawlog size	Second growth: Under sawlog size 1/	Total	Proportion of total
	- - - - - - - - - Thousand board feet			- - - - - - - -		Percent
Pines:						
Longleaf	-	46,300	27,400	1,700	75,400	1.0
Shortleaf	154,900	140,800	1,239,800	22,400	1,557,900	20.8
Loblolly	232,900	124,800	2,027,000	28,400	2,413,100	32.2
Total pines	387,800	311,900	3,294,200	52,500	4,046,400	54.0
Pulping hardwoods:						
Red gum	178,600	137,800	464,500	7,000	787,900	10.5
Black and tupelo gum	75,600	43,500	192,000	2,600	313,700	4.2
Others 2/	64,300	30,600	107,200	2,700	204,800	2.7
Nonpulping hardwoods:						
Red oaks	145,200	159,700	390,500	13,300	708,700	9.5
White oaks	244,000	138,500	232,900	10,800	626,200	8.4
Post oak	45,800	60,800	193,100	9,000	308,700	4.1
Ash	10,700	9,400	17,400	1,100	38,600	0.5
Hickory	25,100	27,900	111,400	3,200	167,600	2.2
Others	83,900	57,300	146,400	3,300	290,900	3.9
Total hardwoods	873,200	665,500	1,855,400	53,000	3,447,100	46.0
Total all species	1,261,000	977,400	5,149,600	105,500	7,493,500	100.0
Percent of total	16.8	13.1	68.7	1.4	100.0	

1/ Includes areas classified as reproduction and clear-cut.
2/ Includes cypress, bay, maple, cottonwood, and willow.

The Doyle rule has been used for the board-foot volume in table 3 because it is in general use throughout the South. Its chief weakness lies in underscaling the contents of trees less than 36 to 40 inches in diameter (if cut into 1-inch lumber), and trees of this size make up practically all of the sawtimber in this unit.

To arrive at an estimate closely approximating lumber tally, the volume is expressed in table 4 in the International $\frac{1}{4}$-inch kerf scale — a much more correct measure of the actual sawtimber contents of these stands than the Doyle.

Table 4. - Net volume, lumber tally, classified according to species-group and forest condition (based on International $\frac{1}{4}$-inch rule)

Forest condition	Pines	Pulping hardwoods	Nonpulping hardwoods	Total
	Thousand board feet			
Old growth:				
Uncut	536,500	407,800	692,200	1,636,500
Partly cut	458,200	280,500	574,400	1,313,100
Second growth:				
Sawlog size	5,866,100	1,113,200	1,523,200	8,502,500
Under sawlog size 1/	114,300	20,500	59,700	194,500
Total all conditions	6,975,100	1,822,000	2,849,500	11,646,600

1/ Includes areas classified as reproduction and clear-cut on which sawtimber volume is too scattered to be available.

Cordwood volume

In estimating the cordwood volume, the entire stand of sound trees 5 inches or over in diameter, outside the bark at breast height, is expressed in terms of standard (4 ft. x 4 ft. x 8 ft.) cords. This estimate obviously includes the sawlog-size trees that have already been included in the board-foot estimate. In addition, a separate estimate of the net sound material in cull trees is included. Under "Sound trees sawlog size" in table 5, only the merchantable sawlog portion of the stem is included. The column headed "Tops of sawlog-size trees" includes the volume in that part of the stem above the sawlogs, taken to a variable diameter of not less than 4 inches inside bark; in the pines the upper stems only are included, but in the hardwoods the usable limbs are included to a 4-inch minimum diameter. The volume listed under "Sound trees under sawlog-size" includes the full stems (but no limbs) of both pines and hardwoods to a variable usable diameter, with a minimum of 4 inches. Under "Sound and rotten cull trees" is included only the sound volume found in such trees. In all classes of material, deduction from the volume has been made for woods cull, that is, that part of the tree that would be left in the woods because of rot, fire scar, crook, bad knots, or other defects.

The pine cordwood volume is practically all loblolly and shortleaf, the longleaf being of minor importance. Of the pine volume, 26 percent is in sound trees under 9 inches in diameter, 63 percent in the sawtimber portion of the sawlog-size trees, 10 percent in the tops of these trees, and the remainder in cull trees. Red gum is the leading pulping hardwood, although black gum, cypress, bay, and maple are common. In these species, 36 percent of the cordwood volume is in sound trees under 13 inches in diameter, 49 percent in sawlog-size trees, and 15 percent in cull trees. In the nonpulping hardwoods, the red and white oaks make up most of the volume; here the volume in sound and rotten culls (21 percent) is proportionately greater than in the other species-groups.

Table 5. - Net volume in various classes of sound material, expressed in cords

Species-group	Sound trees sawlog size	Tops of sawlog-size trees	Sound trees under sawlog size	Sound and rotten cull trees 1/	Total all classes	Proportion of total
	Cords					Percent
Pines	15,603,000	2,660,200	6,440,600	194,600	24,898,400	40.6
Hardwoods:						
Pulping	4,544,700	2,314,100	5,138,000	2,178,800	14,175,600	23.1
Nonpulping 2/	6,624,100	3,862,800	7,082,400	4,748,100	22,317,400	36.3
Total hardwoods	11,168,800	6,176,900	12,220,400	6,926,900	36,493,000	59.4
Total all species	26,771,800	8,837,100	18,661,000	7,121,500	61,391,400	100.0
Percent of total	43.6	14.4	30.4	11.6	100.0	

1/ Scrub oak volume is included with nonpulping hardwoods.
2/ Hardwood species not commonly used for pulpwood, although certain of these species have been used experimentally.

The estimate of cordwood volume classified according to species-group and diameter of trees is shown graphically in figure 4. The volume shown here does not include scrub oak, cull trees, or tops and limbs of sawlog-size hardwood trees, but it does comprise all sound trees down to, and including, 5.0 inches d.b.h.

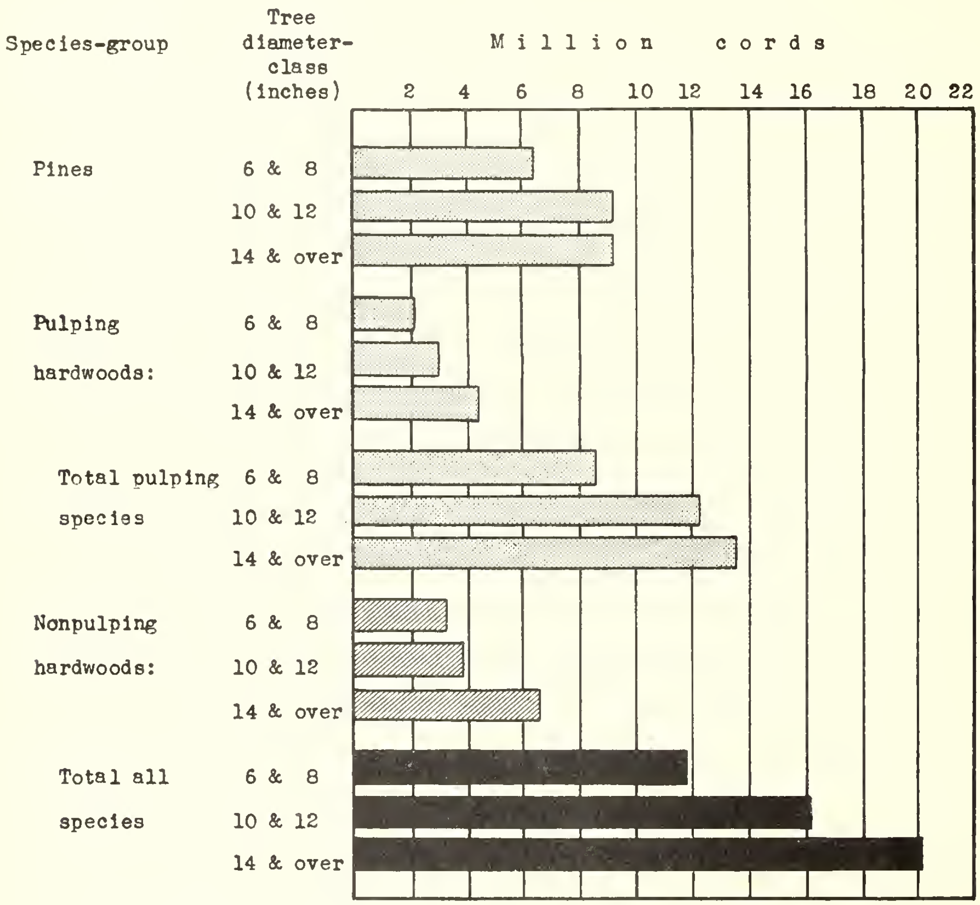


Figure 4. - Cordwood volume of pulping and nonpulping species

Pine pole and pile estimate

In table 6 is shown the estimated number of pine poles and piles that will meet the specifications of the American Standards Association. Although this estimate probably is low, because experience shows that the difficulty of accurately judging standing trees as to their suitability for poles or piles leads to the making of conservative estimates, the indicated proportions of lengths and sizes very closely approach their actual occurrence in the forest stands. The volume in these poles and piles is included in the volume estimates shown in previous tables.

Table 6. - Total number of pine poles or piles, classified according to length and diameter

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Proportion of total
	20	25	30	35	40	45	50 or over		
Inches	Thousand sticks								Percent
7.0 - 8.9	3,782	1,073	489	87	-	-	-	5,431	33.6
9.0 - 10.9	1,832	1,263	1,105	479	257	196	32	5,164	31.9
11.0 - 12.9	623	746	932	422	241	196	144	3,304	20.4
13.0 - 14.9	122	289	507	219	145	102	103	1,487	9.2
15.0 - 16.9	10	84	235	95	61	42	45	572	3.5
17.0 - 18.9	-	16	103	38	29	16	23	225	1.4
Total	6,369	3,471	3,371	1,340	733	552	347	16,183	100.0
Percent of total	39.4	21.5	20.8	8.3	4.5	3.4	2.1	100.0	

Forest Increment

A forest is a constantly changing community of trees of all sizes and ages. It increases its volume through the annual addition of wood to the individual trees and through the continuous influx of young trees that attain measurable volume, but this increase is partly offset by the death of standing trees and the loss of material in live trees due to decay or injury. The resulting balance, whether plus or minus, is known as forest increment.

Current annual increment percent

Table 7 shows the increment rates of the forest stands in the various forest conditions, and also the increment rates of the pine and hardwood species-groups that make up these stands. These rates apply only to the year 1935 and do not hold as an average for a given 10-year period. The influx of small trees into the larger size-classes is largely responsible for the high rates shown in the under-sawlog-size condition. The increment rates shown are based upon the measurement of stands that have suffered throughout their entire history from the effects of frequent forest fires and shortsighted cutting practices. As a consequence, these stands are only partly stocked and contain accumulations of damaged and slow-growing trees, the presence of which exerts a marked and unfavorable effect upon the growth of the stand. The application of widespread effective protection from fire and the practice of wise cutting rules should result in materially improving the increment. The data shown in table 7, as well as those in table 8, apply to the entire forest area and can be used on smaller areas only when it has been determined that the forest stands are typical of the forests of the unit.

Table 7. - Rate of increase (current annual increment percent) in 1935 of stands in the various forest conditions 1/

Forest condition	Pine component		Hardwood component		Weighted average	
	Board feet	Cords	Board feet	Cords	Board feet	Cords
	- - - - - - - - - - - - - -	Percent	- - - - - - - - - - - - - -			
Old growth:						
Uncut	2.4	2.5	2.3	2.3	2.4	2.3
Partly cut	4.1	3.8	2.8	2.7	3.3	3.0
Second growth:						
Sawlog size:						
Uncut	6.8	5.0	5.3	4.2	6.4	4.7
Partly cut	6.1	4.0	5.3	3.7	5.8	3.9
Under sawlog size	45.2	15.9	21.1	9.0	35.3	11.7
Reproduction and clear-cut	7.3	7.8	4.5	7.2	6.2	7.5
Weighted averages	6.7	5.1	4.4	4.0	5.8	4.6

1/ Data rounded to nearest 0.1 percent.

Increment per acre

The increment per average acre in 1935 in the various forest conditions, all forest types combined, is given in table 8. It is the increment that would have accrued if the growing stock had remained undisturbed by cutting throughout the year. The per-acre volumes given in board feet represent only the increment on sawtimber material, while cubic-foot and cordwood volumes include the increment on the usable length of all pines above 5.0 inches d.b.h., under-sawlog-size hardwoods, and the sawtimber portion of hardwoods 13.0 inches d.b.h and larger. No limbs or cull trees were included in the calculation of increment. The bark is not included in the cubic-foot or board-foot volumes but is included in the estimates of cordwood volume.

Table 8. - Increment in 1935 on average acres (undisturbed by cutting) in the various forest conditions

Forest condition	Pine component			Hardwood component			Total per acre		
	Bd.Ft.	Cu.Ft.	Cords	Bd.Ft.	Cu.Ft.	Cords	Bd.Ft.	Cu.Ft.	Cords
Old growth:									
Uncut	56	11.2	.14	108	22.9	.34	164	34.1	.48
Partly cut	70	13.9	.18	91	20.5	.30	161	34.4	.48
Second growth:									
Sawlog size:									
Uncut	216	42.9	.56	63	18.4	.28	279	61.3	.84
Partly cut	104	19.3	.25	56	14.7	.23	160	34.0	.48
Under sawlog size	57	16.5	.23	19	13.0	.20	76	29.5	.43
Reproduction and clear-cut	2	.7	.01	1	.5	.01	3	1.2	.02
Weighted averages	122	25.1	.33	54	16.0	.24	176	41.1	.57

Forest increment within the unit

The amount of wood added by growth to the inventory in 1935 (deducting the growth on timber removed during the year in addition to mortality) was 649,000,000 board feet, green lumber tally, representing a volume increase of 5.6 percent. This does not mean that the inventory was increased to this extent, for during the year an amount nearly equal to the increment was harvested from the growing stock (see table 14). Twelve percent of the increment was in old-growth stands that have an average volume of 5,880 board feet per acre, while 79 percent was in second-growth sawlog-size stands that average 3,660 board feet per acre. Only 60 million board feet of the total increment was in areas supporting under-sawlog-size stands (which had a volume of less than 400 board feet per acre at the time of the survey), and these stands were increasing at the rate of 76 board feet per acre in 1935. Since the increment is accelerating annually, in 10 years many of these young stands will have over 1,500 board feet of sawtimber per acre.

Table 9. - Forest increment in board feet and cubic feet in the various forest conditions, 1935

Forest condition	Sawtimber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	-- Thousand board feet --			-- Thousand cubic feet --		
Old growth	29,400	48,100	77,500	5,930	10,600	16,530
Second growth:						
Sawlog size	374,400	137,300	511,700	72,900	38,610	111,510
Under sawlog size	43,900	15,300	59,200	13,590	11,080	24,670
Reproduction and clear-cut	400	100	500	100	70	170
Total all conditions	448,100	200,800	648,900	92,520	60,360	152,880

The increment is expressed in standard cords (4 ft. x 4 ft. x 8 ft.) in table 10. This material is identical with that given in cubic feet in table 9, except that bark is included, as cordwood is generally handled on an unpeeled basis throughout the South. In converting cubic feet to cords, a factor of 90 was used for pine and cypress, and 80 for hardwood.

Table 10. - Forest increment in 1935, expressed in cords, in the various forest conditions

Forest condition	Pine	Hardwood	Total
	- - - - - -	Cords	- - - - - -
Old growth	76,700	156,600	233,300
Second growth:			
Sawlog size	954,500	589,200	1,543,700
Under sawlog size	184,900	174,400	359,300
Reproduction and clear-cut	1,200	1,000	2,200
Total all conditions	1,217,300	921,200	2,138,500

Sawmills

During 1935 there were approximately 118 sawmills operating in the unit, as shown in table 11. These mills furnished 492,000 man-days of employment, 46 percent of which was in the woods, and 54 percent in the mill and yards. The lumber production of these mills in 1935 (see table 12) exceeded that of 1934 by 35 percent. Although field data are not available, it is estimated that the 1936 lumber cut exceeded that of 1934 by at least 60 percent. Mills cutting over 40M board feet per day are relatively few, although a new pine mill of this size was constructed at Spring Hill in 1936. The only mill in the unit with a rated daily capacity of 80M board feet or over is at Clarks.

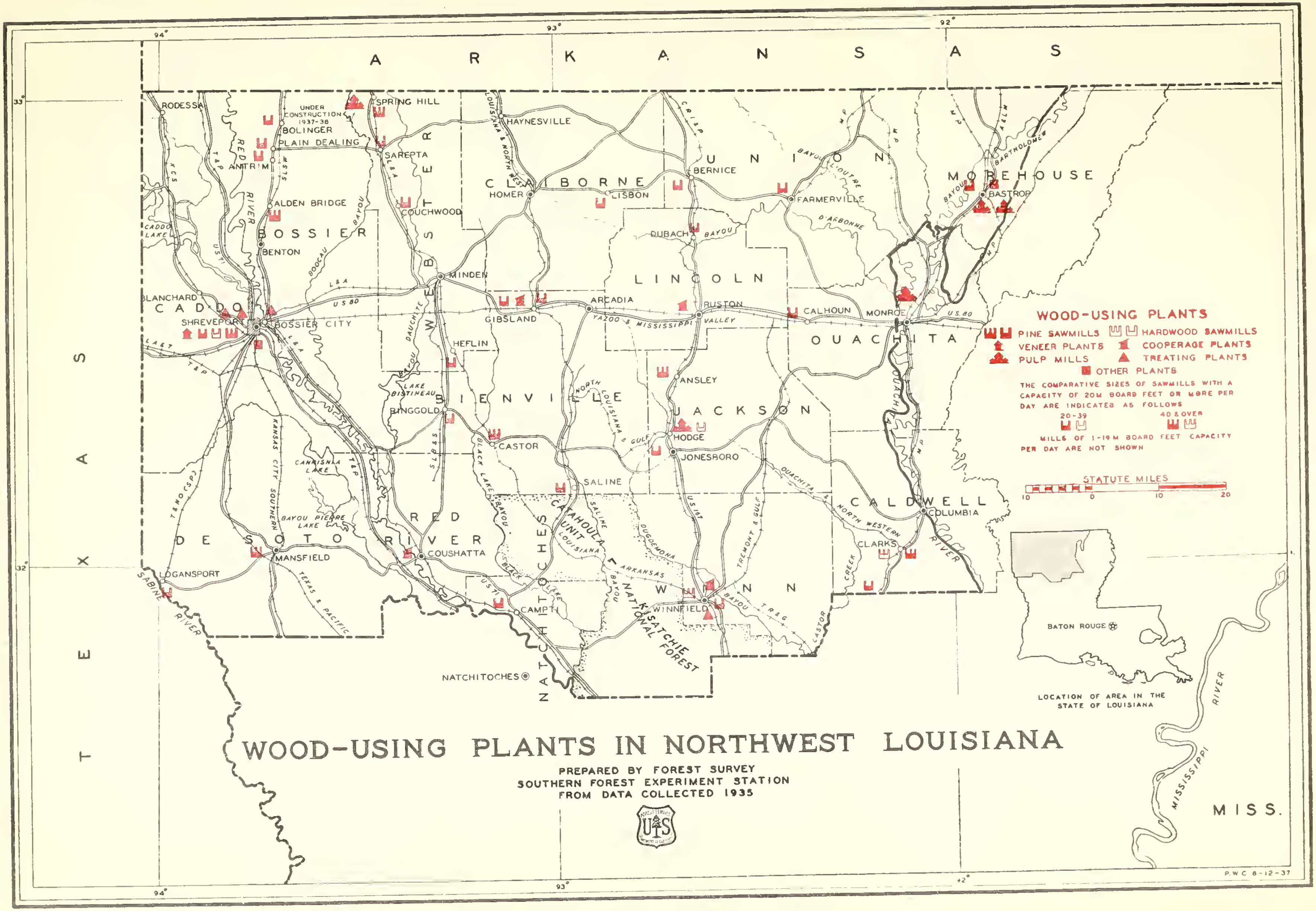
Table 11. - Number of sawmills and extent of employment, classified according to size of mill, 1935

Daily (10 hrs.) rated capacity 1/ in M board feet	Number of mills 2/			Thousand man-days of employment		
	Pine	Hardwood	Total	In woods	In mill	Total
Under 20	77	8	85	34	57	91
20 - 39	22	2	24	70	95	165
40 and over	7	2	9	123	113	236
Total	106	12	118	227	265	492

1/ The rated capacity indicates size of mill rather than actual output.
2/ The data given here on the number of mills in the smallest class are only estimates based upon all available records and were not checked by actual count, but the figures for the larger mills are based upon field counts as well as upon records.

Other forest industries

In 1935, in addition to the 118 sawmills mentioned, there were in the unit only 14 other plants using raw material direct from the forest: 4 timber-treating plants, 3 pulp mills, 4 cooperage plants, 1 veneer plant, and 2 miscellaneous plants (see fig. 5). An additional pulp mill at West Monroe is outside of the unit but draws most of its timber supply from it, as do several sawmills a short distance outside the unit boundary. In 1936 a new treating plant was constructed at Bossier City, adjacent to Shreveport, and in 1937 construction began on a large pulp mill to be located at Spring Hill, near the Arkansas line. The production of poles, piles, cross ties, fuelwood, and fence posts is also an important activity throughout the unit. Table 12 shows the number of plants, the production of the various commodities, and the man-days of employment furnished by these various forest industries.



WOOD-USING PLANTS IN NORTHWEST LOUISIANA
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
FROM DATA COLLECTED 1935
WOOD-USING PLANTS
PINE SAWMILLS
HARDWOOD SAWMILLS
VENEER PLANTS
COOPERAGE PLANTS
PULP MILLS
TREATING PLANTS
OTHER PLANTS
THE COMPARATIVE SIZES OF SAWMILLS WITH A CAPACITY OF 20M BOARD FEET OR MORE PER DAY ARE INDICATED AS FOLLOWS
20-39
40 & OVER
MILLS OF 1-19 M BOARD FEET CAPACITY PER DAY ARE NOT SHOWN
STATUTE MILES
10 0 10 20
LOCATION OF AREA IN THE STATE OF LOUISIANA
BATON ROUGE
ARKANSAS
TEXAS
MISS.
CADDO
BOSSIER
WEBSTER
CLAIBORNE
UNION
MOREHOUSE
LINCOLN
OUACHITA
BIENVILLE
JACKSON
CALDWELL
DE SOTO
RED RIVER
NATCHITOCHES
WINN
RODESSA
UNDER CONSTRUCTION 1937-38
BOLINGER
PLAIN DEALING
SPRING HILL
SAREPTA
ANTRIM
ALDEN BRIDGE
BENTON
COUCHWOOD
HAYNESVILLE
HOMER
LISBON
BERNICE
FARMERVILLE
BASTROP
DUBACH
MINDEN
BLANCHARD
SHREVEPORT
BOSSIER CITY
GIBSLAND
ARCADIA
RUSTON
CALHOUN
MONROE
HEFLIN
RINGGOLD
ANSLEY
HODGE
JONESBORO
CASTOR
SALINE
COLUMBIA
CLARKS
MANSFIELD
LOGANSPORT
COUSHATTA
CAMPTI
NATCHITOCHES
WINNFIELD
KISATCHIE NATIONAL FOREST
CATAHOULA UNIT
P.W.C. 8-12-37

FIGURE 5.

Table 12. - Production and employment data, 1935

Kind of plant or commodity	Number of plants	Amount produced or used	Thousand man-days of employment		
			In woods	In mill	Total
Sawmills	118	241,400 M bd.ft.	227	265	492
Treating plants	4	2,380 M cu.ft.	-	40	40
Cross ties	-	991 M pieces	137	-	137
Poles and piles	-	107 M pieces	20	-	20
Fence posts	-	2,037 M pieces	27	-	27
Cooperage	4	9 M cords	9	7	16
Pulpwood	3	260 M cords	371	587	958
Fuelwood	-	536 M cords	708	-	708
Miscellaneous 1/	3	11 M cords	6	16	22
Total	132		1,505	915	2,420

1/ Includes 1 veneer plant, 1 handle plant, and 1 paper-plug mill.

Employment

As seen in table 12, the production of pulpwood furnished 40 percent of the employment in the forest industries during 1935. Although often making no cash return to the individual, the labor necessary to meet the fuelwood requirements of the unit constituted 29 percent of the total for the forest industries, even exceeding that of the sawmill industry, which furnished only 20 percent of the total man-days of employment. The new pulp mill at Spring Hill will furnish nearly a million man-days of employment yearly, in the woods and mill, or slightly more than is being furnished by all three of the present pulp mills. The pulp industry in this unit will furnish about 50 percent of the forest employment by 1939, if employment in the other industries remains relatively constant and if all the pulpwood is cut within the unit except that required by the new Spring Hill plant, the greater portion of which may come from southern Arkansas.

Utilization Drain

To appraise the forest supply situation in a particular area, it is necessary to determine the annual drain for industrial requirements on the growing stock of sound trees, and to compare this with the annual increment of the forest. Utilization drain, as used in this report, includes both the material cut and utilized and the sound usable material in felled trees left in the forest after logging. Material cut from limbs or from dead or cull trees is not included. In table 13 the drain on the sawtimber section of the tree, including both the used and wasted portions, is shown in board feet lumber tally, while the volumes given in cubic feet inside bark include the drain on material in small trees, in the upper stems of sawlog-size pines, and in sawtimber material.

Table 13. - Utilization drain from sound trees, 1935

Commodity	Sawtimber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	-- Thousand board feet --			-- Thousand cubic feet --		
Lumber	206,700	94,200	300,900	38,560	13,560	52,120
Cross ties	28,000	28,200	56,200	4,970	4,210	9,180
Poles and piles	9,400	1,500	10,900	1,800	230	2,030
Cooperage	-	5,900	5,900	-	840	840
Misc. manufactures	-	3,500	3,500	-	510	510
Pulpwood	96,600	-	96,600	29,100	-	29,100
Fuelwood	80,700	12,600	93,300	25,400	2,890	28,290
Fence posts	1,400	300	1,700	480	60	540
Misc. farm use and land clearing	44,300	20,700	65,000	12,450	7,710	20,160
Total	467,100	166,900	634,000	112,760	30,010	142,770

Comparison of Increment and Drain

The net effect of growth, mortality, and utilization drain upon the sawtimber growing stock is shown in table 14. The volumes given are of sawtimber material only, and are expressed in green lumber tally.

It is apparent that the pine growing stock was reduced in volume during 1935, when the utilization drain exceeded the increment by 19 million feet. With the reduced growing stock at the beginning of 1936 and a utilization drain that is estimated to have increased from 20 to 30 percent over 1935, the pine growing stock continued to decrease in 1936. Unless the cut is reduced or the growth rate is increased, the inventory and the increment will continue to diminish for at least the next several years, since the incoming body of young timber is not sufficient to create a favorable balance during this time. As may be seen from the chart and text on page 5, the growing stock of the unit is far below its possibilities in average stand per acre, and consequently the total annual increment is perhaps less than half of what it might be. Furthermore, as is seen in figure 1, the present stand is lacking in a satisfactory representation of trees in the larger diameter-classes. To approach a more normal stand and increment it is highly desirable that a part of the present annual increment be reserved from cutting and left to accumulate and build up the growing stock in both volume and quality.

Table 15 expresses the balance between increment and drain in cubic feet inside bark. The volumes shown here include the sawtimber volume of table 14, and in addition sound trees under sawlog size and the upper stems of merchantable pines. It will be noted that in this class of material also, there is a difference between pine increment and drain of over 20 million cubic feet. Furthermore, it can be expected that this deficit will increase through 1937 because of the increased activity of the established industries, and with the completion of the new pulp mill at Spring Hill in 1938 the cubic-foot drain will be even greater. Analysis of the reserve stock of small trees indicates that this disparity between increment and drain will continue if a drain equal to that of 1935 is removed annually from the forest and if no effective steps are taken to increase the increment.

Table 14. - Balance between increment and drain of sawtimber material

	Pines	Hardwoods	Total
	Thousand board feet		
Net growing stock, January 1, 1935	6,975,100	4,671,500	11,646,600
Growth, 1935	502,300	251,300	753,600
Mortality, 1935	54,200	50,500	104,700
Forest increment, 1935	448,100	200,800	648,900
Utilization drain, 1935	467,100	166,900	634,000
Net change in growing stock, 1935	-19,000	33,900	14,900
Net growing stock, January 1, 1936	6,956,100	4,705,400	11,661,500

The situation in respect to the hardwood species is somewhat more favorable than that in respect to the pines. The increment of the hardwoods, as shown in table 15, exceeded the drain by 30 million cubic feet, or to state it in another way, the drain in 1935 was only half the increment. At first glance this seems to reflect a desirable situation, but in reality a major portion of the drain is coming from large, high-quality timber, while much of the increment is accruing upon young second-growth trees, often of poor quality, and frequently of low value, under present standards of hardwood utilization. If full use is to be made of the increment now accumulating in the hardwood stands, new methods must be devised for utilizing second-growth timber that is smaller and of lower quality than that customarily used in the past.

Table 15. - Balance between increment and drain in cubic feet

	Pines	Hardwoods	Total
	Thousand cubic feet (i.b.)		
Net growing stock, January 1, 1935	1,885,890	1,548,120	3,434,010
Growth, 1935	112,190	82,190	194,380
Mortality, 1935	19,670	21,830	41,500
Forest increment, 1935	92,520	60,360	152,880
Utilization drain, 1935	112,760	30,010	142,770
Net change in growing stock, 1935	-20,240	30,350	10,110
Net growing stock, January 1, 1936	1,865,650	1,578,470	3,444,120

Outlook for the Future

The forests in this unit are being cut at the present time faster than they are growing, particularly the pine stands, which, as previously shown, are being reduced each year, when measured either in board feet or in cubic feet. The increment on the hardwood growing stock was sufficient to meet the requirements of the forest industries in 1935, but with the subsequent increased industrial activity in 1936 and 1937, it is reasonable to suppose that the hardwood species are now being overcut. Continued overcutting, with a consequent reduction in the growing stock and increment available for utilization, will mean a growing scarcity of timber and a change in the character and size of the wood-using industry. It should be realized, of course, that the above situation applies as an average to the unit as a whole, and that many local situations may differ greatly from these general findings, ranging from those in communities depleted of their timber resource to others in communities still capable of increasing their present cut without exceeding the annual increment.

An analysis of the board-foot drain on the forest in 1935 shows that about half is caused by the lumber industry, mills with a capacity of more than 40M per day producing 36 percent of the lumber cut. Such mills draw heavily on the remaining supply of the larger trees that contain high-quality sawtimber. Reference to figure 1 shows that the basal area of the larger sawtimber trees makes up a very minor portion of the stand in the pine-hardwood types. If overcutting continues, the supply of such trees will inevitably become so reduced that the large sawmills will be driven from the unit. An increasing amount of the lumber cut has been produced by portable mills, and this trend will undoubtedly continue. These small operators can move readily from place to place and utilize trees of very small diameter, but since they seldom own any land and have few permanent ties, they are little impressed by the need for conservation in any one location. The presence of a large and growing number of such mills in the unit must be recognized as a threat to the future development of the forest, since they tend very definitely to reduce the forest to a stand made up predominantly of small trees. This tendency is accentuated by the development of the pulp and paper industry, which competes directly with the portable mills for the smaller timber. To protect themselves against an otherwise inevitable shortage of large trees, lumber companies that wish to continue in business, must deliberately embark upon a program of growing high-quality sawtimber on lands managed for that purpose. It is not necessary to depend upon planting to obtain a new stand of trees, as there are now large areas of second-growth timber (owned in part by lumbermen) which can be handled under selective logging methods to produce quality timber within a reasonable time.

The wood-pulp industry, which is already an important factor in the forest economy of the unit, is destined to have an increasingly important place. Its continued expansion may result in establishing the stumpage price of pulpwood at a point where adequate returns will accrue to forest owners. Reference to figure 1 shows that there is a greater basal area in trees 8 and 10 inches d.b.h. than in other size-classes on an average acre in the pine-hardwood types. In this respect the stands of the unit are rather favorably stocked for pulpwood production, but the stand per acre can, and should, be greatly increased. While no adequate measure of the optimum stocking is available, figure 2 shows that the cubic-foot volume of the average acre in the pine-hardwood types is less than half of the volume attained by the upper 10 percent of the stands. In order to increase the growing stock and increment, build up a permanent timber supply, and control to a large extent their future wood costs, pulp companies should increase their land holdings so that at least half of their requirements can be produced eventually on their own lands. Skillful buying to include well-stocked stands on the better sites, combined with forestry measures designed to increase the growing stock and the productivity of the forest, should keep the investment in land at a minimum.

Although the forests are at present in a condition of rather low productivity because of frequent fires and short-sighted methods of cutting, the natural growing conditions are so favorable that it is possible, even now, to change the present shrinking timber supply to an increasing resource that will continuously supply to the people of the unit raw material, employment, and a means of profitable land use. It is, however, high time that the forest industries of the unit realize that their future timber supplies must come from the lands around them and not from distant stands of virgin timber. It is equally important that forest owners realize that the demand for timber has developed to the point where the intelligently planned use of their formerly neglected timberland will be found profitable. Until the growing stock of timber and the resulting annual increment has been increased through better forestry practices, it would seem to be sound policy for State authorities to develop new forest-using industries only when it is definitely known that their requirements will not exceed the productive capacity of the forest. An intensive study of the timber resource of the unit might show that further expansion in certain forest industries would be at the expense of already established plants. On the other hand, there are wood-using industries that could be developed to use material now generally going to waste. From every angle of consideration it is apparent that the timber resource of this section of Louisiana is destined to have an increasingly important part in the future economic and social security of the people of the State. A widespread intensification of the efforts of public agencies to give the forests adequate fire protection, to plan for the future development of local industries, to educate forest landowners, and to promote forestry research, therefore, is both justified and imperative.

FOREST SURVEY RELEASE NO. 32 APRIL 16, 1938

FOREST RESOURCES

of the

NORTH ARKANSAS DELTA

A Progress Report

by

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

This release, which should be regarded only as a progress report, is based on a field survey made during November and December 1934 and January 1935. It contains Forest Survey data that will be included in complete reports to be published later, and that, although considered reliable, are subject to correction or amplification as the work of computation proceeds; while item 4 above, which is being studied on a national basis, is not discussed in this report.

In the presentation of these survey data, it is to be noted that owing to the sampling method used in collecting them, the greater the number of samples in any given classification the more accurate are the data for that classification. Hence classes that are of infrequent occurrence and relatively small in quantity generally cannot be determined with as high a degree of accuracy as classes that occur more frequently and in substantially greater quantities. Small tabular items are to be taken as showing, not the exact magnitude of the classes involved, but their relative magnitude in comparison with those of other classes.

Staff Assignment

Preparation of Report	- R. K. Winters, Forester
In Charge of Field Work	- J. A. Putnam, Associate Forest Economist
In Charge of Computations	- P. R. Wheeler, Associate Forest Economist

FOREST RESOURCES OF THE NORTH ARKANSAS DELTA

Location and General Description

The North Arkansas Delta survey unit includes the flood plains of the Mississippi River and its principal tributaries between Helena, Arkansas, and Cape Girardeau, Missouri, with boundaries as shown in figure 1. Although chiefly in Arkansas, it includes portions of Missouri, Tennessee, and Kentucky. A conspicuous topographic feature is Crowley's Ridge, a narrow elevation rising some 200 feet above the general level of the surrounding plain and extending about 180 miles from Helena, Ark., to the vicinity of Advance, Mo. Elsewhere the relief is remarkably uniform, seldom varying locally more than 20 feet, with drainage generally to the southward.

The soils are in general of alluvial origin and when cleared and drained are often of high agricultural worth. Practically the entire land area supported originally a stand of hardwood timber, although nearly 60 percent of the land area is now in some form of agricultural use. Cotton is the principal crop in the Arkansas portion of the unit, but farther north it gradually gives way to more diversified farm crops. The area is largely peopled by rural dwellers; while small villages abound, only two towns, Blytheville and Jonesboro, Ark., have populations of more than 10,000 persons. The negro population, which is largest in the counties adjacent to the Mississippi River, diminishes rapidly from east to west and gradually northward.

Table 1 shows the relative importance of the principal kinds of land use in the unit.

Table 1. - Land area classified according to major uses, 1935

Land use	Total land area	
	Acres	Percent
Forest	2,613,200	38.9
Agricultural:		
In cultivation:		
Old cropland	3,394,100	50.5
New cropland	164,900	2.5
Out of cultivation:		
Idle	134,900	2.0
Abandoned	67,000	1.0
Improved pasture	185,400	2.8
Total agricultural	3,946,300	58.8
Other: Marsh, waterways, towns and villages, roads, railroads, etc.	156,200	2.3
Total land area	6,715,700	100.0

Land taxes are generally high. In addition to a high ad-valorem tax, caused by a relatively high valuation of agricultural land, many areas bear an additional tax to pay for drainage improvements. In 1933 when approximately 2.7 million acres of land in the unit were in organized drainage districts, an average drainage tax of 58¢ per acre was assessed against the land in this area. Since then many drainage districts have been refinanced with loans from the Reconstruction Finance Corporation, with a resulting reduction in the current drainage tax. An additional area in organized drainage districts in the Missouri portion of the unit bears a similar tax. Furthermore, some portions bear an annual levee tax as great as 25¢ per acre. In certain extreme instances the total tax, including state and county taxes, may be more than $2 per acre per year. Forest land in many parts of this unit has a relatively high value because of its speculative worth as agricultural land. On account of this high value and high annual tax, cut-over forest land is used for agriculture if its quality permits and if economic conditions justify its use for this purpose.

Forest Description

Although most of this area was originally covered with a dense virgin hardwood forest, its proximity to the northern markets consuming hardwoods and its excellent timber stand made it one of the first areas of the Mississippi River Delta to be logged commercially. This cutting, begun certainly prior to 1880, carried on over a relatively long period, and followed as it often was by agricultural development, has resulted in a relatively small residual forest area. On the front lands along the Mississippi River in Arkansas, and in the Missouri portion of the unit, extensive areas occur in which the forest occupies no more than 10 to 15 percent of the land area. Certain areas less suited for agriculture, such as Crowley's Ridge and areas of very poor drainage, are now largely forested and can be expected to remain so. A considerable part of the present forest area, however, is potential agricultural land, and may become so if economic conditions warrant its use for this purpose. The situation in regard to the forest area is shown in greater detail in table 2, where this area is classified into 9 forest types on the basis of the species found there and into 5 forest conditions on the basis of the character of the timber stand. The general distribution of the forest types is also shown in figure 1, although the types shown here are somewhat more generalized than those given in table 2. The red gum-water oak, overcup oak-bitter pecan, cottonwood-willow, and hackberry-elm-ash types of table 2 have been combined in figure 1 into the red gum-mixed hardwood type, which, like the cypress-tupelo gum type, is commonly found on the bottoms. The mixed oak-mixed hardwood and the scrub oak-scrub hardwood types, characteristic of the terraces, have been combined in figure 1 to give the oak-mixed hardwood type. The water oak type of table 2, which occurs on both bottoms and terraces, has been included in figure 1 with the red gum-mixed hardwoods when it occurs on the bottoms, and with the oak-mixed hardwoods when it occurs on the terraces. The upland hardwood type is found on Crowley's Ridge and on the Commerce Hills south of Cape Girardeau, Mo.

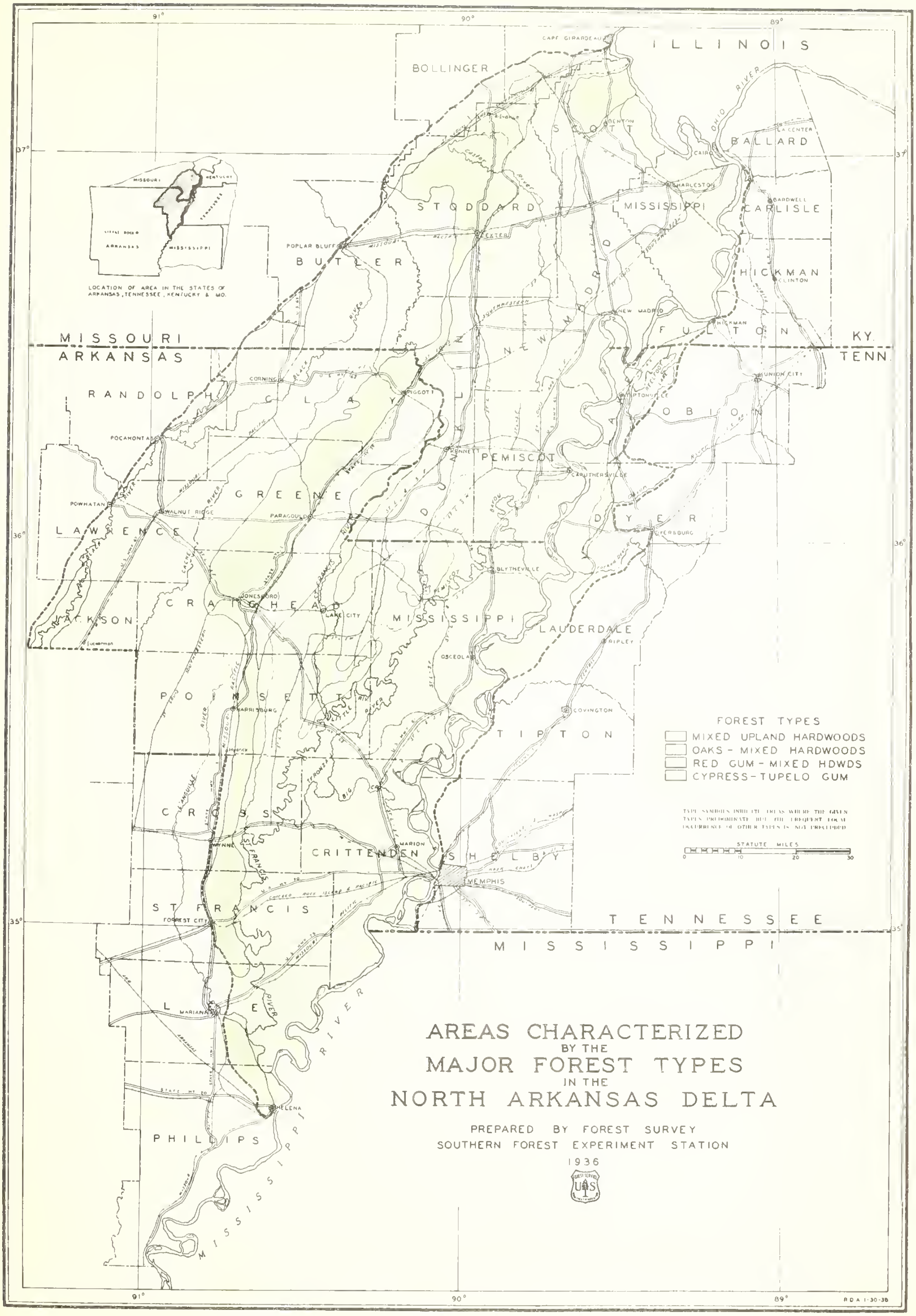

AREAS CHARACTERIZED
BY THE
MAJOR FOREST TYPES
IN THE
NORTH ARKANSAS DELTA
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
1936
FOREST TYPES
MIXED UPLAND HARDWOODS
OAKS - MIXED HARDWOODS
RED GUM - MIXED HDWDS
CYPRESS-TUPELO GUM
STATUTE MILES
0
10
20
30
LOCATION OF AREA IN THE STATES OF ARKANSAS, TENNESSEE, KENTUCKY & MO.
MISSOURI
ARKANSAS
KY.
TENN.
TENNESSEE
MISSISSIPPI
ILLINOIS
BOLLINGER
SCOTT
BALLARD
STODDARD
MISSISSIPPI
CARLISLE
BUTLER
HICKMAN
FULTON
NEW MADRID
RANDOLPH
CLAY
OBION
PEMISCOT
GREENE
DUNKLIN
LAKE
LAWRENCE
DYER
CRAIGHEAD
JACKSON
MISSISSIPPI
LAUDERDALE
POINSETT
TIPTON
CROSS
CRITTENDEN
SHELBY
ST FRANCIS
LEE
PHILLIPS
MEMPHIS
HELENA
MARIANNA
FOREST CITY
WYNNE
MARION
OSCEOLA
BLYTHEVILLE
LAKE CITY
JONESBORO
PARAGOULD
WALNUT RIDGE
POWHATAN
POCAHONTAS
CORNING
PIGGOTT
KENNETT
CARUTHERSVILLE
NEW MADRID
HICKMAN
CLINTON
BARDWELL
CHARLESTON
CAIRO
LA CENTER
BENTON
CAPE GIRARDEAU
POPLAR BLUFF
DEXTER
UNION CITY
TIPTONVILLE
DYERSBURG
RIPLEY
COVINGTON
MISSISSIPPI RIVER
OHIO RIVER
91°
90°
89°
37°
36°
35°
R D A 1-30-38

Figure 1.

Table 2. - Distribution of total forest area in the various forest types and forest conditions, 1935

Forest type	Old growth		Second-growth sawlog size		Second-growth under sawlog size, reproduction, and clear-cut	All conditions	
	Uncut	Partly cut	Uncut	Partly cut			
	Acres						Percent
Red gum-water oak	33,100	26,000	77,300	74,100	227,200	437,700	16.7
Hackberry-elm-ash	15,000	50,500	115,200	101,700	190,100	472,500	18.1
Overcup oak-bitter pecan	9,500	27,600	29,200	37,100	62,200	165,600	6.3
Cottonwood-willow	-	-	82,000	26,800	153,900	262,700	10.1
Cypress-tupelo gum	1/	38,600	63,900	75,700	86,900	270,600	10.4
Water oak	1/	14,200	49,700	86,000	115,100	266,600	10.2
Mixed oak-mixed hardwood	1/	24,500	68,600	100,200	208,200	405,400	15.5
Upland hardwood 2/	1/	24,500	37,900	38,700	116,600	219,300	8.4
Scrub oak-scrub hardwood	-	6,300	6,300	13,400	86,800	112,800	4.3
Total all types	70,200	212,200	530,100	553,700	1,247,000	2,613,200	100.0
Percent of total	2.7	8.1	20.3	21.2	3/ 47.7	100.0	

1/ Although the Survey data show an area in this type and condition, it is too small to indicate accurately even the relative magnitude of the individual item. The area estimated, however, is carried in the total for the type and condition.

2/ Includes a small area of pine-hardwood type.

3/ Of this total area, only about 2 percent can be classed as "clear-cut."

The total forest area has been further subdivided into commercial and noncommercial areas. By a "commercial" forest area is meant one that supports a stand of adequate quality and volume per acre to warrant operation under normal conditions for such high-grade products as industrial lumber, cooperage stock, or veneer. Since practically all of the forest area in this unit is accessible for truck logging during some season of the year, industrial operators generally find it feasible to log areas bearing 1,000 board feet or more per acre of high-grade material; throughout this report such forest areas are considered to be commercial. "Noncommercial" areas include all forest lands that do not meet these qualifications. These areas frequently bear stands suitable for cross ties, structural timbers, and lumber for domestic use.

High-grade material is contained specifically in (1) lumber-mill and veneer-mill logs and (2) other high-quality logs suitable chiefly for the manufacture of cooperage and small-dimension stock. Lumber-mill logs are those at least 14 inches (12 inches in ash, yellow poplar, and black walnut) in diameter that can be expected to yield 30 percent or more of their lumber volume in grades No. 1 common and better. Logs in this class average about 60 percent of their volume in these grades of lumber. Cooperage and small-dimension logs are at least 10 inches in diameter and of the same general quality as lumber-mill logs, but they cannot be so classified because of their small diameter or excessive sweep. These small, high-grade logs are suitable for industrial uses that require bolts or blocks rather than logs. High-grade material in cypress and pine includes the contents of all individual trees which will cut a minimum of 80 to 90 percent of their lumber volume in grades No. 2 common and better, and which, in addition, will produce more than 5 percent in firsts and seconds or B and better. Low-grade logs of all species are those that do not meet the above qualifications. In all partly cut sawlog-size forest conditions, the high-grade volume is largely made up either of species that did not at the time of the last cutting have a well-established market, or of small logs suitable only for cooperage and small-dimension stock.

Of the total forest area, only 200,000 acres, or less than 10 percent, supports sufficient high-quality timber (1,000 board feet or more per acre) to be classified as commercial. Of this commercial area, approximately 27 percent is in the old-growth uncut condition, 24 percent in the old-growth partly cut condition, 32 percent in the second-growth sawlog-size uncut condition, and 17 percent in the second-growth sawlog-size partly cut condition. Approximately one-third of the commercial forest area was in the red gum-water oak type.

Timber Inventory

The volume estimate has been broken down into sawtimber volume (expressed in board feet, Doyle log scale) and into cordwood volume. The sawtimber volume includes the net volume of all usable logs in good trees of sawlog size, regardless of log grades. Such trees are at least 13.0

inches d.b.h.[1/] (9.0 inches in pine) and contain at least one 12-foot usable log (i.e., one 10 inches or more in diameter at the small end in hardwood, and 6 inches or more in pine); and at least 50 percent of their volume in material suitable for the manufacture of lumber of commercial grade, low-grade structural material, low-grade box material, or railroad cross ties. The sawtimber volume, however, includes neither the volume of sound cull and rotten cull trees, nor the cull volume in good trees.

The cordwood volume of trees under sawlog size (5.0 - 12.9 inches d.b.h. in hardwood and cypress, and 5.0 - 8.9 in pine) includes the wood and bark of the main stem to a usable top, the minimum allowable top being never less than 4 inches and seldom more than 8. The cordwood volume is also net, that is, the volume of cull material that normally would be left in the woods as waste has not been included.

Board-foot volume

The total net board-foot volume, as shown in section A of table 3, is 3.0 billion board feet, according to the Doyle log rule. Of this total, approximately 21 percent is in old-growth uncut stands; 20 percent is in the old-growth partly cut; 32 percent in the second-growth sawlog-size uncut; 22 percent in second-growth sawlog-size partly cut stands, and 5 percent on the remaining second-growth and clear-cut areas. Considering the total board-foot volume from another point of view, 41 percent (or 1.2 billion board feet) is on commercial areas; approximately half of this is high-grade material suitable for industrial lumber, veneers, and cooperage. On noncommercial forest areas approximately 12 percent of the total board-foot volume is high-grade material.

Although these are the total volumes, a sharper picture of the timber stands in the unit perhaps can be obtained best from a statement of the total stand per average acre, high-grade and low-grade material combined, in the various forest conditions.

Forest condition	Average number of board feet per acre (Doyle log scale)
Old growth:	
Uncut	9,066
Partly cut	2,798
Second growth:	
Sawlog size:	
Uncut	1,852
Partly cut	1,196
Under sawlog size, reproduction, and clear-cut areas	112
Weighted average, all conditions	1,153

1/ "d.b.h." is the abbreviation for "diameter at breast height," which is the tree diameter at 4½ feet above ground. The Survey uses 2-inch diameter-classes; thus for example, the lower and upper limits of the 14-inch diameter-class are 13.0 and 14.9 inches, respectively.

Table 3.-- Total net volume of good trees on forest areas, classified according to forest condition and species-group, 1935

A. BY FOREST CONDITION

Forest condition and species-group	Volume on commercial areas			Volume on noncommercial areas			Total volume	
	Sawtimber (Doyle)		Cordwood 1/	Sawtimber (Doyle)		Cordwood 1/	Sawtimber (Doyle)	Cordwood 1/
	In high-grade logs	In low-grade logs		In high-grade logs	In low-grade logs			
	M bd.ft.	M bd.ft.	Cords	M bd.ft.	M bd.ft.	Cords	M bd.ft.	Cords
Old growth:								
Uncut	328,100	242,500	145,500	10,900	54,900	54,500	636,400	200,000
Partly cut	133,100	126,500	155,200	24,600	309,500	515,900	593,700	671,100
Second growth:								
Sawlog size:								
Uncut	131,900	143,700	323,900	118,900	587,400	2,372,700	981,900	2,696,600
Partly cut	50,300	68,100	166,700	54,400	489,600	2,163,300	662,400	2,330,000
Under sawlog size	-	-	-	11,300	124,200	4,056,600	135,500	4,056,600
Reproduction	-	-	-	-	1,700	12,300	1,700	12,300
Clear-cut	-	-	-	-	2,200	12,400	2,200	12,400
Total	643,400	580,800	791,300	220,100	1,569,500	9,187,700	3,013,800	9,979,000

B. BY SPECIES-GROUP

Red gum	225,000	123,500	54,800	10,800	81,700	511,200	441,000	566,000
Water oaks	22,100	29,100	57,000	15,900	291,500	1,470,400	358,600	1,527,400
Red oaks	33,200	26,500	47,000	19,700	100,400	871,400	179,800	918,400
White oaks	11,900	18,700	27,800	8,700	49,500	350,100	88,800	377,900
Overcup oak 2/	15,300	70,200	30,100	7,200	177,900	952,800	270,600	982,900
Ash	45,500	27,700	59,100	11,400	33,000	453,100	117,600	512,200
Cottonwood	57,000	68,000	20,300	11,600	95,500	344,600	232,100	364,900
Willow	8,600	8,400	12,700	13,500	75,100	580,500	105,600	593,200
Elms 3/	57,000	62,600	118,500	25,300	200,900	876,100	345,800	994,600
Tupelo gum 4/	11,600	17,000	36,600	12,900	45,600	410,700	87,100	447,300
Cypress	63,600	12,100	55,300	31,500	120,100	730,800	227,300	786,100
Bitter pecan	1,100	4,700	11,000	500	23,000	71,900	29,300	82,900
Hickory 5/	7,600	10,400	46,400	7,700	62,100	467,700	87,800	514,100
Hackberry	11,100	14,200	104,700	11,400	57,500	322,800	94,200	427,500
Miscellaneous 6/	72,800	87,700	110,000	32,000	155,700	773,600	348,200	883,600
Total	643,400	580,800	791,300	220,100	1,569,500	9,187,700	3,013,800	9,979 000

1/ Cordwood volume of trees under sawlog size including the wood and bark of the main stem to a usable top, the minimum allowable top never being less than 4 inches and seldom more than 8. Cordwood volume was calculated on a basis of 80 cubic feet per cord for hardwood species and 90 cubic feet for pine and cypress. Only woods cull was deducted from the cordwood volume.

2/ Approximately 32 percent of this volume is "hill" post oak.

3/ Approximately 80 percent of this volume is white elm.

4/ Approximately 34 percent of this volume is black gum.

5/ Approximately 40 percent of this volume is sweet pecan.

6/ Includes a small volume of pine (approximately 11 million board feet and 17,000 cords).

Thus it is seen that the under-sawlog-size, reproduction, and clear-cut conditions, which make up nearly 48 percent of the forest area (see table 2), support an average stand of only 112 board feet per acre, and the weighted average for the total forest area is only 1,153 board feet per acre. It is apparent that in general the forests of this unit are understocked in trees of sawlog size. In addition to this board-foot volume, the average acre bears approximately 3.8 cords of stem wood in trees under sawlog size. Converting the board-foot volume of sawlog-size trees to cords for purposes of comparison, we get 4.0 cords of sawtimber on the average acre. Almost half the volume in stems of good trees, expressed in cords, is therefore in trees under sawlog size.

Although the Doyle log rule is the legal rule of Arkansas and is in general use for timber estimates in the South, its application to stands made up mainly of small trees results in a considerable understatement of the actual volume recoverable in lumber. The board-foot volume in this survey unit, according to the International $\frac{1}{4}$-inch log rule, which closely approximates green lumber tally, is 4.1 billion board feet; and according to the Scribner log rule, the official log rule of the U. S. Forest Service, it is 3.7 billion board feet. The average stand per acre, using the International $\frac{1}{4}$-inch rule, is 1,577 board feet instead of the 1,153 feet found with the Doyle rule.

Cordwood volume

In addition to the sawtimber volume, and the volume in sound trees under sawlog size, already shown in table 3, there is, as determined by a very rough estimate, 11.7 million standard (4 x 4 x 8 feet) cords of sound wood, including bark, which is classified as follows:

	Cords
Tops and limbs of good trees of sawlog size	6,001,500
Sound wood from stems, tops, and limbs of cull trees	5,659,400
	11,660,900

In sawlog-size trees, this cordwood volume includes that portion of the main stem above the usable sawlog limit and also includes the volume of all hardwood and cypress limbwood over 4 inches in diameter. In cull trees, the volume includes the sound volume of all stemwood in trees at least 5.0 inches d.b.h., together with limbwood in sawlog-size trees.

Cubic-foot volume

The cubic-foot equivalent of the total sawtimber volume is 728 million cubic feet inside bark. The cubic volume of good trees under sawlog size but over 5 inches is 635 million cubic feet excluding bark. The total cubic volume, excluding cull trees and tops, is therefore 1.4 billion cubic feet (1935).

Timber Increment

Annual increment on an area is considered to be the difference between the net volume of live, good trees standing on the area at the beginning of any year and the corresponding volume at the end of the same year, assuming that no volume is removed by cutting in the meantime. It is, therefore, the increase over and above the volume lost through natural mortality, and is equivalent to the cut that can be made that year without reducing the volume of the original growing stock.

Board-foot increment is made up of (1) the growth on trees already sawlog size and (2) the total board-foot volume of trees becoming sawlog size during the year. This increment is expressed in net log scale, and is based on good trees only, from which all cull material is excluded. Similarly, cubic-foot increment represents (1) the growth on sound stemwood in good trees at least 5.0 inches in diameter, plus (2) the total volume of small trees growing up to, or exceeding, this diameter during the year.

Table 4 shows the annual increment per acre in the various forest conditions in terms of board feet and cubic feet, excluding bark. In these increments, deductions for natural mortality have been made; no deductions have been made, however, for material removed in timber-cutting operations. Increment in board-foot material is expressed in lumber tally as measured by the International ¼-inch rule. Cubic-foot increment includes material in trees of both sawlog and under sawlog sizes.

Table 4. - Annual increment 1/ on the average acre of commercial and noncommercial forest, by forest conditions, 1935

Forest condition	Annual increment	
	Board feet (Int. ¼-inch rule)	Cubic feet (i.b.)
Commercial area:		
Old growth, uncut	102	18
Old growth, partly cut	106	22
Second growth, sawlog size	200	34
Noncommercial area:		
Old growth, uncut	96	18
Old growth, partly cut	79	20
Second growth, sawlog size	128	27
Second growth, under sawlog size	48	29
Clear-cut and reproduction	2/ -7	2/ -5
All conditions	85	25

1/ Figures in this table do not include increment resulting from the change of noncommercial areas to commercial areas (see footnote 3, table 5).

2/ Negative increments occur when the volume lost to the stand through natural mortality of residual trees is greater than the increase in volume in good trees.

Table 5 shows the total net volume of wood added to the inventory of good trees on the whole forest area during 1935, expressed in board feet (International $\frac{1}{4}$-inch rule) for sawlog-size material and in standard cords of 4 x 4 x 8 feet for material under sawlog size. In arriving at these estimates, deductions were made for natural mortality but not for cuttings. The total increment for all conditions is about 223 million board feet of sawtimber material and 574,000 cords in the stems of good trees under sawlog size. Conversion of the board-foot increment to cords, on the basis of 2 cords per thousand board feet, gives nearly 450,000 cords. Considerably more than half the increment, therefore, is on trees under sawlog size. Of the board-foot increment, nearly two-thirds is in trees below the 20-inch diameter-class. Also, employing the same conversion factor as before (2 cords per M bd. ft.) we find (from table 5) that nearly 75 percent of the total increment expressed in cords is on noncommercial areas. Thus we see that the increment is predominately in trees below the 20-inch diameter-class and on noncommercial areas, and consequently of low immediate value from the viewpoint of the industrial lumber operator. Because the increment is largely on the smaller trees and in understocked stands, however, one should not conclude that the increment per acre is necessarily small. Converting the board-foot increment to cordwood volume (including bark), the total annual increment per acre in the second-growth sawlog-size and under-sawlog-size conditions, which make up 87 percent of the forest area, is between 0.4 and 0.5 cord.

Table 5.-- Total annual increment,[1] classified according to forest condition, 1935

Forest condition	Increment[2] in trees under sawlog size			Increment in sawlog-size trees						
				Diameter-classes 14 - 18 inches		Diameter-classes 20 inches and over		All sawlog-size trees		
	Commercial area 3/	Noncommercial area	Total	Commercial area 3/	Noncommercial area	Commercial area 3/	Noncommercial area	Commercial area 3/	Noncommercial area	Total
	Cords			M board feet (Int. ¼-inch rule)						
Old growth:										
Uncut	3,400	900	4,300	600	300	5,000	1,200	5,600	1,500	7,100
Partly cut	6,700	21,900	28,600	1,700	5,900	3,600	6,900	5,300	12,800	18,100
Second growth:										
Sawlog size	94,300	30,700	125,000	23,800	59,100	43,400	20,000	67,200	79,100	146,300
Under sawlog size	7,000	414,700	421,700	100	53,700	1,300	3/ -2,700	1,400	51,000	52,400
Reproduction and clear-cut	-	4/ -5,700	4/ -5,700	-	3/ -1,100	-	100	-	3/ -1,000	3/ -1,000
Total all conditions	111,400	462,500	573,900	26,200	117,900	53,300	25,500	79,500	143,400	222,900

1/ Increment figures are based on the assumption that no cutting takes place.

2/ This increment includes the annual growth on trees at least 5.0 inches d.b.h. that remain under sawlog size throughout the year, plus the volume in trees that during the year move into the 6-inch diameter-class.

3/ The annual increment on commercial forest areas includes not only the increment on areas that were commercial forest at the beginning of the year, but also the total timber volume added through movement of areas from the noncommercial to the commercial class as a result of one year's growth. Negative board-foot increment on noncommercial forest areas indicates (1) that the volumes on areas moving from the noncommercial to the commercial class were greater than the increment on areas remaining in the noncommercial class, and (2) that the mortality in residual stands is heavy.

4/ Negative annual increments of trees under sawlog size means that the volume of trees changing from under sawlog size to sawlog size is greater than the increment of the trees that were under sawlog size at the end of the year (see footnote 2).

Forest-Products Industries

In 1936, the North Arkansas Delta (which, as previously stated, includes portions of Missouri, Tennessee, and Kentucky) supported within its boundaries 273 primary wood-using plants (figure 2), of which 237 were sawmills and 36 were nonlumber plants.

Lumber industry

The sawmills of this unit are of two distinct classes: (1) those that cut industrial lumber of standard grades, used largely in the manufacture of furniture, fixtures, vehicles, flooring, mill work, and implements; and (2) those that produce (a) heavy structural material for such uses as cross ties, car stock, dock and bridge material, and (b) light structural material for local building. Industrial lumber mills in general have a daily capacity of at least 20,000 board feet. Usually band mills, equipped to cut well-manufactured, air-dried, rough lumber for factory consumption, they require a large proportion of high-grade logs. Hardwood mills producing structural material usually are small mills, often with a circular saw and lacking facilities for the proper edging, trimming, and yarding of their output. They can operate generally on a lower average quality of timber than can the industrial lumber mills.

Table 6 shows that 122 million board feet of lumber was manufactured in the sawmills of the unit in 1936. From this table it can be seen also that although the sawmill industry is characterized by small mills, which chiefly cut heavy structural material and material for local building, these small mills produced only about 39 percent of the lumber cut in this unit. Furthermore, although the mills in the unit produced 122 million board feet of lumber, 168 million board feet was cut from the stands of the unit, indicating that a considerable volume in sawlogs was shipped out to mills located elsewhere. A large part of this volume was shipped to Memphis, Tennessee, an important hardwood industrial center just across the Mississippi River from this unit.

Table 6. - Production and employment data in the lumber industry, 1936[1/]

Daily mill capacity	Mills	Produced by mills in the unit	Mill employment	Produced from forests of the unit	Woods employment
M bd.ft.	Number	M bd.ft.	Man-days	M bd.ft.	Man-days
Under 10	200	25,500	34,400	25,300	35,400
10 - 19	25	22,100	32,900	24,000	27,300
20 - 39	7	22,900	52,300	48,500	88,800
40 - 79	3	25,900	60,800	59,900	81,500
80 and over	2	25,700	35,900	10,500	13,600
Total	237	122,100	216,300	168,200	246,600

1/ Based on a 10-hour operating day and net log scale (International $\frac{1}{4}$-inch log rule).

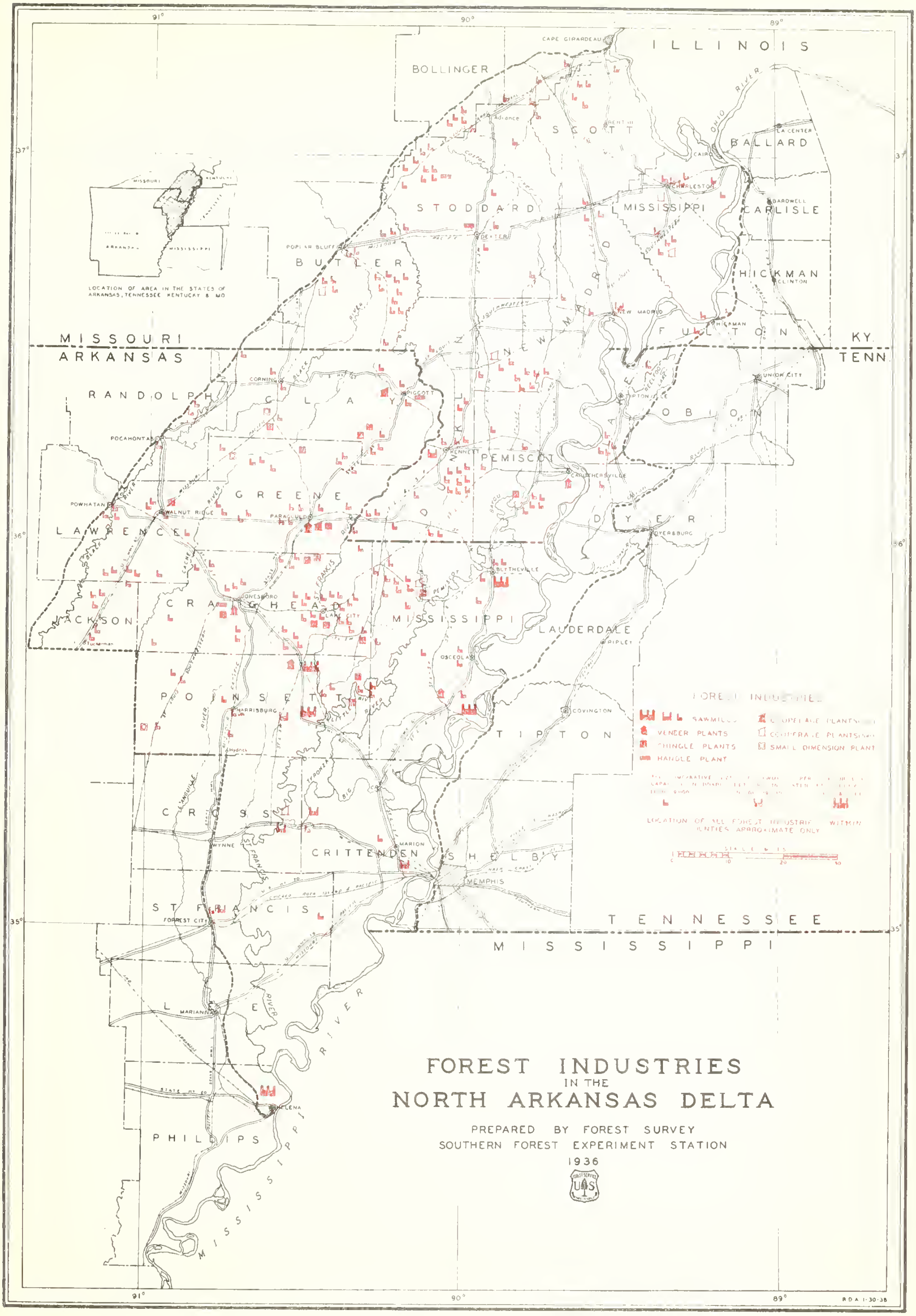

FOREST INDUSTRIES
IN THE
NORTH ARKANSAS DELTA
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
1936
LOCATION OF AREA IN THE STATES OF ARKANSAS, TENNESSEE, KENTUCKY & MO.
VENEER PLANTS
HANDLE PLANT
SMALL DIMENSION PLANT
ILLINOIS
MISSOURI
ARKANSAS
KY.
TENN.
TENNESSEE
MISSISSIPPI
BOLLINGER
SCOTT
BALLARD
STODDARD
MISSISSIPPI
CARLISLE
BUTLER
HICKMAN
NEW MADRID
FULTON
RANDOLPH
CLAY
OBION
PEMISCOT
GREENE
DYER
LAWRENCE
JACKSON
CRAIGHEAD
MISSISSIPPI
LAUDERDALE
POINSETT
TIPTON
CROSS
CRITTENDEN
SHELBY
ST. FRANCIS
LEE
PHILLIPS
CAPE GIRARDEAU
CAIRO
CHARLESTON
DEXTER
POPLAR BLUFF
NEW MADRID
HICKMAN
CLINTON
UNION CITY
CORNING
PIGGOTT
POCAHONTAS
KENNETT
CARUTHERSVILLE
POWHATAN
WALNUT RIDGE
PARAGOULD
DYERSBURG
BLYTHEVILLE
JONESBORO
LAKE CITY
OSCEOLA
RIPLEY
COVINGTON
HARRISBURG
WYNNE
MARION
MEMPHIS
FORREST CITY
MARIANNA
HELENA
MISSISSIPPI RIVER
91°
90°
89°
37°
36°
35°

Figure 2.

Nonlumber industries

In general the manufacture of veneer, tight and slack cooperage stock, poles and piles, and such miscellaneous products as small dimension stock, handles, and vehicle stock, requires a large proportion of high-grade logs or bolts. These nonlumber industries, however, can draw ordinarily on the high-grade material in the second-growth stands and partly cut stands left after logging for industrial lumber mills. The industries producing cross ties, shingles, and chemical wood, which do not require high-grade material, can operate effectively on the kind of timber most abundant in partly cut and second-growth stands.

Table 7 shows the 36 nonlumber wood-using plants in the unit. These plants, together with the many small sawmills cutting structural material, play an important part in the utilization of the forest and have to a considerable extent adjusted themselves to a forest growing stock characterized by low average volumes per acre and a relatively small proportion of high-grade timber.

Table 7. - Production and employment data in the nonlumber industries, 1936 1/

Commodity	Plants in unit	Produced by plants in the unit	Plant employment	Produced from forests of the unit	Woods employment
	Number	Cords	Man-days	Cords	Man-days
Tight cooperage material 2/	3	11,600	42,000	11,800	12,000
Slack cooperage material 3/	6	21,000	30,500	28,000	29,100
Chemical wood	-	-	-	4,100	5,200
Handles	4	4,300	12,000	8,400	16,000
		M bd.ft.		M bd.ft.	
Veneer	5	11,900	27,900	29,600	47,300
Shingles	15	1,500	4,200	1,500	4,200
Small dimension stock	3	400	2,300	2,600	8,500
		Pieces		Pieces	
Cross ties	-	-	-	319,000	32,200
Poles and piles	-	-	-	19,000	5,200
Total	36	-	118,900	-	159,700

1/ Cordwood volume is expressed in standard (4 x 4 x 8 feet) cords, including bark. Board-foot volumes are in terms of the International $\frac{1}{4}$-inch log rule. Man-days are based on a 10-hour day.

2/ Both staves and heading.

3/ Only staves.

Employment

The total forest industrial employment in the unit in 1936 was 741,500 man-days (see tables 6 and 7), of which 462,900, or 62 percent, were expended in the sawmill industry and the remainder in the nonlumber industries. In addition, it is probable that the labor involved in cutting about a million cords of fuelwood and miscellaneous material used on farms, as well as the 5,750,000 fence posts used in the unit, amounted to approximately 1,300,000 man-days. Although only a small portion of this employment — probably no more than 10 percent — was for cash wages, it represents an important employment item in the life of the people. The material thus produced, without cash outlay and usually without interference in normal gainful employment, is a substitute for material that would otherwise have to be purchased.

Forest Drain

The total volume of wood removed from the good trees of the unit in 1936 for use in industry and for domestic purposes has been expressed in table 8, in terms of drain against the growing stock of good trees. As used here, forest drain means the total volume of usable material removed from the stands by cutting, including the full volume of the trees felled; it does not include losses due to mortality, which are taken into account in calculating the increment. Neither does it include material cut from cull and dead trees or from limbs. Thus, drain in board feet in the first column of figures in table 8 includes the volume actually used (from tables 6 and 7), plus the volume left in the woods as waste because, although it met the Survey specifications for usable logs, it did not meet the requirements of the particular user. Drain in the last column of table 8 includes the cubic-foot contents of the sawlog portion of sawlog-size trees, plus the cubic-foot contents of the main stem of good trees at least 5.0 inches d.b.h. but under sawlog size.

Table 8. - Net volume of timber drain from good trees, 1936

Commodity	From sawlog-size trees	From all trees 5 inches d.b.h. and larger
	M bd.ft.1/	M cu.ft.2/
Lumber	189,100	28,860
Veneer	33,400	4,810
Tight cooperage material	8,400	1,230
Slack cooperage material	18,200	2,940
Handles	3,900	1,000
Shingles	1,600	330
Small dimension stock	3,000	570
Poles and piles	2,000	370
Cross ties	19,200	2,940
Material cut in clearing land	19,400	8,840
Chemical wood	100	280
Material cut for fuelwood, farm fence posts, and other domestic uses	80,600	27,170
Total	3/378,900	4/79,340

1/ According to the International $\frac{1}{4}$-inch log rule.

2/ Inside bark.

3/ 5,200,000 board feet, or approximately 1.4 percent, is pine; the remainder is hardwood and cypress.

4/ 940,000 cubic feet, or approximately 1.2 percent is pine; the remainder is hardwood and cypress.

The total 1936 drain from sawlog-size trees was 378.9 million board feet, of which 5.2 million is pine; in 1935 the drain from sawlog-size trees was 354.5 million board feet. Approximately half of this drain comes from commercial areas, which furnish a high proportion of the cut for lumber, veneer, and cooperage material. Noncommercial areas, on the other hand, furnish the greater part of the board-foot drain occasioned by land clearing, for fuelwood, and for other domestic use, since the sawlog material cut for these purposes is usually unsuited for high-grade industrial uses.

Comparison of Increment and Drain

The total net growing stock in the forests of the unit on January 1, 1935, was 4,122 million board feet, green lumber tally. The board-foot drain in that year exceeded the increment on noncommercial areas as well as on commercial. Furthermore, the total cubic-foot drain exceeded the total cubic-foot increment. It is evident that the sawmills and nonlumber industrial plants and other cutting operations are depleting their forest capital. At the end of 1935, the growing stock had been reduced to 3,974 million board feet, a net reduction of forest capital of 148 million board feet. In 1936 the drain increased over that of 1935, resulting in a further reduction in growing stock. The comparison of growth and drain and the state of the growing stock for 1936 are shown in table 9.

These facts indicate that this unit is suffering from a chronic case of over-cutting. It is close to the agricultural and industrial centers of the Midwest, to which freight rates on industrial lumber from the unit are generally favorable. Furthermore, local markets are available for the relatively low grades of lumber and other wood products. Because of these advantages over competing hardwood-producing regions more distant from the principal consuming centers, it is to be expected that commercial cuttings in the Arkansas Delta are feasible on areas that would be impracticable to log in the hardwood regions farther south. Furthermore, during recent years relatively large areas of cut-over forest land have been cleared for agricultural uses. This trend in land clearing probably will continue, thus reducing the forest acreage still further and possibly resulting in still greater excesses of drain over growth. In addition, the rural population within the unit is increasing, and there is a corresponding increase in its wood-utilization requirements.

Table 9. - Comparison of increment with drain, 1936

Item	Total forest area	
	M bd.ft. 1/	M cu.ft. 2/
Net growing stock, Jan. 1, 1936	3,974,300	1,350,970
Increment, 1936 3/	202,500	63,090
Utilization drain, 1936	378,900	79,340
Net change in growing stock, 1936	-176,400	-16,250
Net growing stock, Jan. 1, 1937	3,797,900	1,334,720

1/ According to the International $\frac{1}{4}$-inch rule.
2/ Exclusive of bark.
3/ Increment figures are based on the assumption that cutting took place.

Outlook for the Future

In general, this unit is an agricultural region and can be expected to become even more so. The area east of Crowley's Ridge, especially in the northern portion of the unit is now very largely agricultural, with forest areas restricted to small scattered blocks of woodland evidently unable to meet adequately the domestic needs of the present farming population. Here the primary function of the forest area is to supply the needs of an agricultural people for fuelwood, fence posts, other domestic uses, and forest pasture. In much of the remainder of the unit, the forest is also an adjunct to farming, but the supply of wood is in excess of that needed for domestic use. Here farmers can expect to increase their cash income through the production of logs for sawmills and other primary forest industries. A relatively small percentage of the forest area is owned by industrial timber operators, who are, in general, selling their cut-over lands to farmers as rapidly as possible. Certain areas, however, principally on the "batture" (i.e., the land between the levee and the river), probably will continue to be held for timber production by industrial operators.

It is therefore apparent that this unit is primarily not an industrial timber-growing region, and that the timber that is produced for industrial use can be expected to come in large part from farm woodlands and batture land. Furthermore, the woodland area is steadily decreasing through conversion to cultivated land. The present excess of drain over increment, occasioned by the increasing demand for wood and the shrinkage in forest area, can be expected to continue for some time; but with the application of the few relatively simple forest-management practices mentioned below, the forest growing stock can in time be built up to produce a much greater increment of a higher quality than that now being obtained. The owner of permanent forest land should consequently wish to improve the quality of his forest increment so that he may be able to supplement his cash farm income by the sale of industrial wood products in addition to producing wood for his domestic needs.

In general, the forests of this unit are at present badly run down; both the average volume per acre and the relative proportion of high-grade material suitable for industrial use are low. As can be seen from a comparison of figures 3A and 3B, there is on the average forest acre a dearth in the proportion of trees in the larger diameter-classes (12 inches and over). In the actual forest, the 12-inch diameter-class shows the largest basal area,[2/] whereas in a well-managed forest, designed to give optimum continuous production, the maximum basal area is in the 18- and 20- inch diameter-classes. In the noncommercial forest areas (more than 90 percent of the whole) the prevailing cutting practices are tending to increase the present maladjustment of size-classes; the general lack of larger trees is forcing the cutting of medium-sized trees, which should be left to grow into the larger size-classes.

Unless remedial measures are adopted, it is very apparent that sooner or later the production of the more valuable forest products from this area will be reduced materially because of a lack of suitable standing timber of the proper kind and quality. In other words, the present tendency is inevitably towards progressively confining the future output of the forests to smaller trees of low value. To increase the value of the forest growth, larger trees of higher quality must be grown. This will require the general adoption of a longer rotation, that is, trees that are to constitute the final harvest must be left to grow until they are 20 inches in diameter or larger. At the same time the forest growing stock must be built up; in general, the present run-down stands average only one-fourth to one-third of the board-foot volume the sites are capable of sustaining. It is obvious that stands cannot be built up as long as the annual drain from individual areas, and also from the unit as a whole, is greater than the annual increment. During the several decades needed to rehabilitate the forest stands, a reduction in the cut of industrial timber would be necessary.

2/ The basal area is the sum of the areas of the cross sections of the trees at breast height.

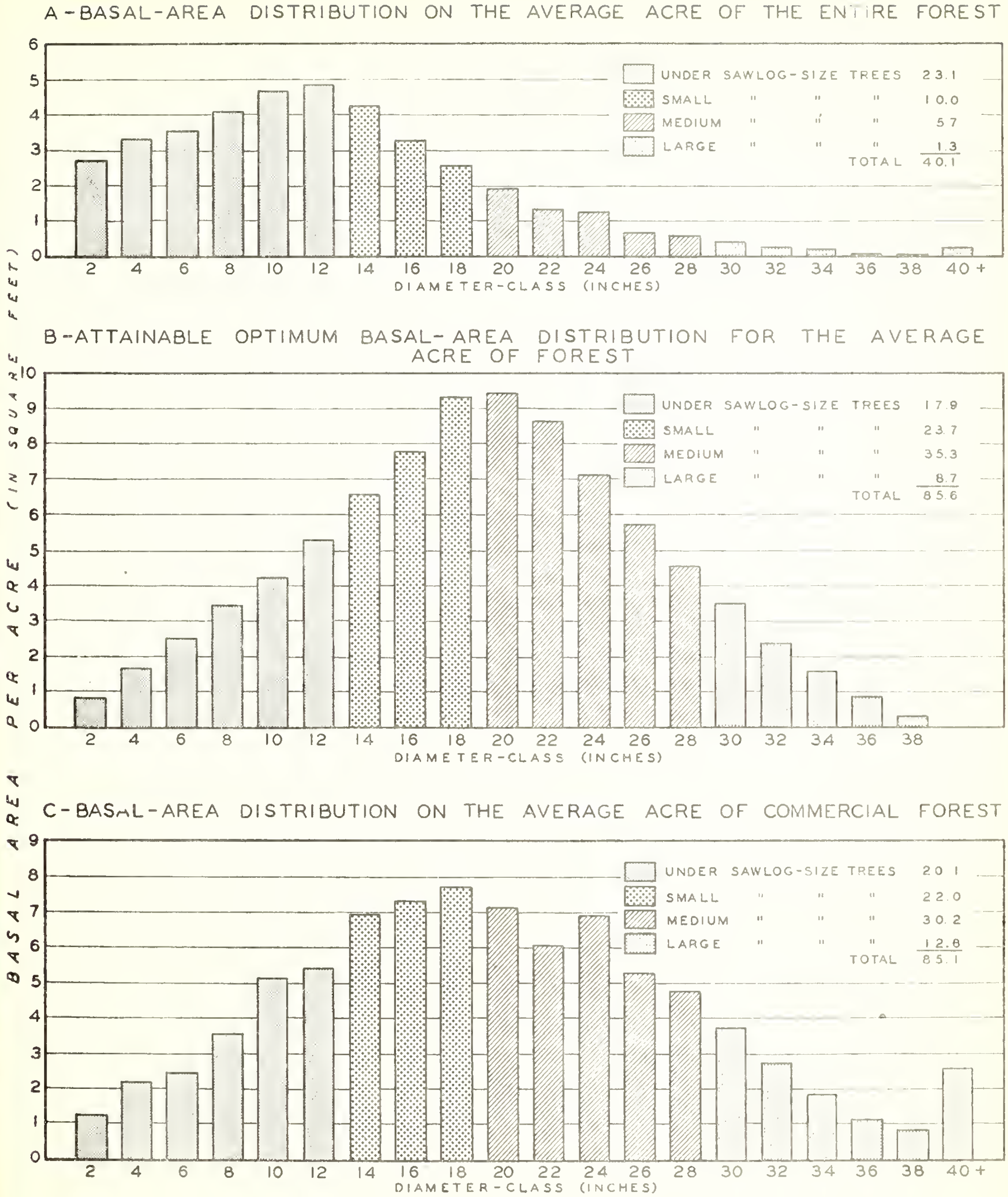

A-BASAL-AREA DISTRIBUTION ON THE AVERAGE ACRE OF THE ENTIRE FOREST
UNDER SAWLOG-SIZE TREES 23.1
SMALL " " " 10.0
MEDIUM " " " 5.7
LARGE " " " 1.3
TOTAL 40.1
DIAMETER-CLASS (INCHES)
B-ATTAINABLE OPTIMUM BASAL-AREA DISTRIBUTION FOR THE AVERAGE ACRE OF FOREST
UNDER SAWLOG-SIZE TREES 17.9
SMALL " " " 23.7
MEDIUM " " " 35.3
LARGE " " " 8.7
TOTAL 85.6
DIAMETER-CLASS (INCHES)
C-BASAL-AREA DISTRIBUTION ON THE AVERAGE ACRE OF COMMERCIAL FOREST
UNDER SAWLOG-SIZE TREES 20.1
SMALL " " " 22.0
MEDIUM " " " 30.2
LARGE " " " 12.8
TOTAL 85.1
DIAMETER-CLASS (INCHES)
BASAL AREA PER ACRE (IN SQUARE FEET)

Figure 3.

Growth possibilities in this unit are inherently great. In spite of the present understocked condition of the second-growth stands, the annual increment is between 0.4 and 0.5 of a cord per acre on 87 percent of the total forest area. This increment could be increased substantially through the application of the following basic measures of timberland management: (1) increasing the timber volume on the average acre by cutting less than the annual increment and encouraging an increase in the number of stems, since it is obvious that a forest with a stand of 2,500 board feet per acre will lay on more wood per annum at a given increment rate than will a stand of only 1,500 board feet; (2) retaining in the stand for a few more years the most rapidly growing trees (i.e., trees 16 to 20 inches d.b.h.) instead of cutting them while they are still growing at their most rapid rate, thus tending to increase the volume per acre and to take full advantage of the rapid-growth period of the individual trees; (3) removing the relatively slow-growing and low-quality trees for fuelwood and other domestic uses, thus releasing the rapid-growing young trees from competition; and (4) reducing to a practicable minimum the timber loss through natural causes, by effectively preventing forest fires and removing cull trees and trees destined to die before they reach maturity.

Although these simple measures can be applied by almost anyone interested in making his woodland contribute most to his needs, there is need for extension workers to "sell the idea" of "timber culture" to an agricultural people and to demonstrate that in this area there is a definite place for both "timber culture" and agriculture. Because of the peculiar soil and drainage conditions found here, there is a considerable area of land that will remain forested for many years to come. Timber cropping on this land should be a desirable adjunct to agriculture, since it provides both material for domestic use and off-season woods employment to farm labor, and also adds to the farm or plantation income through the sale of wood products.

Because an intimate relationship exists between farm and forest, because markets for high-grade lumber in industrial and agricultural centers are relatively near, and because there is already a local demand for low-quality material, it is to be expected that most of the woodlands in this unit will continue in private ownership. On the other hand, high land taxes, especially within the boundaries of organized drainage districts, are (and will continue to be) a handicap to private timber growing. Wherever practicable, areas of low agricultural value should be given preferential treatment in the drainage tax schedule and should be dedicated to timber production. Also efforts should be made to establish a reasonable, uniform, and stable taxing policy for lands suitable chiefly for timber production, since such a policy would greatly stimulate the continuous use of this land for this purpose.

Summary and conclusions

In brief, the outlook for the future in this unit comprises (a) a shrinking forest area as a result of conversion to agriculture, (b) a continuing excess of forest drain over increment, and (c) a decrease in the volume of production of high-grade industrial forest commodities. This paints a depressing picture for forestry, but the superior claim of agriculture to the fertile soils of this favorably located section of the Delta must be recognized. Nevertheless, successful agriculture here will always need woodlots and their products. Furthermore, there are certain areas of high forest values in all parts of the unit that will be neither readily converted nor soon needed for agricultural crops. On some of these areas, notably on batture land and on Crowley's Ridge, the growing of timber as an activity in itself may be feasible. Owners of such lands should be aided through tax relief, extension work in forestry, and cooperative fire-protection service, to develop the forest possibilities of these areas to the full capacity of their sites. In this way will these forest lands best serve their owners and the communities in which they occur.

FOREST SURVEY RELEASE NO. 33 June 18, 1938

FOREST RESOURCES OF NORTHWEST FLORIDA

A Progress Report

by

THE SOUTHERN FOREST SURVEY

I. F. Eldredge

Regional Survey Director

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

Excellent shipping facilities, especially along the Gulf Coast, encouraged the early growth of important forest industries; and the excellent railroad and recently developed highway systems have made possible the establishment of many forest-products plants in the interior (fig. 4). The Apalachicola and the Choctawhatchee Rivers and, to a lesser extent, the Aucilla, Ochlockonee, Escambia, and Perdido, are navigable for barges; flowing southward into the Gulf, they form the principal drainage system of the unit. In general, the coastal belt is low, flat, and poorly drained, but sand and clay hill areas in the northern half have elevations up to 300 feet above sea level.

Farmers own approximately one-fifth of the area, although farmland (including farm woodlands), according to statistics provided by the Census, decreased more than 10 percent between 1910 and 1935. The Forest Survey found that about three-fourths of the total agricultural land was in cultivation, corn and cotton being the principal crops; while over 200,000 acres that had been out of cultivation for the last 2 years were classed as idle or definitely abandoned agricultural land. Acreage in improved pasture is small, chiefly because the large cattle industry depends for grazing upon the open forest and farm woodlands. A study of three counties in 1934 indicated that nearly 20 percent of the area is owned by the various forest-products industries, while about 12 percent is in public ownership — principally in the Apalachicola and the Choctawhatchee National Forests, which offer excellent examples of the possibilities of providing forest industries with a continuous supply of raw materials. The remaining area is in the possession of land speculators, banks, insurance companies, and non-residents. The study of land ownership in the above-mentioned counties revealed that the size of the average holding was about 210 acres and that 92 percent of the ownerships were small (less than 500 acres each). In 1934 almost one-third of the entire area was in tax default for 3 or more years, and in several counties more than one-half of the land was in default. Non-payment of taxes, however, does not necessarily imply abandonment of private ownership.

Description of the Forest

In this locality the predominance of pine is encouraged by an abundant rainfall, a growing season about 8 months long, and a soil composed chiefly of sandy loam or deep sand. About 44 percent of the forest area is rolling uplands; 30 percent is flatwoods; and the remaining 26 percent is in swamps, bays, ponds, and river bottoms. The longleaf-slash pine type-group, which covers over 4 million acres, or 68 percent of the forest area, is the principal type-group in the unit (table 2). The hardwood type-group, with its gums, oaks, and other southern hardwoods, covers 20 percent of the forest land, while the loblolly and the cypress types occur to only a limited extent.

The prevalence of certain forest types over large areas is shown on the map (fig. 1), although within the broad range limits there delineated occur many small intermingled areas of other types, as well as areas of cleared land. The longleaf-slash pine types are usually found on the rolling uplands or flatwoods. The loblolly pine (or "nonturpentine" pine) types are usually confined to the more fertile clay soils of the rolling hills in Jackson, Gadsden, Leon, and Jefferson Counties, while both the hardwood and the cypress types are usually confined to the larger bottomlands and swamps and to the

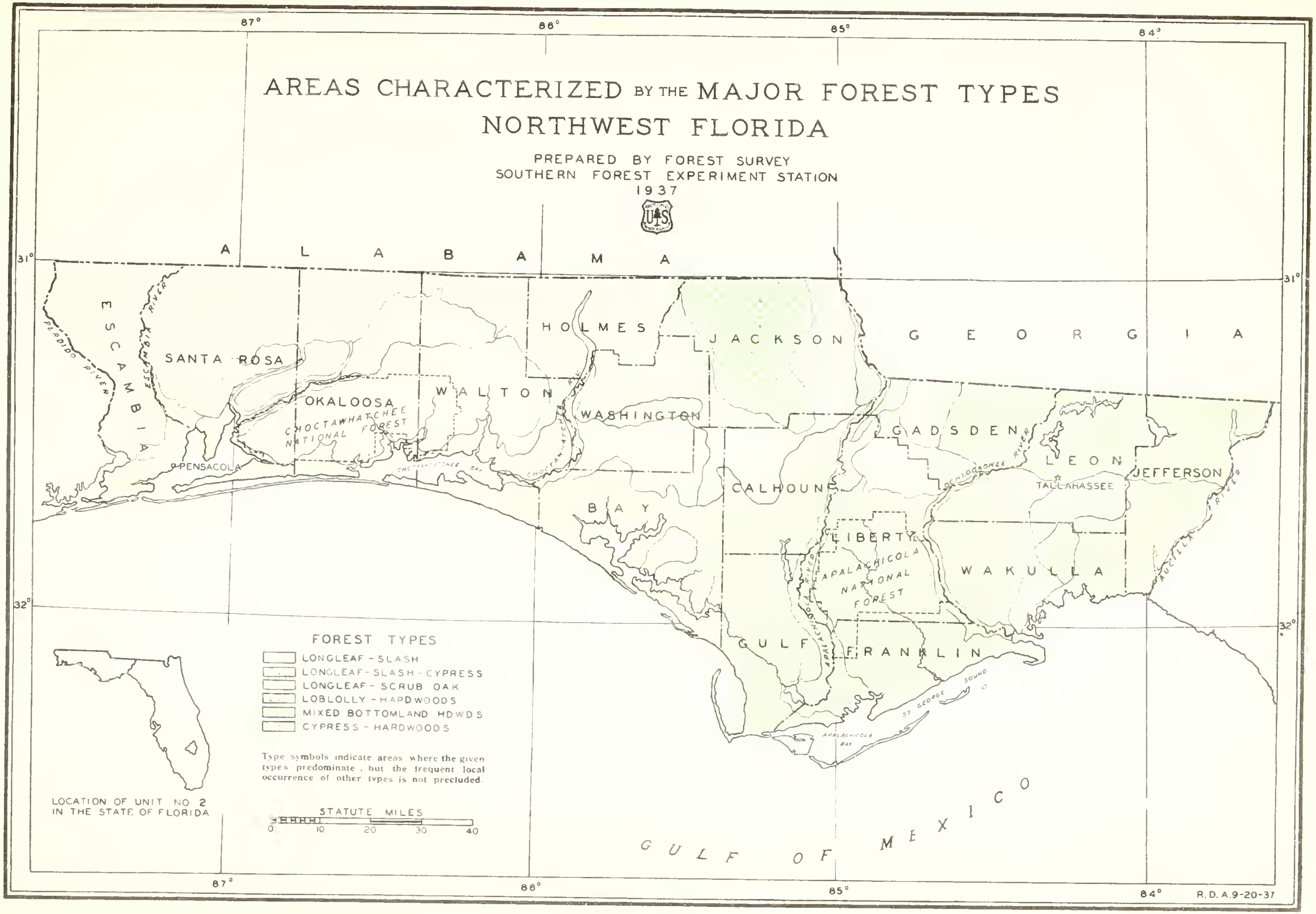

AREAS CHARACTERIZED BY THE MAJOR FOREST TYPES
NORTHWEST FLORIDA
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
1937
ALABAMA
GEORGIA
ESCAMBIA
SANTA ROSA
OKALOOSA
WALTON
HOLMES
WASHINGTON
JACKSON
CALHOUN
BAY
GULF
LIBERTY
FRANKLIN
GADSDEN
LEON
WAKULLA
JEFFERSON
TALLAHASSEE
PENSACOLA
PERDIDO RIVER
ESCAMBIA RIVER
CHOCTAWHATCHEE NATIONAL FOREST
APALACHICOLA NATIONAL FOREST
APALACHICOLA RIVER
OCHLOCKONEE RIVER
AUCILLA RIVER
ST GEORGE SOUND
GULF OF MEXICO
FOREST TYPES
LONGLEAF - SLASH
LONGLEAF - SLASH - CYPRESS
LONGLEAF - SCRUB OAK
LOBLOLLY - HARDWOODS
MIXED BOTTOMLAND HDWDS
CYPRESS - HARDWOODS
Type symbols indicate areas where the given types predominate, but the frequent local occurrence of other types is not precluded.
STATUTE MILES
0 10 20 30 40
LOCATION OF UNIT NO 2 IN THE STATE OF FLORIDA
87° 86° 85° 84°
31° 32°
R.D.A.9-20-37

FIGURE 1.

"ponds" and "bays" throughout the flatwoods. The scrub oak-hardwood type, which now occupies much of the land formerly covered with longleaf, is an exception, in that it is found upon the dry, rolling, sand hills.

As may be seen in table 2, second-growth stands, which are characteristic of this Survey unit, occupy nearly 69 percent of the forest area. Old-growth stands, containing large trees that would make high-quality lumber, now occupy only 17 percent of the forest area. Old-growth stands exist mostly in small isolated patches, although a few good-sized blocks of old-growth hardwoods are found along the Apalachicola River. More than half of the old-growth area has been subjected to partial cutting that has involved the removal of 10 percent or more of the saw timber (i.e., hardwoods at least 13.0 inches d.b.h. and pines and cypress at least 9.0 inches d.b.h.) but has left per acre at least 1,000 board feet (green lumber tally) of hardwoods and cypress, or 600 board feet of pine. The uncut old-growth stands average per acre nearly 5,000 board feet, while the partly cut stands average about 3,300.

Of the second-growth stands, which are scattered throughout the area in both large and small blocks, about 22 percent by area is classified as sawlog size, having a minimum of 600 board feet per acre if uncut and 400 if partly cut. Combining uncut and partly cut stands, this forest condition contains an average volume per acre of about 2,600 board feet, or 12 cords (including under-sawlog-size material). Second-growth stands, made up chiefly of trees under sawlog size, contain an average of 200 board feet per acre, or slightly more than 2 cords, and occupy approximately 61 percent of the second-growth area. The reproduction condition, which is the youngest second-growth condition, occupies 17 percent of the second-growth area and consists chiefly of seedlings and sprouts less than 1 inch d.b.h.

The distribution of the seedlings in the natural reproduction area varies greatly. Approximately 17 percent of the area classed as longleaf pine reproduction, and 13 percent of the slash pine reproduction, are well-stocked with more than 900 well distributed seedlings per acre. Also 19 percent of the longleaf and 13 percent of the slash pine reproduction area has from 170 to 900 well distributed seedlings per acre. On approximately 7 percent of the longleaf and 8 percent of the slash pine reproduction area, however, there is a fair stand of seedlings (300 or more per acre), but they are poorly distributed, i.e., in dense groups with open spaces between. The remainder, and by far the greater part of the reproduction area, has a minimum stocking of 80 seedlings per acre (seldom more than 300), that usually are poorly distributed. Where longleaf pine stands are clear-cut on deep sandy land, scrub oaks often capture and occupy the area for many decades. On the better soils, loblolly pine is taking over large areas formerly held by longleaf pine. There is much evidence that, where the incidence of forest fires is kept to a minimum, slash pine tends to replace longleaf after cutting, if seed trees are present.

It is significant that this Survey unit has an unusually large area in the clear-cut condition. Fully 14 percent (about 877,000 acres) of the forest area has been cut so severely and thereafter burned over so frequently that natural reforestation has failed to restock it with at least 80 seedlings per acre. Of this entire area, approximately 356,000 acres have 3 or more pine seed trees at least 6 inches d.b.h. and should reforest naturally if fires are kept out; 319,000 acres have 1 or 2 pine seed trees and may eventually reforest, if fires are controlled; while the remaining 202,000 acres are without seed trees and probably will require artificial reforestation to make them productive of desirable species. Practically all of the clear-cut area is in the longleaf-slash pine types.

Table 2. -- Forest area classified according to type-group and condition

Forest condition	Forest type-groups designated by predominant species: Longleaf and slash pine	Loblolly and other pine	Hardwood	Cypress	Total	Percent of total forest area
	Acres					
Old growth:						
Uncut	148,500	32,100	136,000	45,600	362,200	6.0
Partly cut	283,700	44,800	226,200	92,900	647,600	10.8
Total old growth	432,200	76,900	362,200	138,500	1,009,800	16.8
Second growth:						
Sawlog size:						
Uncut	524,300	157,900	67,600	16,000	765,800	12.7
Partly cut	70,100	47,200	10,200	1,700	129,200	2.1
Under sawlog size	1,697,000	168,100	632,400	27,000	2,524,500	42.0
Reproduction	552,300	44,700	101,300	12,600	710,900	11.8
Total second growth	2,843,700	417,900	811,500	57,300	4,130,400	68.6
Clear-cut	846,100	14,300	10,100	6,800	877,300	14.6
Total all conditions	4,122,000	509,100	1,183,800	202,600	6,017,500	100.0
Percent of total	68.5	8.5	19.6	3.4	100.0	

The productivity or site quality of the forest is indicated by the height attained by dominant trees at 50 years of age. Approximately 10 percent of the sites dominated by pine are classed as "good," growing trees 80 feet or higher in 50 years; 72 percent are "medium," as indicated by 60- and 70-feet trees; and 18 percent of the sites are "poor," under 60 feet. The proportion of good sites is about the average for the Naval Stores Belt. Good sites for loblolly are most common in the well-drained, rolling terrain in the northeastern counties, and for hardwoods in the bottomlands along the larger streams. The poor sites for turpentine pines are most prevalent in the deep sand hills of Santa Rosa, Okaloosa, Walton, and Washington Counties, and in the poorly drained areas like Tate's Hell Swamp in Franklin County.

Figure 2 shows the relative prevalence of sound trees by 2-inch diameter-classes.[1/] The striking features brought out by these diagrams are (1) the comparative shortage of trees in the larger diameter-classes from which commodities of high value are produced, and (2) the large number of 2-inch trees. It should be appreciated that the latter class is a highly perishable one and will be reduced through the effects of fire, overcrowding, and the other causes of mortality. Improvement and extension of fire protection, however, will reduce the mortality in this and other small size-classes and insure an eventual increase of the stocking in the larger diameter-classes.

In order to judge the adequacy of the present forest from the standpoint of ideal sustained-yield management, its age-class and volume distribution has been compared in figure 3 with that of a managed forest under an assumed rotation of 70 years, which is the period conceivably needed to produce lumber, poles, naval stores, and pulpwood as an integrated crop. The volume figures used are cubic foot, inside bark; no deductions for woods cull (which would be negligible in a managed forest) have been made, and as an equalizing factor, no volumes in turpentined butts have been included. The ideal forest is shown divided into 7 equal areas, each containing one 10-year age-class; and the per-acre volumes used are based on the most heavily stocked 10 percent of the present forest stands for weighted average sites in the turpentine pine types. The area and volume per acre of the present forest is diagramed from field estimates of the age-classes of the 4,122,000 acres in the turpentine pine types.

The above comparison discloses two principal deficiencies in the composition of the present stand: (1) The distribution of age-classes by area is far from ideal in that too large a proportion is in the younger age-classes; and (2) the present forest is sadly deficient in stocking, as shown by the fact that the volume per acre in cubic feet in the present stands averages somewhat less than a third of the volume attainable under management, while the volume in the present 0- to 10-year class is largely in residual trees. For instance, instead of the ideal one-seventh of the area being in the 0- to 10-year class, the area occupied by this age-class, about three-fifths of which has failed to restock, is nearly 2½ times this. Also about one-seventh of the forest area is occupied by stands more than 70 years old. Only one of the present age-class areas, viz., that occupied by stands 21 to 30 years old, approximates the ideal requirement as to area.

1/ The 2-inch class ranges from 1.0 to 2.9 inches d.b.h., the 4-inch from 3.0 to 4.9 inches, and so on.

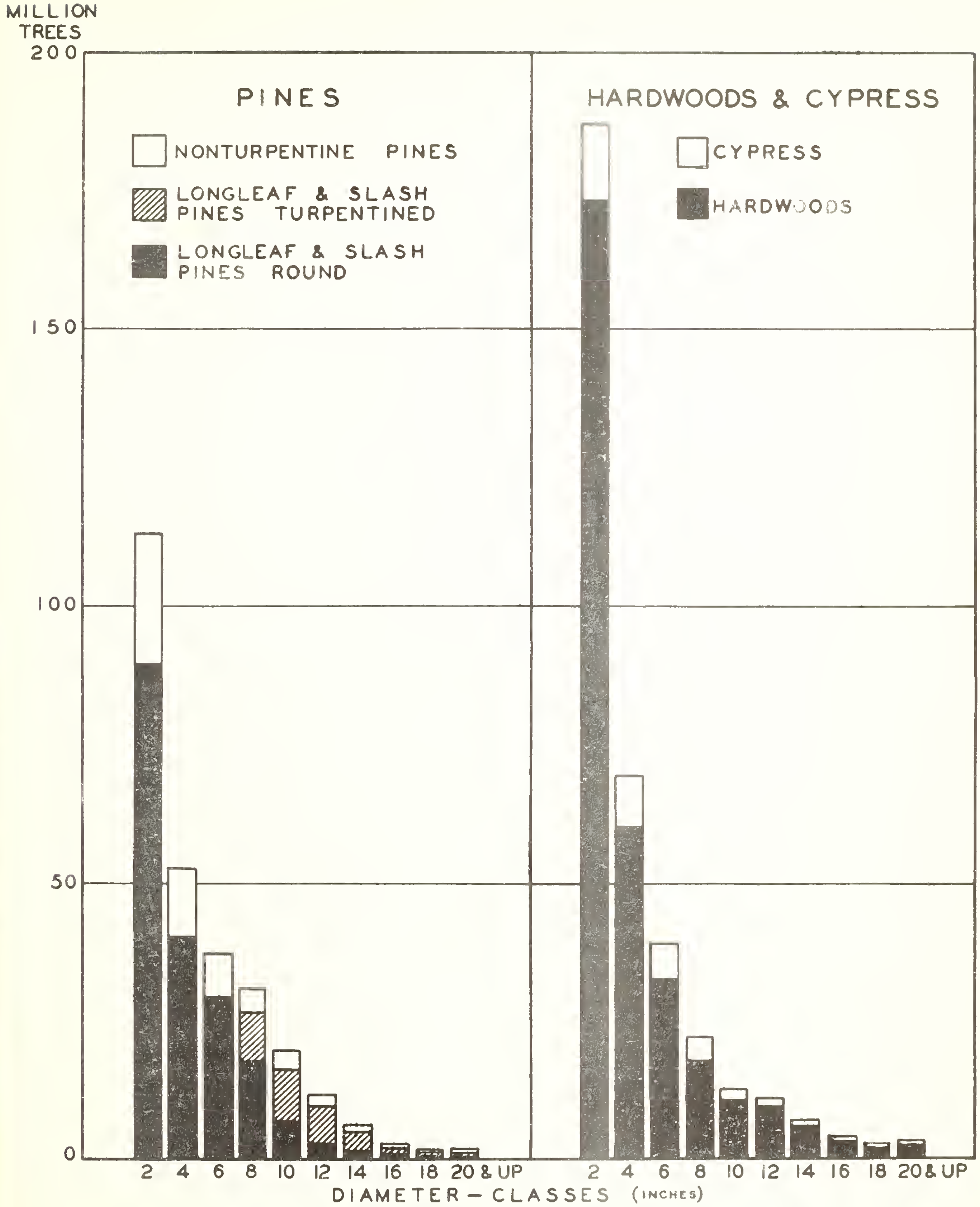


FIGURE 2. - STAND DIAGRAMS

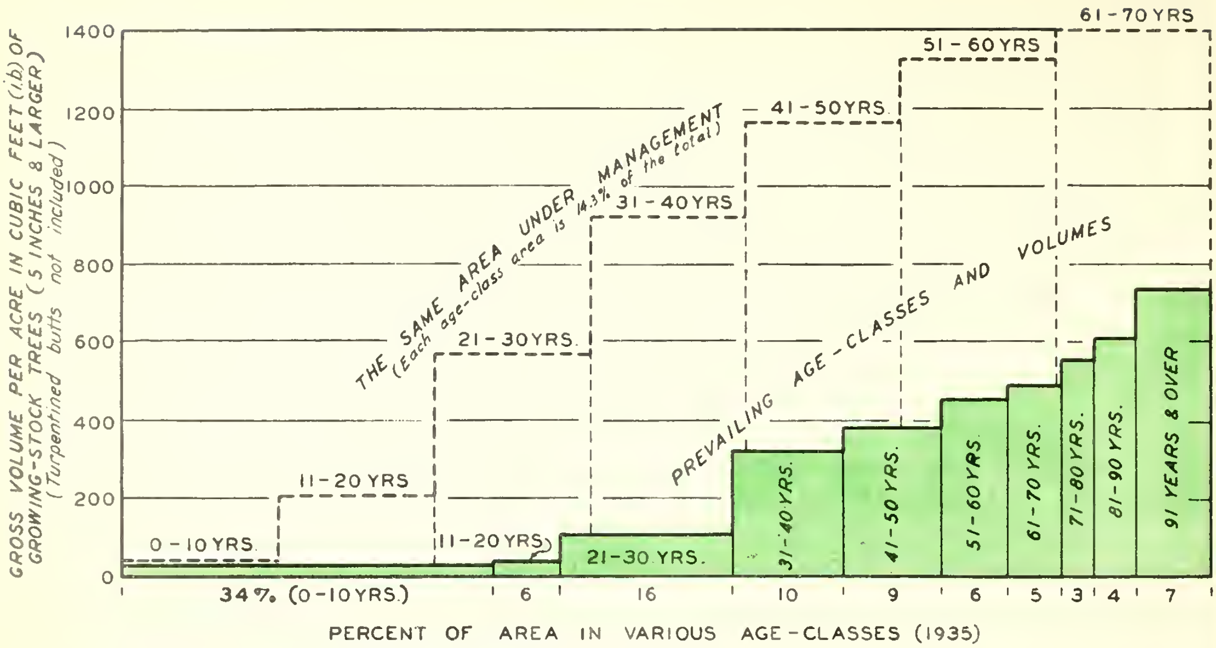


FIGURE 3.- PREVAILING AGE-CLASS AND VOLUME DISTRIBUTION COMPARED WITH THAT ON THE SAME AREA UNDER MANAGEMENT (Based on turpentine-pine type area of 4,122,000 acres)

Naval Stores Industry and Resources

The importance of the naval stores industry in northwest Florida is indicated by the fact that it produces approximately one-tenth of the naval stores of the South and provides annually almost one million man-days of employment — approximately one-third of the total employment in all forest industries. Up until about 1915, the industry was entirely dependent upon gum from living trees, but now wood distillation for the primary purpose of naval stores production is of growing importance. Also in the future an increasing quantity of naval stores may be recovered as a byproduct in the sulphate process of manufacturing paper pulp from pine.

Gum Naval Stores Industry 2/

In the season of 1933-34 (year beginning March 1), northwest Florida produced from the gum of living trees some 39,000 naval stores "units" 3/ valued roughly at $2,000,000. During the season of 1934-35 about 1,339

2/ For additional information see "Statistics on gum naval stores production," Forest Survey Release #17, Dec. 31, 1935, Southern For. Exp. Sta., New Orleans, La. Also Gamble's International Naval Stores Year Book for 1937-38, "Gum naval stores operations of 1934-35 — Their size and distribution and the employment provided by them," by Harry F. Smith and Elsa M. Rayl, Southern For. Exp. Sta.

3/ A unit is made up of one 50-gallon barrel of turpentine and three and one-third 500-pound (gross) barrels of rosin.

"crops"of 10,000 cups each were in operation. Approximately 110 processors or distillers of gum, together with about 400 gum producers without stills were engaged in the work, and 876,000 man-days of employment were provided. The naval stores production for the season of 1936-37 is estimated to be slightly less than 37,000 units. The stills are fairly well distributed over the entire survey unit as shown in figure 4.

Gum Naval Stores Resources

The territory considered as suitable for gum naval stores operations is almost $4\frac{1}{2}$ million acres and includes practically all of the area of the longleaf-slash pine type-group and a fraction of the others. The broad classification of "turpentine area" includes forest that is used or that may be used for commercial operations, together with the coincident patches of clear-cut areas and of loblolly pine and hardwood forest. Approximately 47 percent of this area is in the rolling uplands; 37 percent is in the flatwoods; and the remaining 16 percent is in swamps, bays, and river bottoms.

The turpentine area is classified as "round timber," "working," "resting," or "worked out." "Round timber" areas are made up almost entirely of unturpentined longleaf and slash pine stands ranging from reproduction to old growth. "Working" areas, which have trees that are being chipped, are further classified as (a) "front-faced," if most of the trees are cupped for their first set of faces, or (b) "back-faced," if a significant proportion has a second set of faces. "Resting" areas have been worked but exhibit sufficient opportunities for a second set of faces on worked trees, and for a first set of faces on round trees, to justify another operation. In "worked-out" areas the turpentining possibilities of the present stands have been exhausted, and not until an adequate number of round trees has grown can working be resumed.

It is the usual custom to work front faces for about 6 years, when the cups are removed and the faces abandoned. Following a rest period of about 2 years, new faces (i.e., back faces) are started, and when these faces have been worked as long as possible the trees are usually abandoned, although a third face sometimes is possible. In working old-growth trees that are soon to be cut for lumber, it is often the practice to work the tree only 2 or 3 years prior to cutting.

On the turpentine area there were over 216 million longleaf and slash pine trees (table 3), of which about four-fifths were round (unworked) trees from 1.0 to 8.9 inches d.b.h. and represented the supply for future cuppage. Of immediate importance is the fact that there were almost as many round trees of cupping size (9 inches d.b.h. and larger) as working trees.

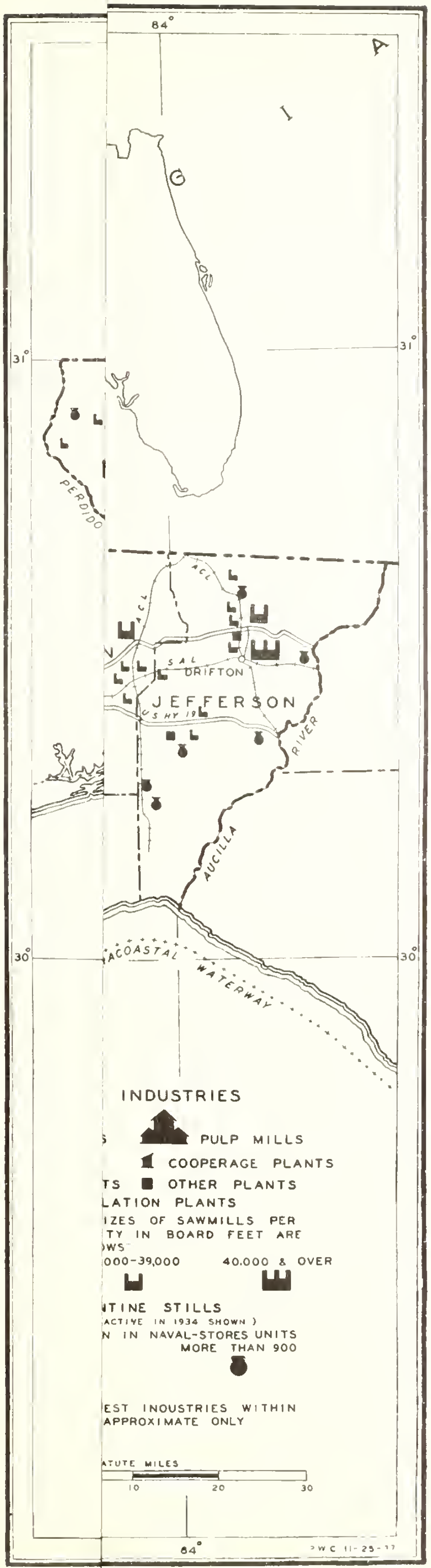
Table 3. -- Round, working, resting, and worked-out longleaf and slash pine trees on turpentine areas of varying history, during the season 1934-35

Turpentine-area history	Round trees: 1.0-8.9 inches	Round trees: 9 inches and over	Working trees	Resting trees	Worked-out trees	Total
	M trees					
Round-timber area	93,602	9,709	-	699	247	104,257
Working area:						
Front-faced area	13,273	135	3,553	51	34	17,046
Back-faced area	26,234	277	8,528	511	1,718	37,268
Resting and worked-out area	41,905	1,824	-	9,156	5,122	58,007
Total turpentine area	175,014	11,945	12,081	10,417	7,121	216,578
Percent of total	80.8	5.5	5.6	4.8	3.3	100.0

The gross round-timber area is about 2 million acres; the working timber area, about 1 million acres; and the combined worked-out and resting areas about $1\frac{1}{2}$ million acres. Figure 5 shows graphically the condition of the turpentine area of $4\frac{1}{2}$ million acres. Of the total turpentine area (bar D), 28 percent is in "well-developed" turpentine stands, i.e., stands with at least 8 future faces per acre on round, resting, or working trees 9.0 inches d.b.h. or larger (they average, as a matter of fact, 19 possible faces per acre, and have many small trees); about 10 percent is in advanced sapling stands, which have a sufficient number of round trees approximately 8 inches in diameter to indicate that the stands will reach the well-developed stage within the next 8 years; 19 percent is in stands that will reach this stage after 8 years and within 20 years, being made up mainly of 2-, 4-, and 6-inch trees; 39 percent is in reproduction, clear-cut, and seed-tree areas that will require over 20 years; and 4 percent is in intermingled non-turpentine areas.

Round-timber area

A few inaccessible areas, usually within the larger swamps and making up a small part of the total, are included in the gross round-timber area of 2 million acres. Also, there are some very small scattered bodies in the more thickly settled agricultural parts of the Survey unit which probably cannot be united into contiguous operations. There is a growing tendency, however, for farmers to work scattered small stands that produce as little as 1 or 2 barrels of gum per month. The preference of turpentine operators for flatwoods timber instead of for timber in the rolling uplands where the forest is broken by agricultural land, or for timber in the swamps, bays, etc. where some of the stands are inaccessible, is indicated by the fact that only one-third of the flatwoods turpentine area is left round while over one-half of that in the latter situations is thus left.



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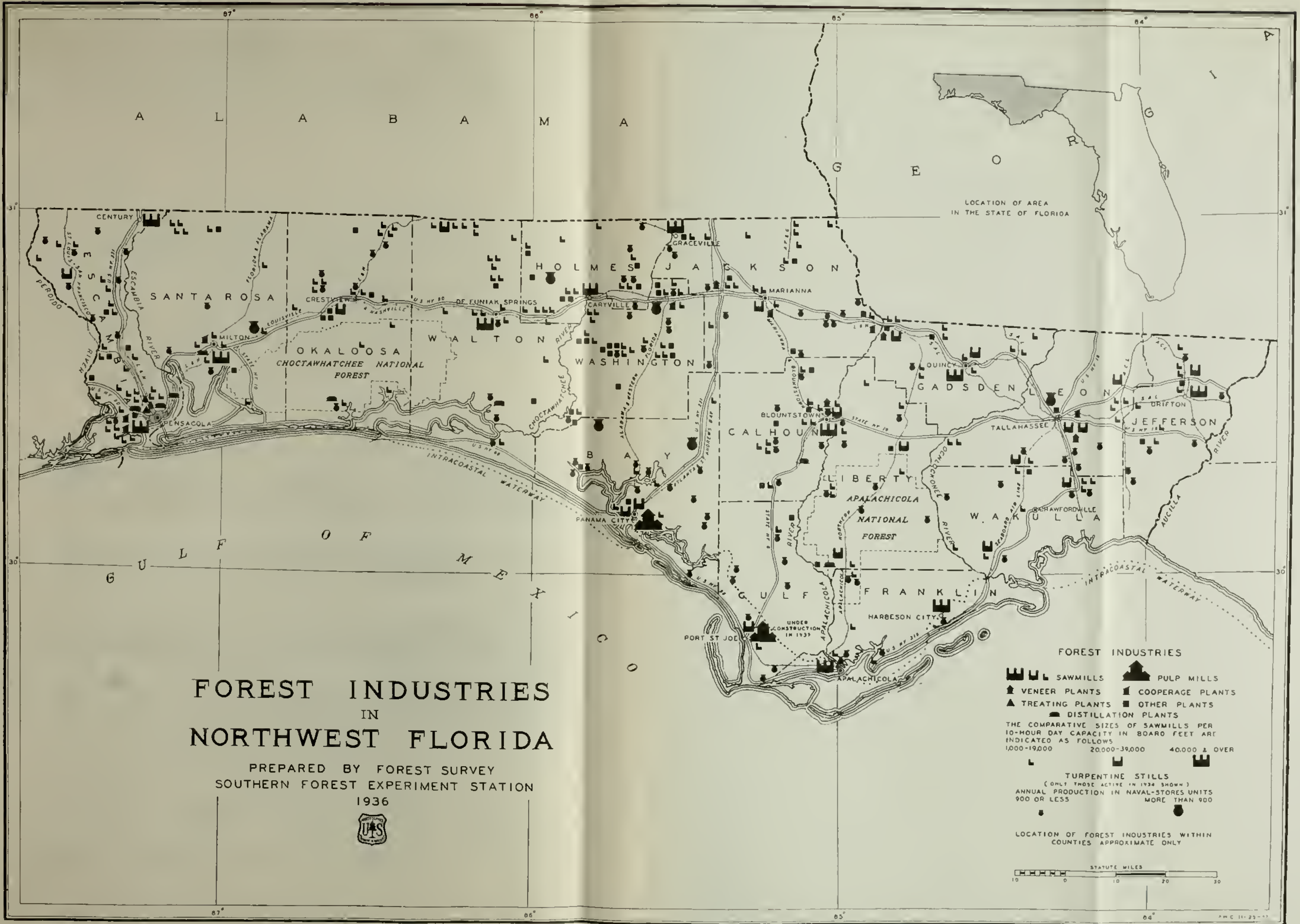
FOREST INDUSTRIES
IN
NORTHWEST FLORIDA
PREPARED BY FOREST SURVEY
SOUTHERN FOREST EXPERIMENT STATION
1936
ALABAMA
GEORGIA
GULF OF MEXICO
LOCATION OF AREA IN THE STATE OF FLORIDA
ESCAMBIA
SANTA ROSA
OKALOOSA
WALTON
HOLMES
JACKSON
WASHINGTON
BAY
CALHOUN
GADSDEN
LEON
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LIBERTY
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FRANKLIN
CHOCTAWHATCHEE NATIONAL FOREST
APALACHICOLA NATIONAL FOREST
CENTURY
MILTON
PENSACOLA
CRESTVIEW
DE FUNIAK SPRINGS
CARYVILLE
GRACEVILLE
MARIANNA
QUINCY
BLOUNTSTOWN
TALLAHASSEE
DRIFTON
CRAWFORDVILLE
PANAMA CITY
PORT ST JOE
UNDER CONSTRUCTION IN 1937
HARBESON CITY
APALACHICOLA
INTRACOASTAL WATERWAY
PERDIDO
ESCAMBIA RIVER
CHOCTAWHATCHEE RIVER
APALACHICOLA RIVER
OCHLOCKONEE RIVER
AUCILLA RIVER
FOREST INDUSTRIES
SAWMILLS
PULP MILLS
VENEER PLANTS
COOPERAGE PLANTS
TREATING PLANTS
OTHER PLANTS
DISTILLATION PLANTS
THE COMPARATIVE SIZES OF SAWMILLS PER 10-HOUR DAY CAPACITY IN BOARD FEET ARE INDICATED AS FOLLOWS
1,000-19,000
20,000-39,000
40,000 & OVER
TURPENTINE STILLS
(ONLY THOSE ACTIVE IN 1934 SHOWN)
ANNUAL PRODUCTION IN NAVAL-STORES UNITS
900 OR LESS
MORE THAN 900
LOCATION OF FOREST INDUSTRIES WITHIN COUNTIES APPROXIMATE ONLY
STATUTE MILES
10
0
10
20
30
87°
86°
85°
84°
31°
30°

FIGURE 4.

Approximately 21 percent of the round-timber area was well developed and probably ready for immediate working (fig. 5, bar A), with an average stand per acre of 19 round trees at least 9.0 inches d.b.h. and 11 trees between 7.0 and 8.9 inches d.b.h. In addition, it is estimated that about 37 percent of the round-timber area will be well-developed with about this same density within 8 to 20 years, but about 38 percent will not reach turpentine size within 20 years, for it is made up of reproduction stands and clear-cut areas. Nonturpentine forest types cover 4 percent of the gross round-timber area.

Working turpentine area

While the gross working turpentine area was almost a million acres, only two-thirds of it had cups. About 373,200 acres averaged more than 12 cups per acre; 116,500 acres, 8 cups; and 119,000 acres, 4 cups per acre; while the remainder had no cups, being made up largely of small sapling, reproduction, and clear-cut areas, as well as nonturpentine pine forests. In the season of 1934-35, on 12,081,000 trees were 13,394,000 cups, approximately one-third of which were first-year or "virgin" cups hung in 1934 (table 4). In number of new cups hung, the season of 1934-35 showed an increase of about 60 percent over that of 1933-34 and about 350 percent over that of 1932-33, after allowance was made for annual mortality.

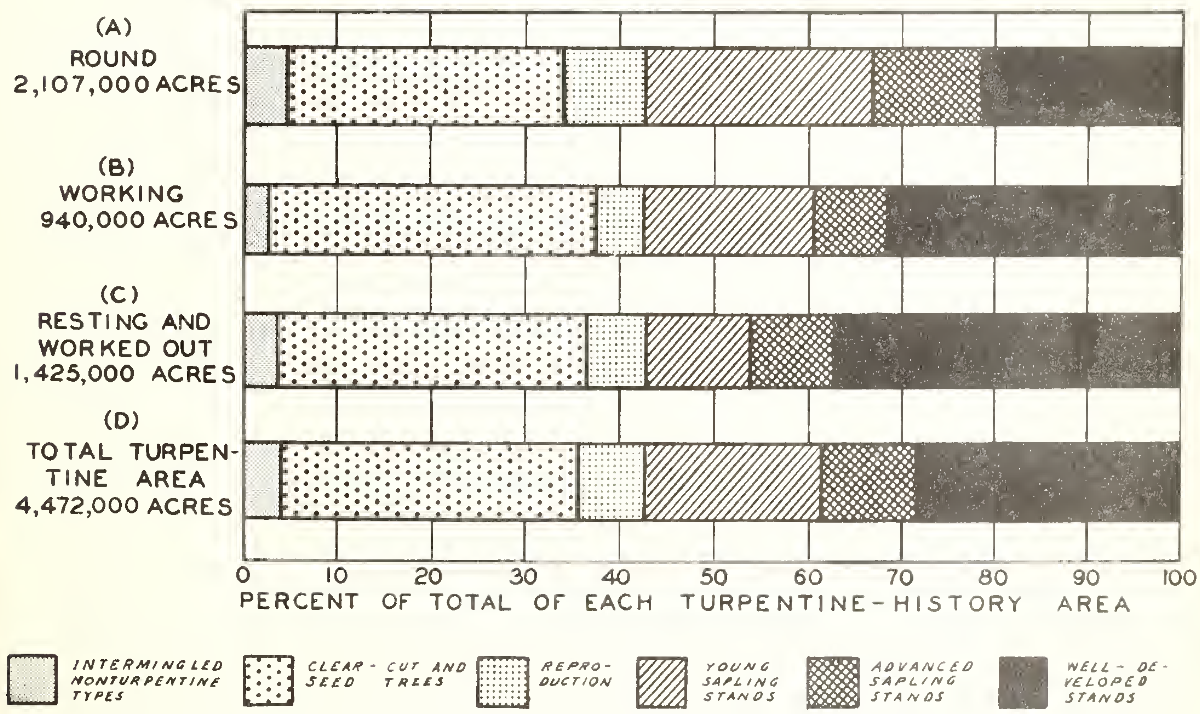

FIGURE 5 - CONDITION OF THE TURPENTINE AREA

Although studies have shown that trees less than 9 inches d.b.h. yield such small quantities of gum that they usually cannot be worked economically, the survey of working crops in 1934 showed that about 30 percent of the working trees were below this size. At the beginning of the 1934-35 season, cups were hung on 48 percent of the 8-inch round trees in the area of newly cupped trees; on 83 percent of the 10-inch trees; and on nearly 100 percent of the larger round trees. Approximately 19 percent of the front-faced trees carried two cups.

Table 4. -- Turpentine cups hung on front and back faces, classified by year of working in the season of 1934-35

Year of working	Cups on front faces	Cups on back faces	Total	Percent
	- - - - - - -	Thousand cups	- - - - - - -	
1st year	2,313	2,203	4,516	33.7
2nd year	1,645	1,124	2,769	20.7
3rd year	428	531	959	7.2
4th year	447	1,123	1,570	11.7
5th year	701	920	1,621	12.1
6th year & up	1,086	873	1,959	14.6
Total	6,620	6,774	13,394	100.0
Percent of total	49.4	50.6	100.0	

On approximately 31 percent of the gross working area (fig. 5, bar B) there are sufficient future faces to justify continued working immediately after the present faces are worked out. This part of the working area has per acre an average of 18 future faces on trees which are now working or have been worked, and over 8 round trees 7 inches d.b.h. and larger that will soon become large enough to work, as well as a large number of smaller trees. It is estimated that after a wait of 8 to 20 years an additional 26 percent of this area will be ready for working again. About 40 percent of the gross working area, however, will not support new operations within 20 years after present faces are abandoned, and 3 percent of the area is in nonturpentine forest.

Resting and worked-out area

In the field work, "resting" and "worked-out" areas, which were grouped together, were found on almost 1½ million acres (fig. 5, bar C). Thirty-seven percent of this area is well-developed, having per acre an average of 16 future faces and 10 round trees 7 inches d.b.h. and larger. It is also estimated that 20 percent of the resting and worked-out area will reach the well-developed stage within 20 years, and that 40 percent will require more than 20 years, while 3 percent is nonturpentine-forest area. Retarding the growth of young trees upon this area are some 5 million worked-out trees, which it will be highly desirable to cut and utilize for lumber, pulpwood, or other wood products in order to facilitate reproduction and to release round trees for faster growth.

Future Outlook for Gum Naval Stores

Inasmuch as the naval stores industry has long been active throughout this Survey unit, it is logical to assume that most of the turpentine pines, with the exception of a relatively small number in swampy, inaccessible areas and in reserves, or scattered in the agricultural sections, will be worked prior to cutting.

As stated in the preceding discussion of working area, 48 percent of the round trees in the 8-inch diameter-class were cupped in the virgin crops of 1934. It is believed that the efforts of the industry, instigated by the A.A.A. Naval Stores Conservation Program, to reduce the proportion of cupping in undersized trees, will be successful and that the practice of cupping trees under 9 inches will be changed gradually. For the purpose of analysis it is assumed that in actual practice one-third of the trees in the 8-inch class will continue to be used. In figure 6, the total number of round and resting trees on the various turpentine areas shown previously (fig. 5) is analyzed for each of three 8-year turpentine cycles. The supply for the first period, 1935 to 1942, standing in the $1\frac{1}{4}$ million acres of "well-developed" areas (in black in fig. 5) is estimated to be 3,714,000 trees annually. The supply for the second cycle, 1943 to 1950, which will come partly from round trees in the advanced sapling stands and partly from trees that were front-faced in the first cycle, will approximate 3,600,000 trees annually. In the third cycle, 1951 to 1958, the indications are that the round trees that have grown to working size on the areas now shown as young sapling stands (fig. 5), plus the round and resting trees then available in the areas previously worked, will amount to 5 million trees annually.

These figures of periodic supply may be compared with the average annual demand of 1,146,000 new cups from round trees and 1,202,000 new cups on resting trees, a total of 2,348,000 cups for turpentining alone (shown by arrow in fig. 6) for the 6 seasons beginning with 1929-30 and ending with 1934-35. These calculations of possible future yield of turpentine trees for the naval stores industry are based upon the assumption that in each 8-year period the total available supply will be used. If the total supply is not used, the unworked trees would be carried over to accumulate for working in later periods. If more than the indicated yield is cupped or otherwise utilized, it will be at the expense of later yields.

The present and estimated future stands of slash and longleaf pines must supply not only the naval stores industry but also the wood-products industry. In 1936 an industry survey showed that more than 1 million round slash and longleaf pine trees 7 inches d.b.h. and larger were cut for wood products before they were worked for turpentine (table 5). If the cutting of round turpentine trees for pulpwood and low-grade lumber continues, obviously it will reduce both the present and the future supply for the naval stores industry. Therefore, if the naval stores industry is to be maintained at the full possibility of the growing stock, the demands of the wood-products industries for longleaf and slash pines must be confined as nearly as possible to worked-out trees.

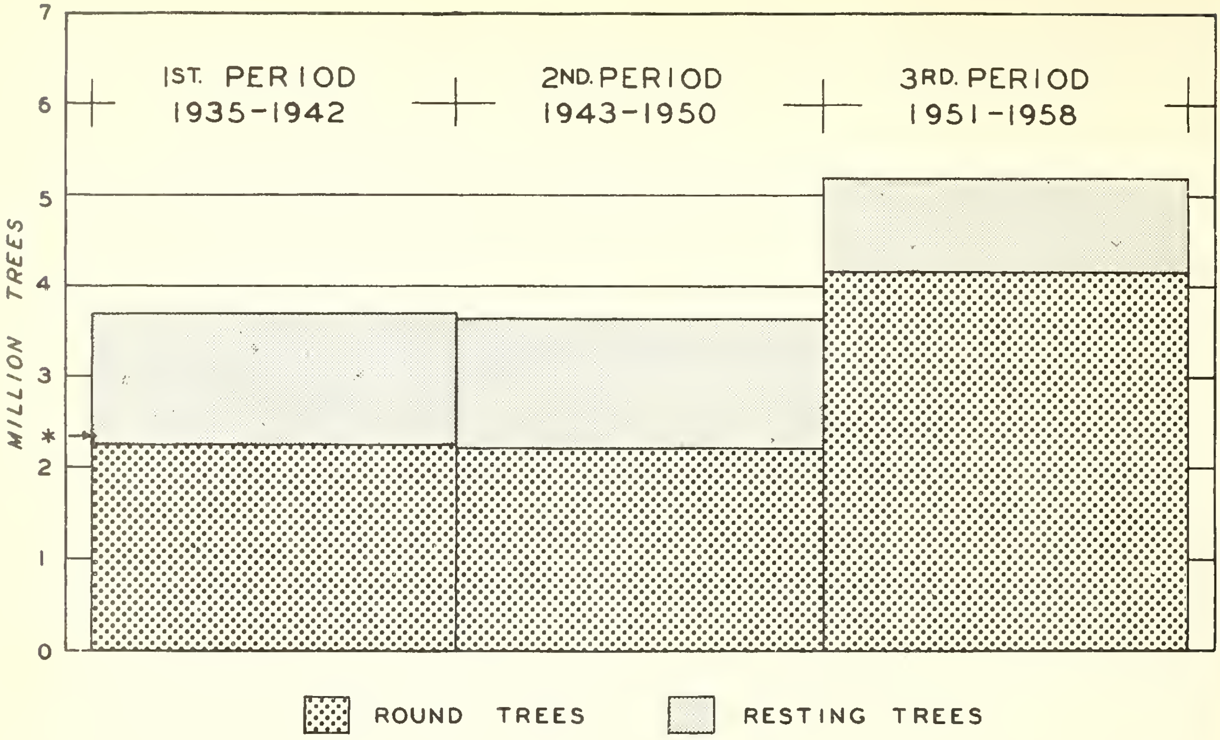

FIGURE 6 - ROUND AND RESTING TURPENTINE PINES THAT MAY BE READY FOR WORKING ANNUALLY.

*The arrow shows the level of average annual demand between 1929 and 1934 for naval stores cups on round and resting trees.

For several years naval stores factors and various forestry agencies have been encouraging the adoption of a 9-inch minimum-diameter limit. An analysis of the future supply of turpentine pines, if only those trees 9 inches d.b.h. and larger were cupped, indicates that for the first 8-year period there would be an annual possibility of 3,183,000 trees of this size (1,717,000 round and 1,466,000 resting); for the second 8-year period, 11 percent less than for the first period; and for the third period, 22 percent more than for the first. It is noteworthy that in 1936 the wood-products industries reduced the supply of round trees at least 9 inches d.b.h. more than half a million.

Table 5. -- Net change in number of round trees 7 inches and up and 9 inches and up between January 1, 1934 and January 1, 1937 in the turpentine area

	1934		1935		1936	
	7 inches and up	9 inches and up	7 inches and up	9 inches and up	7 inches and up	9 inches and up
	Thousand trees					
Round trees as of January 1	29,561	12,172	29,105	11,945	30,142	12,648
Increase due to growth of smaller trees	2,944	1,739	2,944	1,739	2,944	1,739
Decrease due to mortality	610	253	632	268	656	284
Net increase	2,334	1,486	2,312	1,471	2,288	1,455
Trees turpentined	2,050	1,241	443	268	314	190
Trees cut for products	740	472	832	500	1,013	582
Total industrial drain	2,790	1,713	1,275	768	1,327	772
	Decrease	Decrease	Increase	Increase	Increase	Increase
Net change during year	456	227	1,037	703	961	683
Round trees end of year	29,105	11,945	30,142	12,648	31,103	13,331
Percent of number on January 1, 1934	98.5	98.1	102.0	103.9	105.2	109.5

If there is no marked increase in the cutting of trees before they are worked for turpentine, there will be sufficient round timber in well-developed stands to maintain the gum naval stores industry at its present level during the next 15 years. The relatively large proportion of longleaf and slash pine trees now in the 2-, 4-, and 6-inch diameter-classes — sizes in which mortality can be reduced through better management — gives a good prospect that the gum-production level can be raised after that period through the growth of more of these trees to working sizes. The needs of both the naval-stores and wood-products industries should be so integrated and their operations so synchronized that both industries can operate satisfactorily. Since the income from naval stores to the owners of longleaf and slash pines is normally large and since the industry ranks high in economic importance in the region where it is found, it is imperative that both its present and future supply of timber be protected.

Eight wood-distillation plants located in northwest Florida produce rosin, turpentine, pine oils, charcoal, and other products from "lightwood" — the seasoned stumps and heartwood of dead, old-growth, longleaf trees.[4] One installation uses the steam-solvent process, while the remainder use destructive distillation, with charcoal as a residual byproduct. Approximately 230,000 man-days of employment were provided in 1936, and 166,000 tons of "lightwood" (138,000 tons of stumps and 28,000 tons of topwood), most of which came from this Survey unit, were consumed, yielding about 120,000 barrels (500 lbs. gross) of rosin and 22,000 barrels (50 gal.) of turpentine.

Seasoned, old-growth, longleaf pine stumps, at least 8 inches high, and in sufficient density to warrant extraction, were found upon 1,774,000 acres, or 29 percent of the forest area (table 6). The Survey made no effort to estimate the amount of seasoned topwood.

Table 6. -- Stand of merchantable stumps (blasting basis)

Stumps per acre	Area	Topographic situation		Total	Portion of total
		Flatwoods[1/]	Rolling uplands		
	Acres	Thousand tons			Percent
5 or less	534,500	105	109	214	4.1
6 to 13	520,300	478	563	1,041	19.8
14 to 25	399,400	784	814	1,598	30.4
26 and over	320,100	1,248	1,152	2,400	45.7
Total	1,774,300	2,615	2,638	5,253	100.0

1/ Includes a small percentage of the area in swamps and bays.

On a blasting basis (5 stumps per ton of wood), it is estimated that this area has about 3,998,000 tons of stumpwood on the 719,500 acres that contain at least 2.8 tons of stumps per acre. This resource is approximately equally divided between flatwoods and rolling uplands. Clear-cut and reproduction forest conditions together contain 46 percent of the tonnage; while a large proportion of the remainder is found under thinly stocked second-growth sapling stands under sawlog size. In addition to the present matured stumps shown in table 6, there is a potential supply of 4,502,000 tons in unseasoned stumps and in stumps in densely stocked stands where pulling operations are considered impracticable and blasting undesirable. Pulling operations are usually practical only in the flatwoods and where used would increase the recovery approximately 65 percent. Additional stumps will be added to the supply as the present old-growth longleaf pine stands are logged and their stumps are allowed to season (generally for about 10 years).

4/ See: "Longleaf pine stumpwood supply in four Southeastern Survey Units," Forest Survey Release #20, Aug. 29, 1936, Southern For. Exp. Sta., New Orleans, La.

The manufacture of wood naval stores, which for rosin already amounts to almost one-half of the total production of the Survey unit, could be greatly increased if the raw-material resource were the only limiting factor. The recovery of rosin as a byproduct in the manufacture of kraft paper pulp also shows possibilities of adding greatly to the future supply. Prices for naval stores and the keen competition of substitute materials, however, do not encourage any appreciable increase in production from any source.

Inventory Estimates

Sawtimber Volumes

The total net sawtimber volume is more than 4 billion board feet, according to the Doyle rule (the rule in general use in the South), or nearly 7 billion board feet, according to the International $\frac{1}{4}$-inch rule, which closely approximates green lumber tally. The volumes in the important sawtimber species are shown in table 7. It is interesting to note (table 8) that 23 percent of the total sawtimber volume is in longleaf and slash pine trees that have been worked for turpentine.

Living pine and cypress trees at least 9 inches d.b.h., and hardwoods at least 13 inches, are classified as sawtimber trees if they contain one sound butt log 12 feet or more in length, or if 50 percent of their gross volume is in sound material. The usable portions of turpentined butts, as established by common practice, are included in the estimates. All figures are net, a deduction having been made for both woods and mill cull, that is, portions of the tree which cannot be manufactured into lumber on account of fire scars, rot, crooks, bad knots, or other defects.

Practically all of the sawtimber volume is physically accessible with the present mobile logging equipment and the excellent modern transportation facilities, as indicated by the fact that 94 percent of the forest area has been logged over at least once. In this section, although stands as light as 400 feet per acre are now commonly logged, sawtimber stands range from a minimum of 400 board feet per acre to 8,000 or more, with an average of 3,300 per acre.

Table 8 shows that old-growth forest stands, all types combined, contain 57 percent of the total sawtimber volume; second-growth sawlog-size stands, 34 percent; and all other conditions, 9 percent.

Figure 7 indicates the proportional area and volume per acre of the sawlog-size stands in the longleaf and slash pine types. The proportions shown are based upon gross volumes; no deductions have been made for woods cull, but as an equalizing factor, no volumes in turpentined butts have been included. While there is room for error in the lowest volume-per-acre class because the estimates are based on 1/4-acre plots, the combined data in the first two classes are highly significant. Stands in the turpentine pine type-group that have less than 2,000 feet per acre make up 57 percent of the type-group area, but have only 27 percent of the sawtimber; in other words, 43 percent of the type-group area contains 2,000 feet or more of sawtimber per acre and 73 percent of the type-group volume.

Table 7. -- Net board-foot volume expressed in Doyle scale and in green lumber tally based on International $\frac{1}{4}$-inch rule

Species	Doyle scale	Green lumber tally	Species	Doyle scale	Green lumber tally
	- - M board feet - -			- - M board feet - -	
Pines:			Hardwoods:		
Longleaf	769,100	1,528,800	Red gum	278,700	362,40
Slash	686,900	1,253,200	Black gum	502,400	739,20
Loblolly	605,700	959,800	Red oaks	320,600	423,00
Other	130,900	240,800	White oaks	92,200	120,20
			Other hardwoods 1/	426,900	617,00
Total pine	2,192,600	3,982,600			
			Total hardwoods	1,620,800	2,261,80
Cypress	379,100	623,500			
			Total all species	4,192,500	6,867,90

1/ Principally bay, white ash, maples, magnolia, and yellow poplar.

Table 8. -- Net board-foot volume (green lumber tally, based on Int. $\frac{1}{4}$-inch kerf rule) by forest conditions

Species-group	Old growth		Second growth		Total	Percent of total
	Uncut	Partly cut	Sawlog size	Under sawlog-size 1/		
	- - - - - - - - - - Thousand board feet - - - - - - - -					
Pines:						
Longleaf and slash:						
Round	307,300	254,400	482,400	141,300	1,185,400	17.3
Worked	276,400	397,600	629,300	293,300	1,596,600	23.2
Loblolly and other	186,200	146,100	801,300	67,000	1,200,600	17.5
Total pines	769,900	798,100	1,913,000	501,600	3,982,600	58.0
Hardwoods	807,700	1,066,500	310,100	77,500	2,261,800	32.9
Cypress	225,900	277,200	92,400	28,000	623,500	9.1
Total all species	1,803,500	2,141,800	2,315,500	607,100	6,867,900	100.0

1/ Including a small amount in the reproduction and clear-cut conditions.

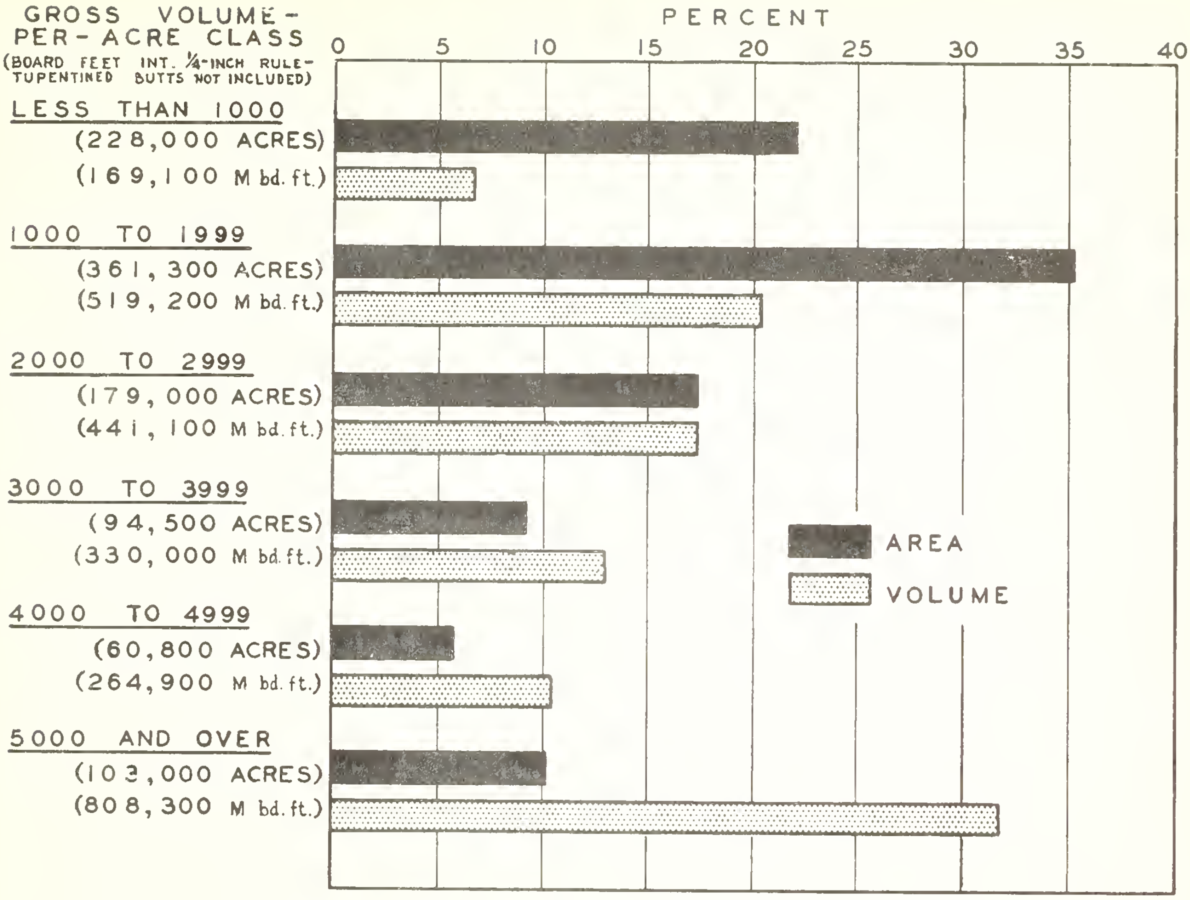

FIGURE 7 — PROPORTIONAL AREA AND VOLUME OF THE SAW-LOG-SIZE CONDITIONS IN THE TURPENTINE PINE TYPES, CLASSIFIED ACCORDING TO VOLUME OF SAWTIMBER PER ACRE

More than three-fourths of the pine volume is in trees 9.0 to 16.9 inches d.b.h. Most of this timber, which is in second-growth forests, is generally converted into lumber, poles, cross ties, staves, and pulpwood. The remaining volume is in larger trees, which occur either in old-growth stands or as scattered residuals in younger stands. These trees are used for high-grade lumber, veneer bolts, poles, and piles.

Of the hardwood volume, less than 8 percent is in trees 29.0 inches and larger, i.e., where much of the quality material is found. Thirty-three percent of the volume is in trees 19.0 to 28.9 inches d.b.h., and 59 percent is in trees 13.0 to 18.9 inches. Cypress trees 17.0 inches in diameter and larger — the sizes from which high-grade lumber is manufactured — have 44 percent of the total cypress sawtimber volume.

The cull factors used in reducing gross to net scale are unusually large for hardwood, cypress, and turpentined pines, owing to the general prevalence in the past of forest fires, nonconservative turpentining practices, and the destructive agencies of wind, fungi, and insects; cull deductions range from 5 percent for slash pine to 20 percent for cypress, including allowance for sweep.

Cordwood Volumes[5/]

The total net volume of usable cordwood material with the bark in both sound and cull trees 5.0 inches and larger is more than 41 million standard cords (4 x 4 x 8 feet). It should be understood, however, that this includes volume that has also been considered in the sawtimber estimate given in the preceding section. In table 9 cordwood volumes are given for the important tree species-groups. "Upper stems of sawtimber trees" includes the usable volume from the upper limit of the sawlogs to a variable minimum-diameter limit, which is not less than 4 inches inside bark but which varies with the quality. For hardwoods and cypress, limbs are included to a 4-inch minimum diameter. In the volume of "Sound trees under sawlog size," the full stems only (without limbs) are included for all species up to a variable diameter limit but not less than 4 inches. Under "Cull trees," only the usable sound portion in such trees is included. As previously stated, all volume figures are net, deductions having been made for woods cull — the material unsuitable for use because of fire scar, rot, or other defects. For the sound trees, the deductions averaged 5 percent, varying from 1 percent for second-growth slash and longleaf to 15 percent for cypress. The deductions for cull trees varied from 20 to 80 percent of their gross volume.

Pulpwood and fuel wood are the principal uses for cordwood material. While most species are useful for fuel wood, in this locality only the pines are used at present for pulpwood, although cypress and the soft-textured hardwoods, such as the gums, magnolia, bay, maple, etc., are suitable for certain types of pulping. Only half of the total pulpwood inventory of almost 34 million cords is in pine; most of the remainder is in pulping hardwoods.

5/ For more detailed information, see "Pulping and nonpulping cordwood volume in Survey Unit #2, Florida," Forest Survey Release #19, Apr. 30, 1936, Southern For. Exp. Sta., New Orleans, La.

Table 9. -- Net volume of all sound material, expressed in cords

Tree species-group	Source of material: Sawtimber trees: Sawlog portion	Sawtimber trees: Upper stems	Sound trees under sawlog size	Cull trees	Total
	- - - - - - - - - -	- - - - - Cords	- - - - -	- - - - -	- - - - -
Pulping species:					
Pines:					
Turpentine pines (round	2,776,400	557,600	2,996,100	30,400	6,360,500
Turpentine pines (turpentined	3,688,300	1,256,000	1,330,700	56,800	6,331,800
Loblolly and other pines	2,708,500	503,400	709,300	190,100	4,111,300
Total pines	9,173,200	2,317,000	5,036,100	277,300	16,803,600
Hardwoods (pulping)	3,786,600 1/	1,946,800	5,296,300	2,840,300	13,870,000
Cypress	1,505,800 1/	500,100	642,500	562,100	3,210,500
Total pulping species	14,465,600	4,763,900	10,974,900	3,679,700	33,884,100
Nonpulping hardwoods	1,897,500 1/	1,072,900	1,934,700	2,329,500	7,234,600
Total all species	16,363,100	5,836,800	12,909,600	6,009,200	41,118,700

1/ Usable limbs included.

Relative stands per acre in cords for the various forest conditions and type-groups, as found by dividing total volumes by the respective areas, are given in table 10.

Table 10. -- Average cordwood volumes per acre of good trees, including bark 1/

Forest type-group	Old growth		Second growth			All conditions 2/
	Uncut	Partly cut	Sawlog size		Under sawlog size	
			Uncut	Partly cut		
	Cords					
Longleaf and slash pines	13.1	8.3	9.8	7.6	2.3	3.5
Loblolly and other pines	20.6	12.6	16.2	11.6	3.5	9.7
Hardwoods	22.2	16.8	17.2	10.2	2.0	7.9
Cypress	18.9	16.9	18.0	11.9	7.8	14.6
All types (weighted averages)	17.9	12.8	12.0	9.3	2.3	5.2

1/ For additional information see "Volumes on Average Acres in the Principal Units of the Naval-Stores Region," Forest Survey Release #29, Oct. 30, 1937, Southern For. Exp. Sta., New Orleans, La. Upper stems and limbs of sawlog-size hardwoods and cypress are not included.

2/ Includes areas of reproduction and clear-cut forest conditions.

The growing stock of all species, made up of sound trees only (upper stems and limbs of sawlog-size hardwoods and cypress, and cull trees excluded), contains 13 million cords in sound trees under sawlog size and 19 million cords in sawtimber trees. The competitive demand for sawtimber, and the present larger stumpage value for naval stores, lumber, poles, and piles, indicate the desirability of holding a considerable part of the smaller sound trees for such future use. There are, however, nearly 4 million cords of pulpwood in cull trees, over 6 million cords in trees that have been or are now being worked for turpentine, about 300,000 cords available annually from tops of sawtimber trees cut, and a large undetermined volume of wood that may be salvaged in thinning over-dense stands of young timber, all of which, if used as fully as possible, should reduce the utilization for cordwood of sawtimber trees both actual and potential. A market for pulpwood and fuel wood provides excellent outlets for forest improvement cuttings. The cordwood volume of the various size-classes of trees (cull trees only excluded) is shown graphically in figure 8.

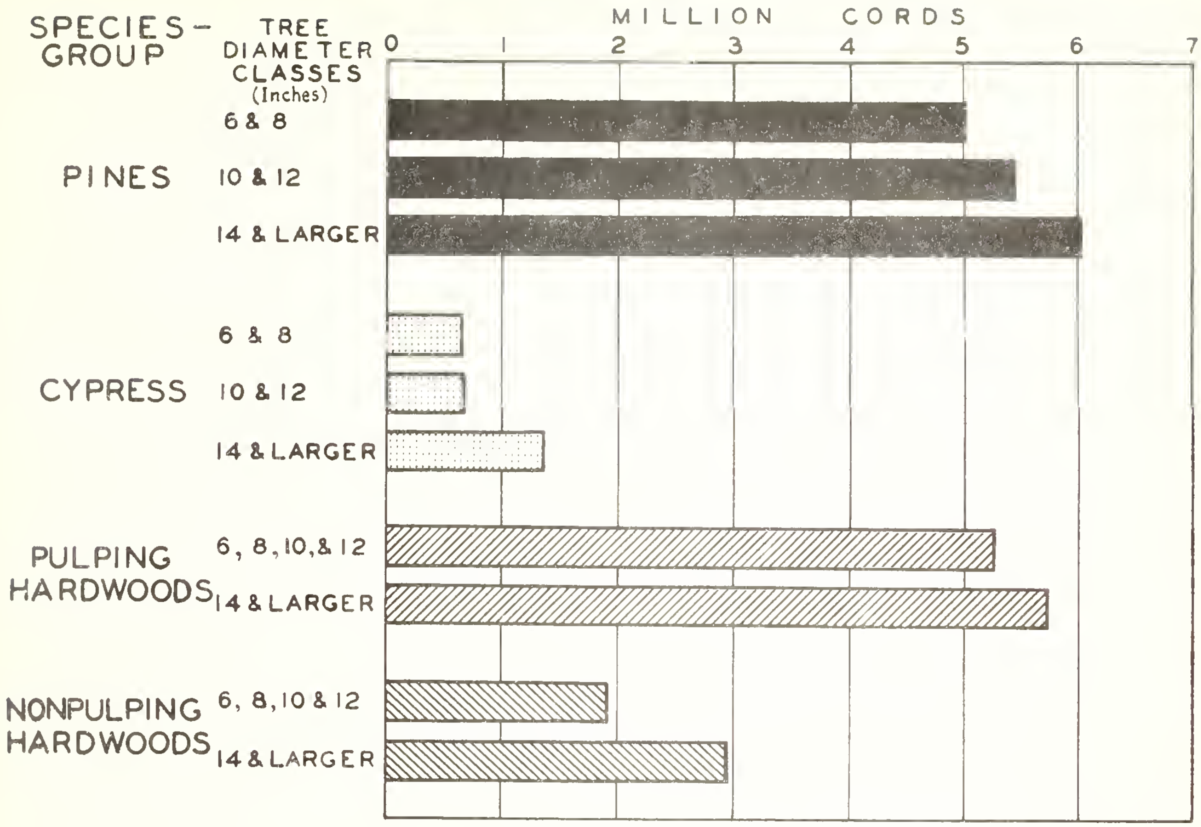

FIGURE 8 - CORDWOOD VOLUMES OF PULPING AND NONPULPING SPECIES BY SIZE-CLASSES, SOUND TREES ONLY.

Poles and Piles[6]

A special inventory was made of poles and piles, based upon the specifications of the American Standards Association, and the resulting estimate of 14½ million pine trees suitable for these uses (table 11) is believed to be conservative. These trees, which have been included in the volume inventories previously given, are scattered throughout the unit, singly or in groups; although found in many forest types, they occur most commonly in the longleaf-slash pine areas. Approximately 63 percent of the poles and piles are in trees 7.0 to 10.9 inches d.b.h., 32 percent are in trees 11.0 to 14.9 inches, and only 5 percent are in trees 15.0 inches or larger. Approximately 94 percent of the trees classed as potential poles or piles will yield sticks 20 to 35 feet long.

6/ For additional information and for comparison with other units, see "Pole and pile timber in four Southeastern Survey Units," Forest Survey Release #21, Aug. 29, 1936, Southern For. Exp. Sta., New Orleans, La.

Table 11. -- Pole and pile resources

Species-group	Length of poles and piles			Total	Percent of total
	20 and 25 feet	30 and 35 feet	40 feet and over		
	Thousand sticks				
Round longleaf and slash pines	5,381	1,753	411	7,545	52.0
Turpentined longleaf and slash pines	3,789	1,439	415	5,643	38.9
Other pines	997	324	-	1,321	9.1
Total	10,167	3,516	826	14,509	100.0
Percent of total	70.1	24.2	5.7	100.0	

Increment

In 1935 the net sawtimber increment of the growing stock of 7 billion board feet of sound trees of all species amounted to 214 million board feet green lumber tally, as measured by the International $\frac{1}{4}$-inch kerf rule (table 12). This does not mean, however, that the sawtimber growing stock showed a net increase of this amount as a result of the year's growth; as a matter of fact, the volume of the sawtimber cut was in excess of the increment. The actual growth due to the increase in volume of the sawlog-size trees in the stand, plus that added by the recruitment of new trees from the smaller sizes, amounted to 353 million board feet; deducting the mortality figure, 139 million board feet, leaves the net increment as stated.

Table 12. -- Total net sawtimber increment classified according to forest condition and species-group, 1935

Forest condition	Species-group				Total all species-groups
	Longleaf and slash pines	Loblolly and other pines	Hardwoods	Cypress	
	Thousand board feet (green lumber tally)				
Old growth	- 20,900	1,900	54,600	6,400	42,000
Second growth:					
Sawlog size	38,200	35,100	17,000	2,900	93,200
Under sawlog size	59,100	10,200	6,900	700	76,900
Reproduction and clear-cut	1,600	300	(1/)	(1/)	1,900
Total	78,000	47,500	78,500	10,000	214,000

1/ Negligible.

Almost 60 percent of the net sawtimber increment is pine; hardwood makes up most of the remainder, as cypress grows very slowly. Old-growth forest conditions, containing over half of the sawtimber growing stock, all species combined, produces only 20 percent of the net increment. In fact, old-growth longleaf and slash pines, both round and turpentined, show a negative net increment. Second growth, with less than half of the growing stock, produces 80 percent of the net increment.

Measured in terms of cordwood, in 1935 the net increment of all sound trees 5 inches d.b.h. and larger amounted to 882,000 cords of rough wood, or 60 million cubic feet of wood inside bark (table 13). Neither the volume in cull trees nor that in the upper stems and limbs of sawlog-size hardwoods and cypress is considered part of the growing stock.

Table 13. -- Net increment, 1935

Forest condition	Net regional increment			Average increment per acre		
	M bd. ft. 1/	Cords 2/	M cu. ft. 3/	Bd.ft. 1/	Cords 2/	Cu.ft. 3/
Old growth	42,000	171,800	10,840	42	.17	11
Second growth:						
Sawlog size	93,200	337,900	23,960	104	.38	27
Under sawlog size	76,900	371,000	25,460	30	.15	10
Reproduction and clear-cut	1,900	1,600	70	1	(4/)	(4/)
Total	214,000	882,300	60,330	36	.15	10

1/ Green lumber tally. 2/ Rough wood, including bark.
3/ Inside bark (i.b.). 4/ Negligible.

Although low net-increment per-acre figures are characteristic of this Survey unit, they vary considerably (table 13), with the greatest in the sawlog-size second-growth stands. The per-acre net increment in 1935 for the entire forest area (i.e., clear-cut and reproduction areas included) was only 36 board feet of sawtimber, or a trifle over 1/7 cord of all material.

With natural conditions, such as climate, species, etc., generally favorable to growth, the net-increment figure for the entire forest is strikingly low. This is explained largely by the facts that the mortality is high; the forest stands are thinly stocked; the proportion of idle or clear-cut forest land is unusually high; and the growth rate of the individual trees has been slowed down by periodically recurring fires and by turpentining. Harsh measures of turpentining, such as chipping too deeply, over-cupping the small trees, and burning the crop acreage, which have been practiced for years in many of the turpentine stands, have reduced their annual sawtimber increment by possibly more than 100 million board feet.

Wood-Products Industries

The lumber industry became active in this Survey unit coincident with the rapid railroad expansion that began in 1870, and the naval-stores industry followed about 1900. Today these industries enjoy excellent transportation facilities, including railroads (the Louisville and Nashville, the Seaboard Air Line, the Atlantic Coast Line, the St. Louis and San Francisco, and several short connecting lines); numerous highways and country roads traversing the unit; and water transportation on the Gulf, the Intracoastal Waterway, and the Apalachicola, Choctawhatchee, and other rivers.

The most important wood-using industry is lumber, as witnessed by the more than 200 sawmills within the unit (table 14). Although about four-fifths of the mills have a daily capacity of less than 20 M board feet, it is significant that only 28 percent of the 290 million board feet of lumber produced was cut by these mills, while 27 percent was cut by mills with a daily capacity of 20 to 39 M board feet, and 45 percent by mills with a capacity of at least 40 M board feet per day. Furthermore, it is noteworthy that the large sawmills, chiefly dependent upon extensive blocks of old-growth timber, are slowly cutting out and that the trend is decidedly towards small, mobile equipment, which can utilize more efficiently the light second-growth stands. In 1936 the sawmills, as a whole, operated at less than half their annual capacity, an indication of the relatively unfavorable condition of the lumber markets.

Table 14. -- Number of sawmills, amount of lumber cut, and man-days of employment, in mills of various sizes, 1936

Daily (10 hrs.) rated capacity in M board feet	Number of sawmills	Lumber cut				Employment
		Pine	Hardwood	Cypress	Total	
		- - - - - Thousand board feet - - - - -				Thousand man-days
Under 20	176	74,100	4,100	4,100	82,300	249
20 - 39	19	66,600	9,100	2,800	78,500	256
40 - 79	8	38,700	27,900	3,500	70,100	247
80 and over	3	53,900	3,600	1,900	59,400	155
Total	206	233,300	44,700	12,300	290,300	907

In 1936, in addition to the large number of sawmills, there were over 60 other wood-products plants, ranging in size from tiny shingle mills to one of the largest kraft pulp and paper mills in the United States. The cooperage industry, with 7 plants largely engaged in the production of pine slack cooperage for rosin barrels, consumed almost 22 thousand cords (table 15). In making veneer, which was generally used for packages and boxes, four mills consumed over 14 million board feet. About 49 shingle mills, mostly very small establishments, were operating nearly always in cypress and for local consumption. While three small-dimension plants, one excelsior mill, and one treating plant added to the diversification of the forest products, the kraft pulp and paper mill at Panama City was undoubtedly the most important single wood-utilization plant in this Survey unit. In 1936 it was the only pulp mill in northwest Florida, but in 1937 another large mill was nearing completion at Port St. Joe (Gulf County). Also the production of cross ties, poles and piles, fuel wood, and fence posts is important. While cross ties, poles, and piles were commercial products, most of the fuel wood and fence posts were produced by farmers for their own use. The total employment figure for all wood-using industries, 2 million man-days, which is equivalent to about 10,000 men regularly employed 200 days a year, is impressive, especially in consideration of the fact that the Census of 1930 reported a population in this Survey unit of 254,000, of whom only 96,000 were gainfully employed in all industries. The following table shows the amount of material produced by the industries in northwest Florida, the raw material for which was taken mostly from this Survey unit but partly from south Alabama, southwest Georgia, and northeast Florida. The labor shown is exclusively that employed in this Survey unit.

Table 15. -- Wood-products production and employment, 1936

Kind of plant or commodity	Units produced	Thousand man-days (10 hours) of employment		
		In woods	At plants	Total
Lumber	290,300,000 board feet	334	573	907
Veneer	14,100,000 board feet	30	19	49
Cross ties	318,000 pieces	43	-	43
Poles and piles	62,000 pieces	13	-	13
Fence posts	879,000 pieces	14	-	14
Cooperage	21,700 cords	22	26	48
Fuel wood	368,000 cords	446	-	446
Miscellaneous (pulp mills, shingle mills, treating plants, 1/ etc.)	356,400 cords	239	340	579
Total		1,141	958	2,099

1/ For the treating-plant, only labor at the plant is included.

Commodity Drain from the Growing Stock

The manufacture of forest products in 1936 caused a drain upon the sawtimber growing stock of the Survey unit of 415 million board feet, or upon all sound trees at least 5 inches d.b.h. of 85 million cubic feet (table 16). This commodity drain, as distinguished from the drain caused by mortality within the stands, is the 1936 cut, including the material cut for shipment to points outside the Survey unit and the waste incidental to the various logging operations. In the last column of table 16, the commodities derived as byproducts are charged to the primary use for which the trees are felled; thus pulpwood obtained from the tops of trees cut for lumber is included under lumber drain.

Pine furnished 70 percent of the drain shown in board feet; hardwoods, 23 percent; and cypress, 7 percent. In spite of the greatly reduced area of old-growth stands, they were the source of about half the total commodity drain.

Table 16. -- Commodity drain from the sound-tree growing stock, 1936

Reason for drain	From sawtimber material				From all growing-stock material
	Species-group			Total	
	Pines	Hardwoods	Cypress		
	- - Thousand board feet (green lumber tally)- -				Thousand cubic feet (i.b.)
Lumber	187,400	50,000	16,100	253,500	46,220
Cross ties	7,300	500	8,800	16,600	2,900
Poles and piles	6,300	-	200	6,500	1,260
Veneer	8,600	8,100	-	16,700	2,690
Cooperage	5,700	4,200	-	9,900	1,990
Fuel wood	25,500	32,800	-	58,300	12,450
Fence posts	-	-	-	-	130
Miscellaneous 1/	50,800	400	2,500	53,700	17,360
Total	291,600	96,000	27,600	415,200	85,000

1/ Includes domestic farm use, pulpwood, and land clearing.

Neither cull trees, dead trees, nor the upper stems and limbs of hardwood and cypress are included in the sound-tree growing stock for which growth is calculated, and no material cut from these sources is included in table 16. It is estimated that in 1936 the drain from this material was as follows:

1. Cut from the tops and limbs of sawlog-size hardwood and cypress trees . . . . 120,000 cords
2. Cut from cull trees . . . . 66,000 cords
3. Fuel wood cut from dead trees . . . . 142,000 cords
4. Fence posts cut from dead trees . . . . 5,000 cords

Total 7/ . . . . 333,000 cords

It is significant that cull trees furnished only 4 percent of the total commodity drain from live trees, although they contain 15 percent of the volume in all sound material, as shown in table 9. While little progress has yet been made in ridding the forest of these undesirable trees, a growing market for pulpwood should offer greater opportunity for their removal.

7/ In addition, 123,300 tons of stumps were used in 1936.

Comparison of Increment and Drain

Inventory data on volumes given in previous tables are based upon field work in 1934. Additions produced by growth and deductions caused by mortality and commodity drain indicate that in the 3 following years the sawtimber growing stock has been reduced 2 to 3 percent per year, as shown in table 17.

Table 17. -- Changes in the growing stock

Date	Sawtimber material: Species-group: Pines	Hardwoods	Cypress	Total	All growing stock
	- - Thousand board feet (green lumber tally) - -				Thousand cubic feet (i.b.)
Jan. 1, 1934	4,089,200	2,289,900	629,900	7,009,000	2,250,630
Jan. 1, 1935	3,982,600	2,261,800	623,500	6,867,900	2,234,260
Jan. 1, 1936	3,865,200	2,212,500	615,000	6,692,700	2,217,040
Jan. 1, 1937	3,722,400	2,195,200	597,200	6,514,800	2,190,630

As with a bank deposit, the growing stock cannot be maintained intact if the withdrawals (mortality and commodity drain in the forest) exceed the interest (forest growth). In 1936, in the combined uncut and partly cut old-growth conditions, the commodity drain was more than four times the net sawtimber increment; and it is evident that many of the large plants that depend upon old-growth timber, e.g., the big sawmills, will be forced to shut down or adapt their operations to second growth. The rapidly expanding demand for pulpwood fortunately can be met from the relatively fast-growing second-growth stands. There is, however, no chance of meeting all industrial sawtimber requirements from the increment from second growth, for the drain in 1936 from second growth equals or exceeds the increment.

In the trees in the growing stock 5 inches d.b.h. and larger, including those of sawlog size, the cubic-foot commodity drain is 1.5 times as great as the net increment (table 18). The excess of drain over increment is greater proportionally in the pines and cypress than in the hardwoods (fig. 9).

Deficiencies in the Present Forest

The principal deficiencies in the present forest, as shown by figure 3 are: (1) the distribution of age-classes by area is unsatisfactory; and (2) the stocking is sadly deficient. After years of harvesting of the larger and more valuable trees in the growing stock, the remaining stands are composed chiefly of small trees 2 to 12 inches d.b.h., as shown in figure 2. These small trees, because of widespread fires, harsh measures of turpentining, and the normal causes of death, have a high mortality rate.

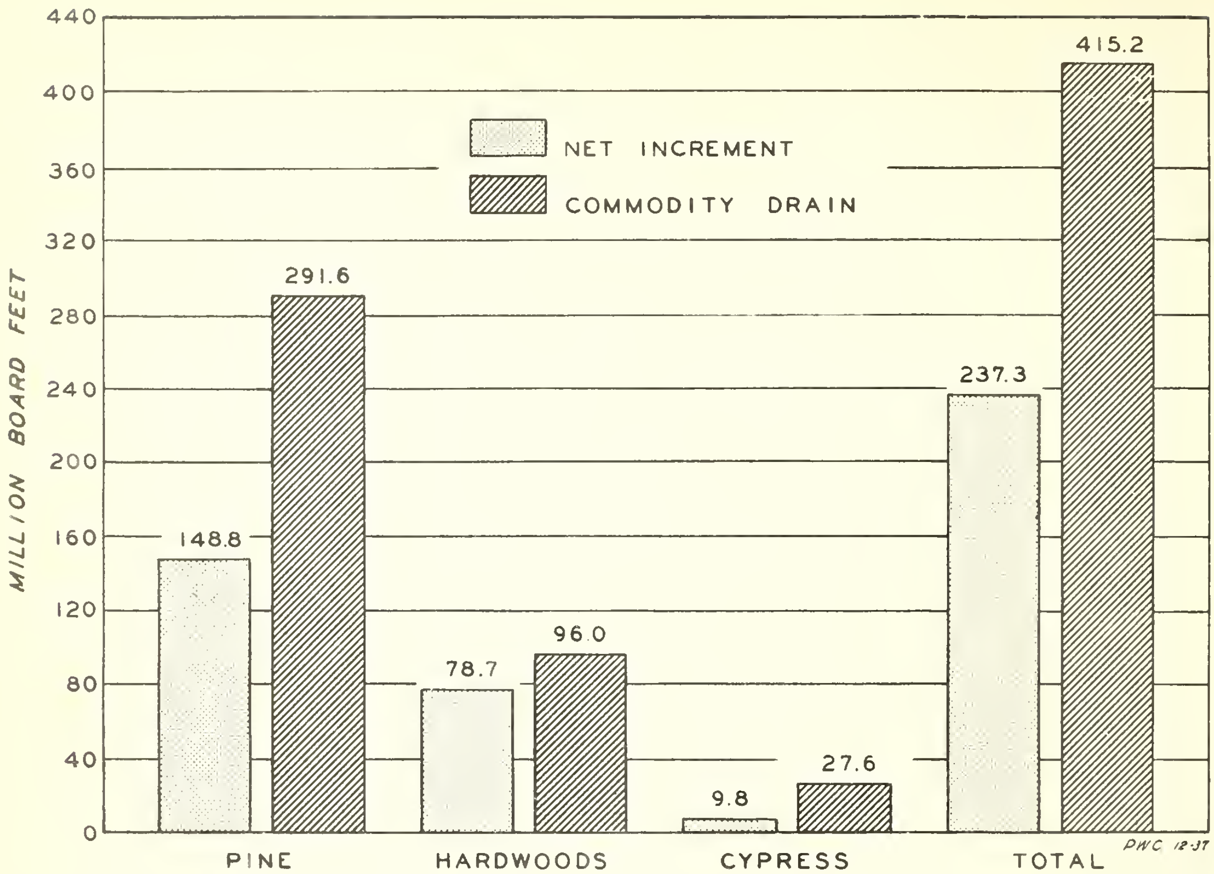

FIGURE 9.- COMPARISON OF NET INCREMENT OF SAWLOG-SIZE TREES WITH THE COMMODITY DRAIN, 1936.

In its present deteriorated condition, therefore, the growing stock with its annual increment composes a mere fraction of the productive capacity of the sites; the present average net increment per acre is only 36 board feet of sawtimber, or 1/7 of a cord of all sound-tree usable material. The presence of a large acreage of clear-cut forest land and of forest lands possessed by scrub oak is partly accountable for the low increment per acre.

Fire is the most important factor militating against the development of well-stocked stands. Uncontrolled forest fires have for years swept through the woods, killing the small trees that are needed as recruits for the growing stock, as well as injuring or killing some of the larger trees. While many of the fires originate from carelessness, the great majority are purposely and systematically set.

Summary of Present Situation and Outlook for the Future

The Forest in the Economic Picture

In Northwest Florida 4 acres out of 5 (average) are in forest use (table 1). The Census figures for the last 15 years show no increase in use of lands for agriculture, and the Unemployment Census taken November 16-20,

Table 18. -- Comparison of increment with commodity drain in board feet and cubic feet, 1936

Item	Sawtimber material: Species-group: Pines	Sawtimber material: Species-group: Hardwoods	Sawtimber material: Species-group: Cypress	Sawtimber material: Total	All growing-stock
	- - Thousand board feet (green lumber tally) - -				Thousand cubic feet (i.b.)
Growing stock, Jan. 1, 1936	3,865,200	2,212,500	615,000	6,692,700	2,217,040
Growth	257,900	97,200	13,800	368,900	99,660
Mortality	109,100	18,500	4,000	131,600	41,070
Net increment	148,800	78,700	9,800	237,300	58,590
Commodity drain	291,600	96,000	27,600	415,200	85,000
Net change in growing stock	-142,800	-17,300	-17,800	-177,900	-26,410
Growing stock, Jan. 1, 1937	3,722,400	2,195,200	597,200	6,514,800	2,190,630

1937, classes almost 13,000 people as unemployed and wanting work. The region was largely developed around its forest resource, upon which it has always leaned heavily for employment and income. It has a well-developed group of forest-using industries, including more than 100 turpentine stills, over 200 sawmills, 2 large pulp mills, and more than 60 other wood-using plants. The future security and opportunity for expansion of these industries is a matter of outstanding importance and concern to every part of the unit. An examination and analysis of the forest stand and its present productivity give strong grounds for the belief that the forest resource has been so depreciated that only organized, intensive, and concerted action on the part of timber owners, forest industries, and public agencies can assure an optimistic future. Although the forest situation is far from satisfactory, it is not too late for remedial action.

Measures for Improvement

Some of the land owners are receiving assistance in the protection of their lands from fire through the cooperative fire-protection sections of the Clarke-McNary Law. Progress has been made in recent years, and now about one-fifth of the privately owned forest land is under organized fire protection, which should be extended to all forest lands in the unit.

On about 200,000 acres of clear-cut land on which no seed trees exist, artificial reforestation must be resorted to, if the area is to be restocked within a reasonable time. The Florida Forest Service has cooperated with private individuals in making many demonstration plantings, which indicate that the possibilities of artificial reforestation are good if the work is done carefully and is confined to the better sites. On 675,000 acres of clear-cut land, pine seed trees are present, and under continued protection from fire a large part of this area may be expected to restock naturally to pine. A half million acres of land formerly in pine, but now occupied by scrub oak, will require many years to restock to pine if left to the slow processes of nature. It is unlikely that economic conditions will warrant the planting of much of this scrub oak area, owing to its low productivity. It may be that private enterprise cannot be expected to reforest artificially the large blocks of clear-cut and scrub oak lands, and that either the State or the Federal Government should undertake the task in the public interest. The area of land needing planting, however, should not increase; in fact, it should decrease if better fire protection and better cutting practices are maintained.

Turpentining in the old manner has been responsible for many of the deficiencies in the pine stands. A widespread adoption of the conservation practices now used by the more progressive naval stores operators would greatly reduce the harmful effect of turpentine operations on growth and mortality and should increase directly the yields both of naval stores and of wood products.

The accumulation of worked-out turpentine trees, no longer of value to the naval stores operator and rapidly deteriorating in value for wood products, should be removed from the stands in the form of pulpwood, poles, ties, and lumber. There are about 2 million cords of this material now on hand in the trees of the unit, which, in addition to representing an economic waste, are retarding the development of new trees on the areas occupied. Furthermore, there are 6 million cords of wood in cull trees of all species (mainly hardwoods and cypress) that also should be removed from the stands to supplement the wood supply as well as to improve the growing conditions. A large amount of wood in the tops, stems, and limbs of trees is left in the woods to rot when the trees are cut; a more complete utilization of this material for pulp and fuel wood not only would help the supply situation but also would reduce the fire hazard in cut-over stands.

Close and profitable utilization of the wood supply will depend largely upon a careful integration of the demands for the many and varied forest industries. The lumber, veneer, pole and piling, and similar industries, depend, by the nature of their products, upon high-quality stumpage; while the demands of the pulpwood, fence post, and fuel wood industries can be met from either high- or low-quality trees.

Land owners in their own interest should recognize quality grades in their trees and should sell or cut them for the commodities that yield the greatest stumpage returns. The several wood-using industries that depend on open-market purchases of stumpage will conserve the forest resource by using for their commodities only those trees that do not have a higher stumpage value for other uses.

State and county tax authorities should recognize that long-time forest management, often involving deferred returns, must have sympathetic tax treatment. A stable policy of reasonable annual taxes, based upon sliding-scale valuations that adjust payments to earning power and periods of cropping, is essential. The Forest Taxation Inquiry authorized by Congress to study such problems has recommended several tax plans with this principle in view.

The material improvement of the forest situation will require the general application of the measures here cited. Since the forest resource is not, and never will be, all under one ownership or management but, on the contrary, is owned and used by thousands of individuals with all kinds of limitations, policies, and objectives of management, the problem of obtaining a widespread acceptance and application of these essential forestry measures will require time and organized action. One obvious way to accomplish this task, slow though it may be, is by educating land owners, wood consumers, turpentine operators, taxing authorities, newspaper editors, and the general public to realize the value of these measures and to understand their application in practice. Specifically, the educational effort required might be exerted by greatly extending and integrating the activities of existing public and quasi-public agencies, including the Extension Services and Forest Services of the State and Federal Governments, the forestry departments of wood-using industries and railroads, and the forestry instruction in the public schools and colleges.

Outlook for the Future

The naval-stores industry has a sufficient supply of round turpentine timber in sight to maintain production of gum, rosin, and turpentine at present levels for many years to come, perhaps indefinitely, provided that this supply is not reduced materially through increased cutting of round trees for pulp mills and sawmills.

The wood-using industries, including those of lumber, pulp, poles, ties, and veneer, are not so secure. The supply of old-growth timber from which high-grade lumber must come, is decidedly limited, and industries depending upon it are confronted in general with a dwindling supply that is not being replenished. The industries that can use low-grade material or small trees are in no immediate danger of shortage, particularly if they use a larger part of the available forest waste previously referred to, but the combined cut for all industries is at present in excess of the annual increment on the growing stock; if this is continued without any ameliorating action, there must inevitably result a progressive reduction of the growing stock and a consequent lowering of the contribution that the forest resource can make to the general welfare of the region.

Northwest Florida should anticipate an improvement in its present social and economic conditions, but to the extent that it must depend upon its forest resource to accomplish this worthwhile objective, the present balance of increment and drain does not justify optimism. It is entirely possible, however, to build up this resource by fire protection, planting, improvement cuttings, and more conservative methods of turpentining and logging. With a highly-developed forest resource, old industries can be expanded and new industries brought in, landowners can realize more on their forest investments, and the entire area can feel the stimulation of more and larger payrolls with their attendant increase in buying power and security.

FOREST SURVEY RELEASE NO. 34 AUGUST 11, 1938

GROWTH AND DRAIN IN THE FORESTS OF CENTRAL AND SOUTHWEST MISSISSIPPI

A Progress Report

by

THE SOUTHERN FOREST SURVEY

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FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

This release contains Forest Survey data that will be included in complete reports to be published later. It should therefore be regarded as a progress report. Although considered reliable, the data are subject to correction or amplification as the work of computation proceeds.

Staff Assignment
In Charge of Field Work and Preparation of Report
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GROWTH AND DRAIN IN THE FORESTS OF CENTRAL AND SOUTHWEST MISSISSIPPI

The part of Mississippi covered in this Release is designated as Survey Unit #3 and includes the upland portion of 28 central and southwestern counties lying east of the flood plains of the Mississippi and Yazoo Rivers (fig. 1). The aggregate area is 10,799,500 acres, 56 percent of which is forest land, 42 percent cropland and pasture, and the remaining 2 percent is used for miscellaneous purposes.1/ The field survey of this unit was made in 1935.

The principal cities are Jackson (the State Capital), Meridian, Vicksburg, and Natchez. In 1930 the total inhabitants of the unit numbered approximately 722,000, of whom 51 percent were negroes.

The land surface ranges from broad rolling prairies near Macon in the northeast to relatively high, hilly country south of Meridian and rough, deeply fissured bluffs near Natchez and Vicksburg. Drainage is principally southward through the Pearl and Pascagoula Rivers and westward through the Big Black and lesser tributaries of the Mississippi. Some form of active erosion, most of which occurs in the more rugged uplands bordering the Mississippi and Yazoo River bottomlands, is prevalent on 20 percent of the land area.

Five major interstate railroad systems, which touch the larger cities, are supplemented by several smaller lines, which serve the more rural counties in the unit. Water transportation is available on the Mississippi and Yazoo Rivers at Vicksburg; while Mobile, Gulfport, and New Orleans, all deep-water ports, are within one day's travel by truck or rail from every part of the area. Good paved highways join the principal cities, and a network of all-weather gravel roads serves the less populated sections.

Growing conditions are favored by a temperate climate. A frost-free season of 210 to 240 days with summer temperatures averaging about 80° F. is ideal for growth of both farm and forest crops. The annual rainfall averages around 55 inches, most of which falls in the winter and spring.

In 1935 more than 6 million acres of this Survey unit were classified as forest land, about 79 percent of which was in rolling uplands. These forests are dominated by stands of shortleaf and loblolly pine mixed with various hardwoods (fig. 1). In the southern counties, longleaf pine occurs in scattered stands often in mixture with other species. In the rough, loessal uplands bordering the Yazoo and Mississippi bottomlands, hardwood stands frequently dominate large areas.

1/ For a more detailed description of the physical features and forest resources of this section, see Forest Survey Release No. 24, "Sawtimber and cordwood volumes in central and southwestern Mississippi," Southern Forest Experiment Station, New Orleans, La., March 13, 1937.

The United States Forest Service has established the Homochitto National Forest in the southwest portion of the unit, with its center in Franklin County, and the Bienville National Forest between Jackson and Meridian, mostly in Smith and Scott Counties. The gross area, both private and Federal, included within the boundaries of these forests is 756,280 acres.

The forest area of the Survey unit was classified according to forest condition, based upon age and cutting history, as shown in table 1, where the dominant second-growth character of the present forest is at once apparent. It is significant that although less than 13 percent of the forest area was in the original old-growth condition, only slightly over 1 percent was classified as clear-cut.

Table 1. - Forest area classified according to forest condition

Forest condition	Acres	Percent of forest area
Old growth:		
Uncut	275,500	4.6
Partly cut	487,200	8.1
Total	762,700	12.7
Second growth:		
Sawlog size:		
Uncut	1,804,100	29.9
Partly cut	1,078,700	17.9
Under sawlog size	2,086,600	34.6
Reproduction	227,300	3.8
Total	5,196,700	86.2
Clear-cut	67,000	1.1
Total	6,026,400	100.0

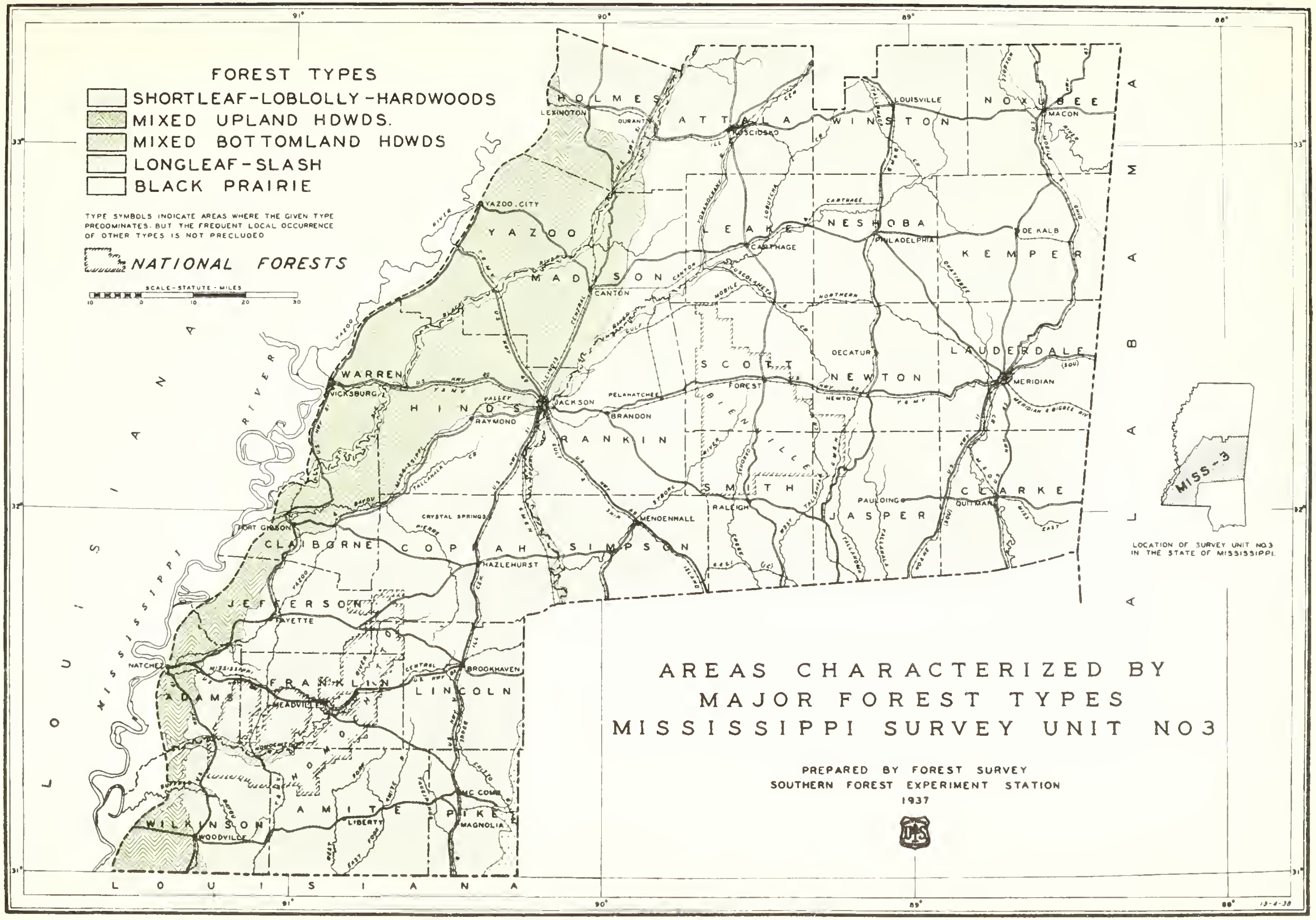

FIGURE 1.-FOREST TYPE MAP

Volume Estimates

Table 2 lists the net saw timber and cordwood volumes according to forest condition and species-group. The board-foot volumes are based on the International $\frac{1}{4}$-inch rule, which closely approximates green lumber tally. Allowance has been made for material that would be left in the woods because of rot, fire scar, crook, limbiness, and similar defects. Likewise, deductions have been made for mill cull, i.e., sweep and interior defects. A saw-timber tree contains at least one usable 12-foot log and will yield at least 50 percent of its gross volume in sound material. In the case of hardwoods the minimum breast-height diameter (at $4\frac{1}{2}$ feet above the ground) outside bark is 13.0 inches; in pines, 9.0 inches. Almost 73 percent of the board-foot volume is in second growth, and over 58 percent is included in the various pine species.

The cordwood volumes, which include a wider variety of material than the board-foot estimates and are measured in standard (4 x 4 x 8 feet) cords, are derived from the following sources:

1. From the merchantable stems of sawlog-size trees.

2. From that portion of saw-timber pines not used as sawlogs but usable as cordwood. This includes the upper stems to a variable top-diameter limit (but not less than 4 inches).

3. From the sound trees under sawlog size at least 5.0 inches d.b.h., in which the entire stem of all species is included to a variable top diameter (but not less than 4 inches).

Deductions for cull include only defects which cause the material to be unsuited for use as cordwood, i.e., sweep and slight crook are not deducted.

Table 2.- Net saw-timber (International $\frac{1}{4}$-inch rule) and cordwood volumes, by species-groups and forest conditions, 1935.

Species-group	Old growth		Second growth		Total	
	M bd.ft.	Cords	M bd.ft.	Cords	M bd.ft.	Cords
Pines	1,900,500	4,473,300	7,919,600	27,746,900	9,820,100	32,220,200
Pulping hardwoods	1,071,700	3,578,300	2,076,000	11,486,300	3,147,700	15,064,600
Nonpulping hardwoods	1,611,500	5,189,900	2,286,200	12,909,400	3,897,700	18,099,300
Total	4,583,700	13,241,500	12,281,800	52,142,600	16,865,500	65,384,100

All of the board-foot inventory volume shown in table 2 is not at present in sufficiently dense stands to justify cutting. Analysis of the $\frac{1}{4}$-acre sample-plot data bearing on all ages and conditions of sawlog-size stands in the pine and pine-hardwood types (excluding the longleaf pine type) discloses the percentage distribution of volume and area in stand-per-acre classes (fig. 2). This may be considered a superficial index to present economic availability. Approximately 78 percent of the forest area dominated by shortleaf and loblolly pine in mixture with hardwoods averages at least 2,000 board feet per acre. Moreover, 94 percent of the total board-foot volume occurred in stands of this same density. This situation is not static, however, since all areas where the growing stock is maintained are steadily increasing in volume per acre.

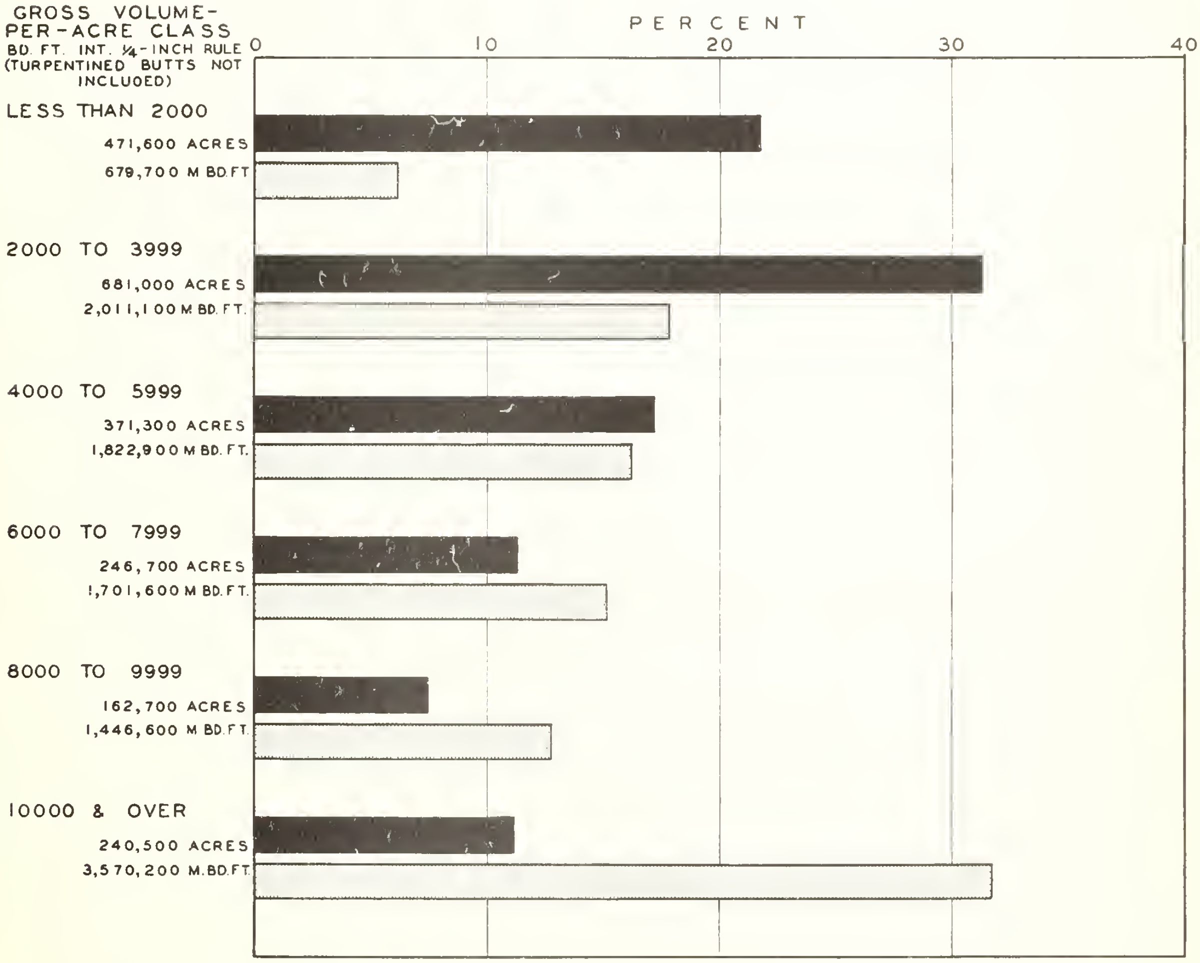

FIGURE 2 - PROPORTIONAL AREA AND VOLUME OF THE SAWLOG-SIZE CONDITIONS IN THE PINE AND PINE-HARDWOOD TYPE-GROUPS*, CLASSIFIED ACCORDING TO VOLUME OF SAWTIMBER PER ACRE.

*EXCLUDING LONGLEAF PINE TYPES

For purposes of comparison with other regions, the average volumes per acre (table 3) are significant. These data represent the average volumes of the component species-groups found on many scattered areas that have been grouped in a common condition.

Table 3. - Average stand-per-acre figures classified according to species-group and forest condition

Forest condition	Pines	Pulping hardwoods	Nonpulping hardwoods	Total
	- - - - - Board feet (Int. ¼-inch rule) - - - - -			
Old growth:				
Uncut	4,708	1,838	2,405	8,951
Partly cut	1,239	1,160	1,947	4,346
Second growth:				
Sawlog size:				
Uncut	3,113	699	720	4,532
Partly cut	1,707	639	711	3,057
Weighted average, all conditions[1/]	1,630	522	647	2,799

1/ Includes under-sawlog-size, clear-cut, and reproduction conditions.

Forest Increment

"Forest increment," as used in this release, means the difference between the net volume of good trees standing on the area at the beginning and the end of the year before deduction of the total commodity drain for the year. If the loss in volume during the year due to mortality, rot, or injury is equivalent to the increase due to growth, there will be no increment; and if these losses are greater than the increase due to growth, there will be a reduction in the growing stock in addition to that caused by commodity drain.

Board-foot increment is made up of the growth on sawlog-size trees and the total board-foot volume of trees becoming sawlog size during the year. Cordwood increment represents growth on the sound stem wood of pines 5.0 inches d.b.h. and over, on under-sawlog-size hardwoods, and on the sawlog portion only of hardwoods 13.0 inches d.b.h. and larger. Included also is the total volume in pines and hardwoods that become 5 inches or larger during the year. In calculating both the board-foot and cordwood increment, cull material is excluded.

In order to arrive at an estimate of average increments for various conditions uninfluenced by cutting, the figures in table 4 were computed These figures represent, therefore, the average increment that occurred on live trees on the area at the beginning of the year, reduction having been made only for mortality.

Table 4. - Average increment per acre in the various forest conditions (assuming no cut), 1935.

Forest condition	Pine component		Hardwood component		Total	
	Board feet	Cords	Board feet	Cords	Board feet	Cords
Old growth:						
Uncut	46	.01	115	.35	161	.36
Partly cut	35	.10	93	.32	128	.42
Second growth:						
Sawlog size:						
Uncut	197	.58	78	.34	275	.92
Partly cut	102	.27	72	.28	174	.55
Under sawlog size	66	.30	24	.27	90	.57
Reproduction and clear-cut	4	.01	2	.02	6	.03
Weighted average	105	.33	58	.29	163	.62

Total forest increment

During the year 1935 a total of 945,100,000 board feet was added to the growing stock through growth. About 47 percent of this occurred in the second-growth sawlog-size pine stands, while hardwoods in the same condition accounted for only 22 percent (table 5). Of the total cordwood increment (3,657,000 cords), 35 percent occurred in the second-growth sawlog-size pine stands.

Table 5. - Total board-foot and cordwood increment in the various forest conditions, 1935.

Forest condition	Pine component		Hardwood component		Total	
	M bd.ft.	Cords	M bd.ft.	Cords	M bd.ft.	Cords
Old growth	25,700	37,700	73,200	246,900	98,900	284,600
Second growth:						
Sawlog size	446,200	1,283,300	211,400	897,000	657,600	2,180,300
Under sawlog size	136,300	632,200	50,600	549,900	186,900	1,182,100
Reproduction and clear-cut	1,000	3,300	700	6,900	1,700	10,200
Total	609,200	1,956,500	335,900	1,700,700	945,100	3,657,200

Forest Industries

Following a preliminary survey in 1934, a more complete survey was made in 1937 of the wood-using industries in this part of Mississippi, covering the production of lumber, veneer, cooperage, and piece products for the calendar years 1935 and 1936. In addition, an estimate was made of the amount of pulpwood and of fuel wood cut for both commercial and domestic purposes.

There were 623 sawmills operating in central and southwestern Mississippi during some portion of 1936 (table 6), of which 578 are of the portable or semi-portable type; this type of mill produced 43 percent of the annual lumber cut and supplied 40 percent of the total man-days of employment provided by the lumber industry. Although the small mills are found in every county of the unit, they appear in greatest numbers in the northern and eastern counties (fig. 3).

Table 6. - Number of sawmills and man-days of employment, classified according to capacity of mill, 1936.

Rated capacity[1] (10-hour day)	Sawmills			Employment		
	Pine	Hardwood	Total	Woods	Mill	Total
M bd.ft.	- - - - - Number	- - - - -		- - - - - Man-days	- - - - -	
Under 20	not classified		578	433,600	905,400	1,339,000
20 - 39	19	11	30	167,700	267,500	435,200
40 - 79	8	2	10	242,600	436,600	679,200
80 and over	5	-	5	406,200	496,800	903,000
Total			623	1,250,100	2,106,300	3,356,400

1/ Rated capacity indicates size of mill rather than actual average production.

There were 35 nonlumber plants in the territory covered by this release during 1936, including veneer mills, cooperage and treating plants, and miscellaneous plants manufacturing shuttle blocks and ski and furniture blanks (fig. 3). Their production in 1936, together with the employment provided by them, is indicated in table 7. These plants provided only 10 percent of the total man-days of employment in the wood-using industries in 1936. The total man-days of employment involved in the production of cross ties, poles, pulpwood, fuel wood, and fence posts is estimated to exceed that in all other nonlumber industries combined. Of these perhaps the least commercial in nature is fuel-wood cutting. While some of the fuel-wood volume shown in table 7 is produced and sold as a commercial enterprise, 90 percent of it is cut by the consumer. It is interesting to note that although no pulp mills or distillation plants are located in this unit,there was a substantial amount of employment provided in cutting pulpwood and producing distillate wood for outside consumption.

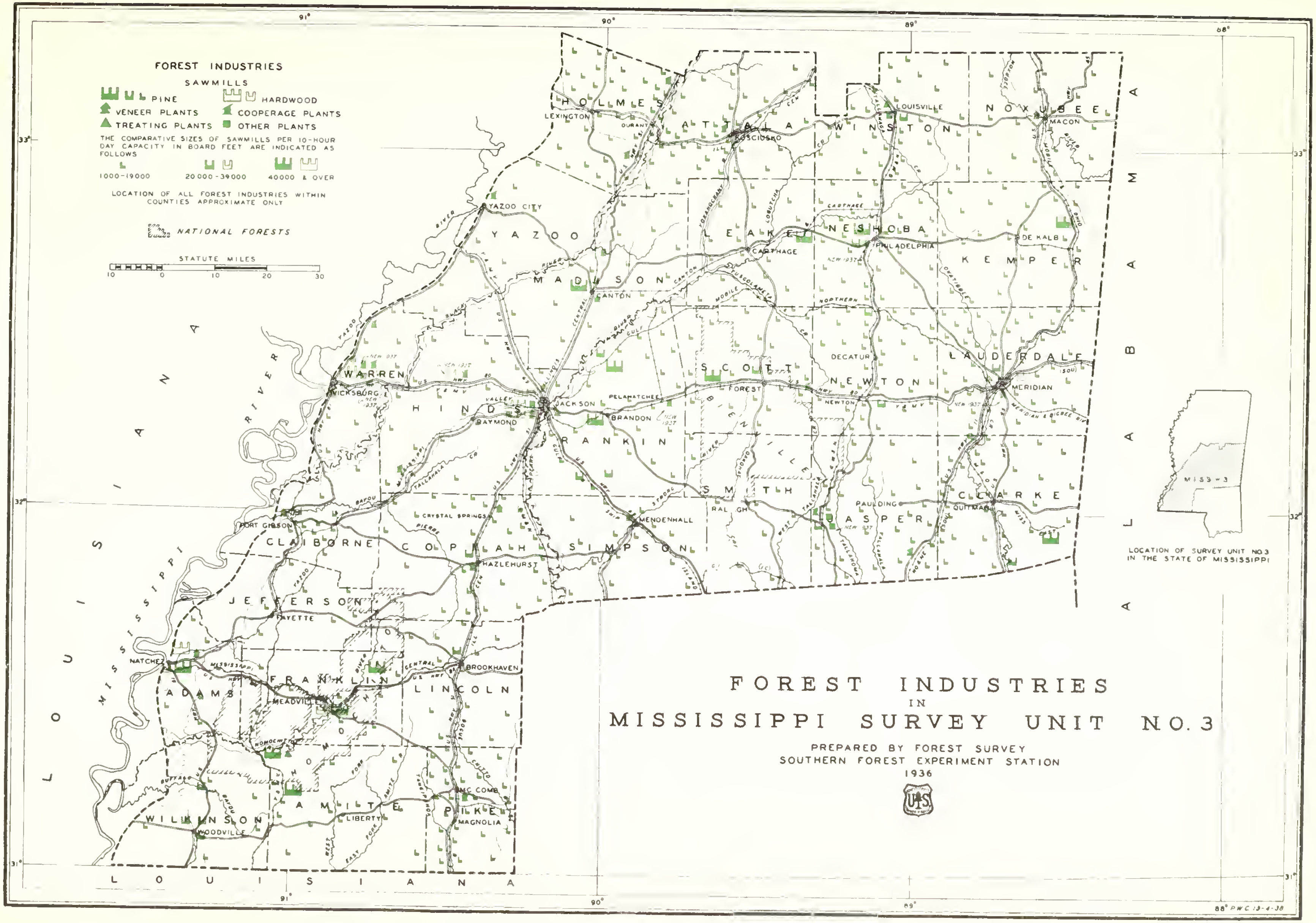

FIGURE 3.- FOREST INDUSTRIES MAP

Table 7. - Production and employment in the woods-products industries, 1936

Industry or commodity	Number of plants	Units produced	Man-days employment (10-hour day)		
			Woods	Plant	Total
		M bd.ft.			
Lumber	623	965,500	1,250,100	2,106,300	3,356,400
Veneer	8	43,200	44,200	283,700	327,900
		Pieces			
Cross ties	-	994,000	140,200	-	140,200
Fence posts	-	5,662,000	65,800	-	65,800
Poles and piles	-	137,000	26,400	-	26,400
		Cu.ft.			
Treating plants	5	4,180,000	-	44,600	44,600
Distillation plants	-	-	13,400	-	13,400
		Cords			
Pulpwood	-	-	189,000	-	189,000
Cooperage	13	69,600	65,400	96,000	161,400
Fuel wood	-	1,295,700	990,300	-	990,300
Miscellaneous mfg.	9	9,600	10,800	12,300	23,100
Total			2,795,600	2,542,900	5,338,500

Commodity Drain

Annual commodity drain is the wood volume removed (including woods waste) during 1 year from the forests of this Survey unit by the various wood-using industries and activities. The board-foot and cubic-foot volumes shown in table 8 represent the drain on the forests of this unit for 1936. The great majority of this material is, of course, manufactured or processed within the unit, but there is a substantial quantity which moves across the Survey unit boundary for consumption outside. All wood cut from sawlog-size trees, regardless of the ultimate commodity into which it is manufactured, is indicated in the board-foot column. The cubic-foot figures include all the material in the board-foot entries, the cubic-foot material in the upper stems of sawlog-size pines, and the cubic-foot contents of the main stems of good trees at least 5.0 inches d.b.h. but under sawlog size. Under miscellaneous drain are included the volumes chargeable to land clearings, domestic farm use, fence posts, and miscellaneous nonlumber manufacturing.

Comparison of Volume Increment with Commodity Drain

In table 9 are compared the two opposing forces that cause the status of the the forest resources to change from year to year. The total growth is balanced against the losses from the stand due to both natural and man-made causes. The chief loss, or drain, is caused by cutting for wood products — cutting, which during 1935 and 1936 and probably for several decades past, has exceeded the total increment during the same period. In 1935 the drain exceeded the increment by nearly 400 million board feet, and during the following year the growing stock was again reduced by more than 580 million board feet.

Table 8. - Commodity drain from good trees expressed in board feet[1] and cubic feet[2], 1936

Commodity	Species-group: Pine	Species-group: Hardwood	Total	Species-group: Pine	Species-group: Hardwood	Total
	M board feet			M cubic feet		
Lumber	795,600	294,800	1,090,400	147,570	45,870	193,440
Veneer	6,400	24,400	30,800	1,090	3,520	4,610
Cooperage	1,200	37,300	38,500	250	5,800	6,050
Pulpwood	40,800	1,000	41,800	12,740	360	13,100
Fuel wood	83,400	121,100	204,500	21,730	19,070	40,800
Poles and piles	12,400	200	12,600	2,320	30	2,350
Cross ties	29,700	23,900	53,600	5,480	3,840	9,320
Miscellaneous	22,900	25,400	48,300	6,690	9,160	15,850
All commodities	992,400	528,100	1,520,500	197,870	87,650	285,520

1/ International $\frac{1}{4}$-inch scale
2/ Inside bark

A similar comparison on the basis of cubic-foot volumes shows a somewhat different picture. The rapid growth accruing to the under-sawlog-size trees, plus the volume in the young trees which become 5.0 inches or larger in diameter during the year, was sufficient to exceed the total cubic-foot drain on the forest in 1935, but fell short by almost 16 million cubic feet in 1936.

Table 9. - Comparison of increment with commodity drain, 1936

Item	Sawlog-size trees: Pine	Sawlog-size trees: Hardwood	Sawlog-size trees: Total	All growing stock 5 inches d.b.h. and larger
	M board feet (Int. $\frac{1}{4}$-inch scale)			M cubic feet (i.b.)
Growing stock, Jan. 1, 1936	9,581,100	6,897,100	16,478,200	4,627,320
Growth	691,500	392,200	1,083,700	317,080
Mortality	83,800	60,100	143,900	47,480
Net increment	607,700	332,100	939,800	269,600
Commodity drain	992,400	528,100	1,520,500	285,520
Net change in growing stock	-384,700	-196,000	-580,700	-15,920
Growing stock, Jan. 1, 1937	9,196,400	6,701,100	15,897,500	4,611,400

A serious overcut in board-foot material is thus taking place in this unit each year. The comparison of volume increment with commodity drain for the year 1936 is graphically portrayed in figure 4.

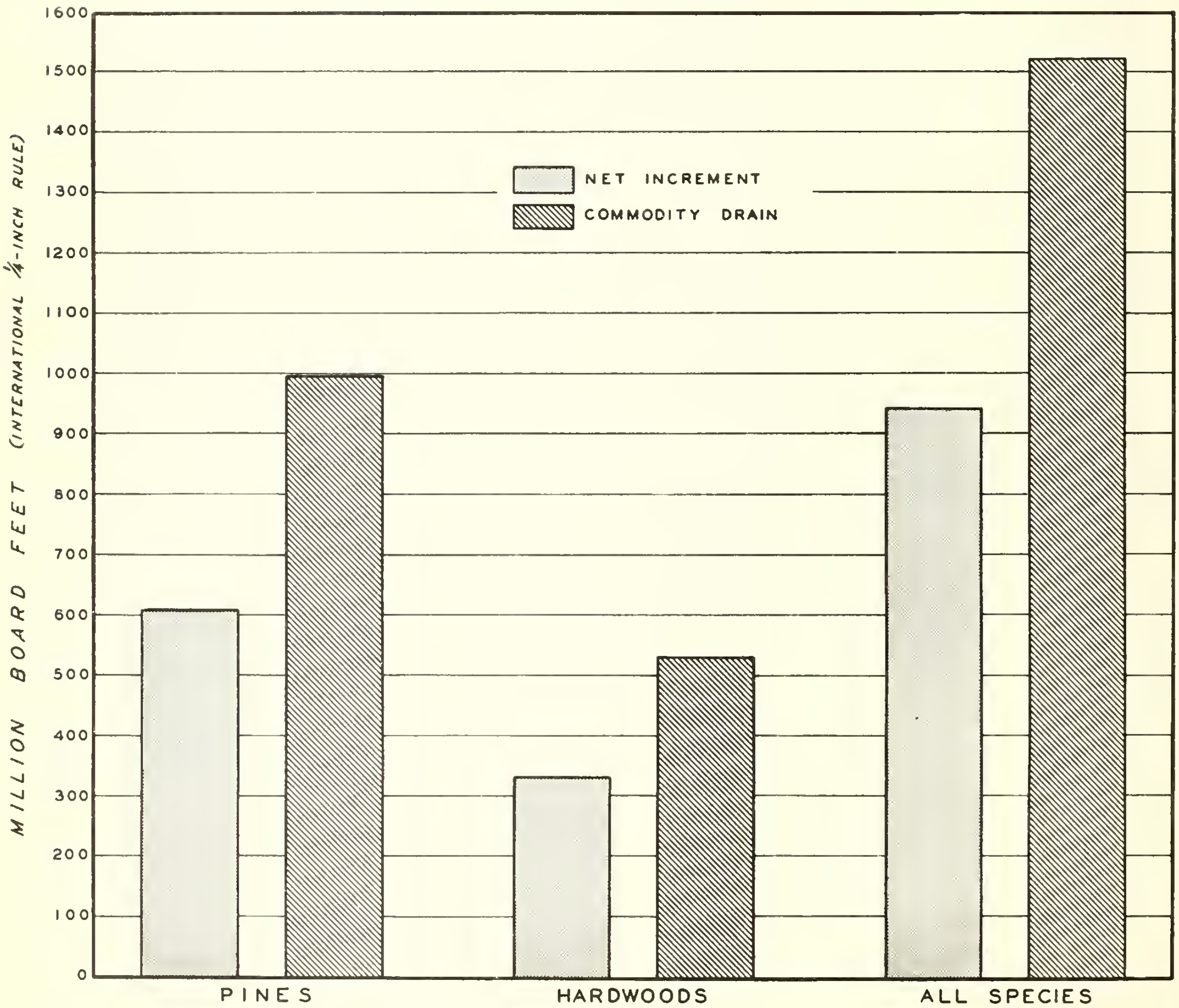

FIGURE 4 — COMPARISON OF NET INCREMENT OF SAWLOG-SIZE MATERIAL WITH COMMODITY DRAIN, 1936

Conclusions

The forest situation in this unit is, in several respects, similar to that existing in many southern forest areas today. Of the total land area, approximately 56 percent is forested and is occupied principally by second-growth stands of loblolly and shortleaf pine, frequently mixed with hardwoods. A small acreage of old-growth timber remains in widely scattered patches. Most of the forest acreage is owned by farmers and other private individuals holding less than 5,000 acres each.

The total drain on the forests, especially that caused by small sawmill operators and contractors for cordwood material, is constantly reducing the growing stock. Indications are that this reduction in the growing stock has been taking place for several years. In 1935, for example, the over-cut amounted to nearly 400 million board feet, and during 1936 the inventory was reduced by approximately 580 million board feet. To continue to cut more each year than is grown can lead only to serious curtailment among existing wood-using industries, decreased employment, and a progressive depreciation of timber quality. This part of Mississippi has a severe unemployment problem to solve. The Federal unemployment census of Nov. 1, 1937,[2/] records a total of approximately 70,000 people that were totally unemployed, working on relief projects, or working only part of the time. Possibly the most promising solution to this problem is the immediate inauguration of an intensive, organized effort to develop the forest resources.

Although serious over-cutting obtains at present, the natural growing conditions are so favorable that it is possible to increase the forest increment so as to bring about a favorable balance of growth and drain and to reverse the present downward trend in supply. If the potentialities of the forest area are to be fully utilized, fire protection must be intensified and extended to unprotected lands; while the present growing stock which must be increased both in volume and quality, should be carefully utilized through selective cutting, removal of cull trees and inferior species, and thinning of stagnated stands. Poorly stocked areas and abandoned fields, on which the establishment of natural restocking will be doubtful or long delayed, should be planted in commercially valuable species. Furthermore, extension work on a scale far greater than that now existing, and designed to reach the small landowners and timber operators, will be required.

Many improvement measures have already been inaugurated on Federal and state holdings, and on a small part of the private ones, but a much more widespread acceptance and practice of these principles must be achieved if the forest resource is to be rehabilitated. The success of the measures already applied indicate clearly that when principles of sound woodland management are applied generally to the forests of central and southwest Mississippi, they will contribute a much larger share than at present to the maintenance of the people and the communities dependent upon them.

2/ Preliminary report on total and partial unemployment, John D. Biggers, Administrator, Washington, D.C., 1937.

FOREST SURVEY RELEASE NO. 35 SEPTEMBER 9, 1938

FOREST RESOURCES OF SOUTHWEST ALABAMA

A Progress Report

by

THE SOUTHERN FOREST SURVEY

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New Orleans, La.

FOREWORD

The nation-wide Forest Survey, being conducted by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

This release, which should be regarded only as a progress report, is based on a field survey made Aug. 4 - Dec. 1, 1934, and April 6 - June 1, 1935. It contains Forest Survey data that will be included in complete reports to be published later, and that, although considered reliable, are subject to correction or amplification as the work of computation proceeds; while item 4 above, which is being studied on a national basis, is not discussed in this report.

In the presentation of these survey data, it is to be noted that owing to the sampling method used in collecting them, the greater the number of samples in any given classification the more accurate are the data for that classification. Hence classes that are of infrequent occurrence and relatively small in quantity generally cannot be determined with as high a degree of accuracy as classes that occur more frequently and in substantially greater quantities. Small tabular items are to be taken as showing, not the exact magnitude of the classes involved, but their relative magnitude in comparison with those of other classes.

Staff Assignment

Preparation of Report	- A. R. Spillers, Associate Forest Economist
In Charge of Field Work	- E. B. Faulks, Associate Forest Economist
In Charge of Computations	- P. R. Wheeler, Associate Forest Economist

Note: The Southern Forest Experiment Station hereby wishes to acknowledge the clerical assistance received from the Works Progress Administration in the preparation of this Release.

FOREST RESOURCES OF SOUTHWEST ALABAMA

General Description

An area of about 8 million acres in southwest Alabama, extending from the Gulf of Mexico northward into the western edge of the Black Belt Prairie, includes two Forest Survey units: Alabama #1 (the southern part of the area, with Covington, Escambia, Baldwin, Mobile, and Washington Counties), and Alabama #2 (the northern part, with Sumter, Choctaw, Marengo, Wilcox, Clark, Monroe, and Conecuh Counties). These two units, together, constitute a source of supply for Mobile, an important wood-using center. The southern part of the area, where turpentine and rosin are produced, is in the "naval stores belt"; and the northern part is in the "pine-hardwood region east of the Mississippi River." Approximately 71 percent of the land is forested (table 1) with various southern hardwoods, cypress, and longleaf, slash, loblolly, and other pines.

In addition to Mobile, the largest city, other cities and towns in the area are Andalusia, Prichard, Demopolis, Atmore, Opp, Brewton, and Florala although more than three-fourths of the total population of 423,000 (1930 Census) live in the country or in towns of less than 2,500 people. Approximately 210,000 live on farms, while many other rural residents live in small communities such as turpentine or lumber camps.

Agriculture (which provides work for approximately half of those gainfully employed) and forest industries are the principal sources of employment in this area. According to the Agricultural Census of 1935, there were 44,000 farms with an aggregate area of about 3 million acres, a decrease in area from 1920 of about 13 percent. The area in cropland, however, increased about 8 percent between 1924 and 1934. In 1935, about two-fifths of the farm area was woodland, which contributes not only important quantities of forest products, but gives part-time employment to many of the agricultural workers.

The rainfall averages between 55 and 60 inches per year, and the growing season lasts about 8 months. Cotton and corn are the principal crops, although many field and orchard crops are grown on a small scale. Dairying, cattle, and poultry raising are also important sources of farm income. Only a small part of the area is improved pasture, the usual practice being to let cattle graze throughout the forest. It is also noteworthy that there are over 300,000 acres of idle and abandoned cropland, much of which will probably revert to forest unless a period of prosperous farming should ensue. In this event, the best of the present idle and abandoned land may be cultivated again.

Southwest Alabama lies entirely within the Coastal Plain, and most of its soils are sands and clays, although limestone predominates in the small area of Black Belt Prairie included in these units. The entire area, which for the most part is gently rolling, is well drained by rivers that enter the Gulf of Mexico and that have a fall of 400 feet in elevation as they flow through the area. The Tombigbee and Alabama Rivers join within the unit and flow into Mobile Bay through a short delta, while the less important Conecuh River crosses northwest Florida before reaching the Gulf.

Table 1. - Total area classified according to land use, 1935

Land use	Southern part	Northern part	Entire area	
	Acres	Acres	Acres	Percent
Forest:				
Productive	2,985,900	2,743,800	5,729,700	70.6
Nonproductive	2,300	-	2,300	1/
Total forest	2,988,200	2,743,800	5,732,000	70.6
Agricultural:				
In cultivation:				
Old cropland	515,200	1,033,600	1,548,800	19.1
Newly cleared cropland	3,100	20,700	23,800	.3
Out of cultivation:				
Idle	49,900	116,700	166,600	2.0
Abandoned	53,900	81,400	135,300	1.7
Improved pasture	9,400	238,100	247,500	3.0
Total agricultural	631,500	1,490,500	2,122,000	26.1
Other nonforest	160,800	104,300	265,100	3.3
Total area	3,780,500	4,338,600	8,119,100	100.0

1/ Negligible.

Excellent shipping facilities by barge and flatboat are available from Mobile northward through the entire length of the area, chiefly on the Tombigbee and Alabama Rivers. To the north, the former gives access to the Birmingham area via the Black Warrior Rivers, while the Alabama River taps the Montgomery territory. Mobile, which is one of the South's busiest seaports, with an excellent deep-water harbor and well developed, state-owned shipping facilities, is also located on the Intracoastal Waterway. Several important railway systems and feeder lines provide adequate railroad transportation. While paved highways are scarce, gravel and graded roads form a transportation network that makes practically all of the area accessible to motor vehicles.

In general, the ownership of the land is unusually stable and tax default is rare. Farmers, wood-using companies, and naval stores operators are the principal landowners. The special Agricultural Census of 1935 classified as "land in farms" 3,174,500 acres, or over 39 percent, of the total area of 8,119,100 acres. Of the total land in farms, more than 44 percent is classed as either "woodland pasture" or "woodland not pastured." There are almost 44,000 farms, a farm being defined by the Census as "all the land which is directly farmed by one person, either by his own labor alone or with the assistance of members of his household, or hired employees." These farms, which vary greatly in size, average 72 acres, more than 32 acres of which are woodland.

As shown by table 2a, which was drawn from Census data, more than two-thirds of the total number of farms are small, i.e.. less than 50 acres in size; and less than 2 percent of all the farms are large, containing 500 acres or more. The large farms, however, while making up less than 2 percent of the total number of farms, include 29 percent of the total farm acreage (table 2b). The aggregate area of all the small farms (less than 50 acres), on the other hand, is only 21 percent of the total area in farms. The northern part of this area has more than twice as many farms as the southern part and almost three times as many small farms.

From the standpoint of forestry extension work, these figures are very significant. To teach forestry to all the farmers will involve reaching in some degree the operators of all 44,000 farms; but if the extension work is limited as to funds and personnel, as it often is, it will be possible to begin by concentrating on the 750 large farms (500 acres or more), which include 29 percent of the total farm area.

Table 2a. - Number of farms by sizes

Size	Southern part		Northern part		Entire area	
	Farms	Proportion of total	Farms	Proportion of total	Farms	Proportion of total
Acres	Number	Percent	Number	Percent	Number	Percent
1 to 49	7,978	60.0	22,535	73.4	30,513	69.4
50 to 99	3,027	22.8	3,828	12.5	6,855	15.6
100 to 499	2,186	16.4	3,679	12.0	5,865	13.3
500 to 999	64	.5	384	1.2	448	1.0
1000 and over	37	.3	271	.9	308	.7
Total	13,292	100.0	30,697	100.0	43,989	100.0

Table 2b. - Acreage in farms by sizes

Size	Southern part		Northern part		Entire area	
	Farms	Proportion of total	Farms	Proportion of total	Farms	Proportion of total
Acres	Acres	Percent	Acres	Percent	Acres	Percent
1 to 49	204,262	22.1	468,360	20.8	672,622	21.2
50 to 99	213,539	23.1	265,501	11.8	479,040	15.1
100 to 499	368,623	40.0	726,946	32.3	1,095,569	34.5
500 to 999	42,530	4.6	261,872	11.6	304,402	9.6
1000 and over	93,861	10.2	528,964	23.5	622,825	19.6
Total	922,815	100.0	2,251,643	100.0	3,174,458	100.0

According to a recent extensive survey of forest-land ownership made by the Division of State and Private Forestry of Region 8 of the Forest Service, the forest-land ownerships of southwest Alabama are classified as follows:

	Acres
1. Large private ownerships:	
(a) Industrial, i.e., sawmill, pulpmill, naval stores, etc.	1,702,000
(b) Investment individuals and inactive corporations	760,000
2. Farm woodlands (1935 Census Report)	1,407,000
3. Publicly owned	
(a) Conecuh National Forest	68,000
(b) Other publicly owned lands (approximate)	107,000
4. Unclassified, private, nonfarm ownerships	1,688,000
Total forest acreage	5,732,000

A recent study of land ownership in 9 of the 12 counties in southwest Alabama, made by the Bureau of Agricultural Economics, in cooperation with the Works Progress Administration of Alabama, discloses that the land is held in 27,000 different ownerships. The small owners (under 100 acres) greatly predominate in number, but the comparatively few large owners (1000 acres and over) control about half the land. In table 3 the proportion of number of owners in different ownership-classes is shown separately for the two Survey units covered in this report.

Table 3. - Proportion of number and size of ownerships by size-classes

Size-classes	Southern part 1/		Northern part 2/	
	Proportion of number	Proportion of area	Proportion of number	Proportion of area
Acres	Percent	Percent	Percent	Percent
Less than 100	69	14	60	13
100 - 259	20	15	24	17
260 - 499	5	9	8	14
500 999	3	10	5	15
1000 and over	3	52	3	41
Total	100	100	100	100

1/ Based on an aggregate area of almost 3 million acres in four of the five counties in the Unit.
2/ Based on an aggregate area of almost 3 million acres in five of the seven counties in the Unit.

The study shows that in the 9 counties 69 percent of the land was owned by persons residing in the same county, 10 percent by owners residing in an adjoining county, 6 percent by owners living elsewhere in Alabama, 10 percent by out-of-state owners, and 5 percent by public agencies or owners whose addresses were unknown.

The study also ascertained the business of the owner. For the nine counties studied, the proportion of the land area owned by different business groups is as follows:

Business group	Percent of area owned	Business group	Percent of area owned
Farm owner-operators	41	Wood-using industries	27
Merchants	3	Mining, power, & railroad companies	1
Professional men	2	Farming companies	1
Administrators & executors	4	All other businesses	3
Banks & mortgage companies	3	Unknown	10
Real-estate agencies	3	Governmental agencies (publicly owned land)	2
		Total	100

Forest Description

Almost three-fourths of the forest area is located on the rolling uplands that are found throughout the area. Topographic situations of less importance are river bottoms, which are fairly well distributed; swamps, bays, ponds, etc.; and flatwoods, found chiefly in the southern part bordering the Gulf Coast.

The type map (fig. 1), which shows only the broad distribution of dominant type-groups, is not intended to delineate either cleared land or intermingled small areas of other types. Longleaf and slash pine types, which are generally located in rolling uplands and flatwoods, usually are confined to the southern part of the area (table 4). Loblolly and other pine types, now occupying much of the land formerly dominated by longleaf pine, show a marked preference for the rolling uplands, especially the red clay hills in the northern part of the area, i.e., in Forest Survey Unit Alabama #2. The cypress and the bottomland and swamp hardwoods prefer the swamps, bays, ponds, and river bottoms; while the upland hardwoods and the scrub oak-scrub hardwoods are confined chiefly to the rolling uplands. The principal hardwood species are red and black gums and red and white oaks.

Of this entire forest area of southwest Alabama, there remains less than a million acres of old growth (table 4), three-fourths of which—since 10 percent or more of the sawlog-size trees have been removed—is classed as partly cut. The smallest sizes considered for saw timber by the Forest Survey are: pines and cypress, 9.0 inches in diameter at breast height (d.b.h.), $4\frac{1}{2}$ feet above the ground; and hardwoods, 13.0 inches d.b.h. The uncut old-growth stands average 8,900 board feet (green lumber tally) per acre, and the partly cut stands 4,000 board feet. Much of the old growth lies in a few, relatively large blocks, but a large area is in small, widely scattered patches. Approximately 44 percent of its area is in the hardwood and cypress types, 42 percent in longleaf and slash pines, and 14 percent in the loblolly and other pine types.

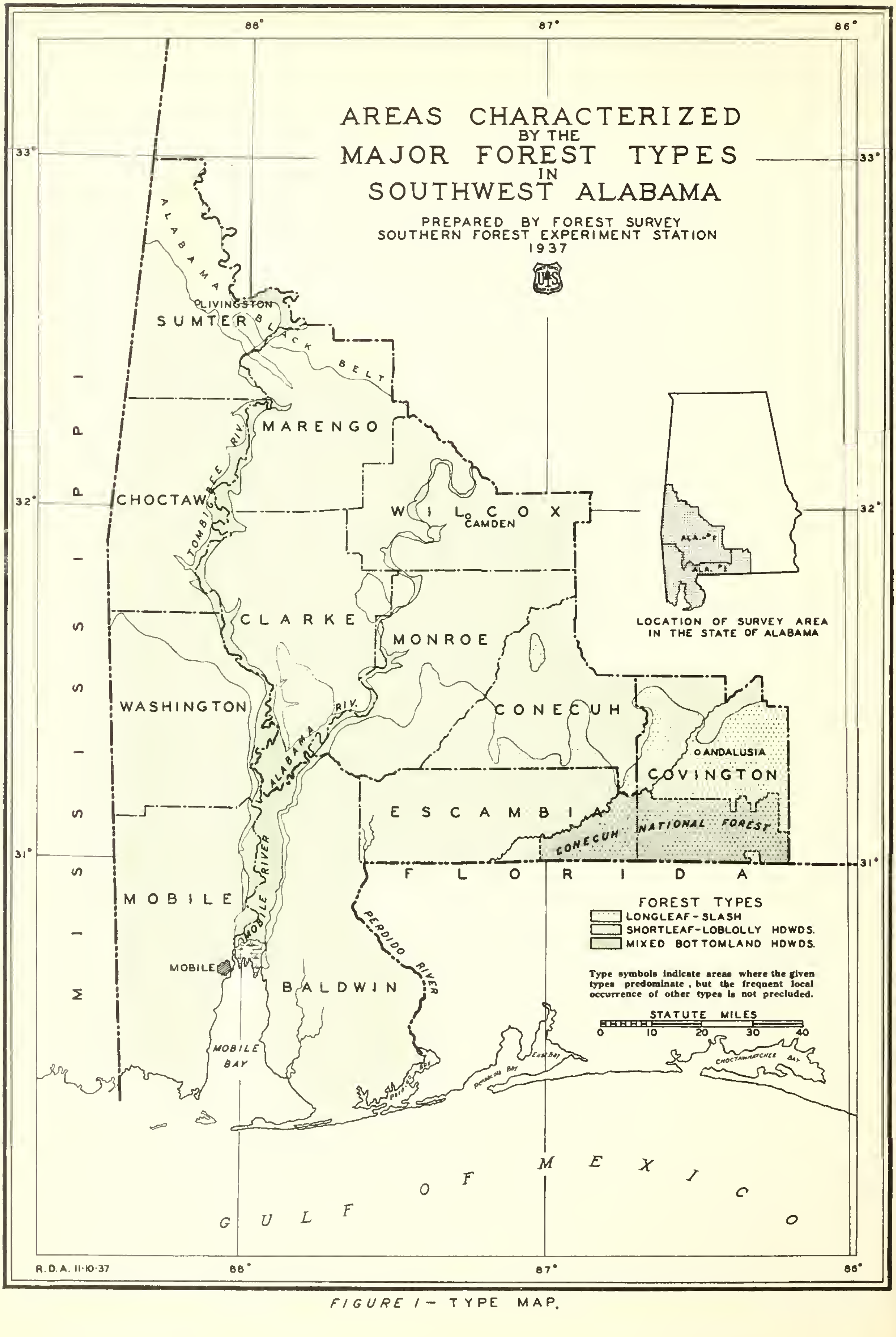


FIGURE 1 — TYPE MAP.

Second-growth stands covering almost 4½ million acres, or more than three-fourths of the forest area, occur in both large and small tracts in all parts of the area. The second-growth sawlog-size stands are well advanced, having, if uncut, an average volume of 3,700 board feet per acre, or, if partly cut, an average of 2,800 board feet per acre. There is a greater area of sawlog-size second-growth stands in the "loblolly and other pine" types than in all other types combined, and nearly twice as much as in longleaf and slash pines. The under-sawlog-size condition, which, from an areal standpoint is the most important of all, is found in all types, although chiefly in the longleaf and slash pines. These "sapling" stands, made up mostly of trees 1 to 7 inches d.b.h., average only 300 board feet per acre, largely in "remnant" trees.

Table 4. - Forest area classified according to type-group and forest condition, 1935

Forest condition	Forest type-groups designated by dominant species			All type-groups	Proportion of total forest area
	Longleaf and slash pines	Loblolly and other pines	Hardwoods and cypress 1/		
	Acres				Percent
Old growth:					
Uncut	78,500	50,200	124,900	253,600	4.4
Partly cut	342,600	90,500	305,700	738,800	12.9
Total	421,100	140,700	430,600	992,400	17.3
Second growth:					
Sawlog size:					
Uncut	472,600	707,800	210,300	1,390,700	24.3
Partly cut	74,400	250,200	67,800	392,400	6.8
Under sawlog size	1,030,900	679,200	541,300	2,251,400	39.3
Reproduction	241,500	67,000	27,700	336,200	5.9
Total	1,819,400	1,704,200	847,100	4,370,700	76.3
Clear-cut	359,600	4,600	2,400	366,600	6.4
Total all conditions	2,600,100	1,849,500	1,280,100	5,729,700	100.0
Percent of total	45.4	32.3	22.3	100.0	
Southern part of area	2,213,100	257,600	515,200	2,985,900	52.1
Percent of southern part	74.1	8.6	17.3	100.0	
Northern part of area	387,000	1,591,900	764,900	2,743,800	47.9
Percent of northern part	14.1	58.0	27.9	100.0	

1/ Includes about 79,300 acres of the cypress type.

"Reproduction" is the term commonly applied to the youngest forest condition, in which seedlings and sprouts less than 1 inch d.b.h., standing 80 or more per acre, form the principal forest cover. About two-thirds of all the reproduction area is in the longleaf and slash pine types. In general, the new forest has the same species pattern as the old, except that, largely as a result of fire protection, the more prolific seeders such as the loblolly and slash pines are encroaching upon sites formerly held by longleaf pine, a species slow to reproduce. Before the turn of the century, longleaf pine dominated most of the area now held by loblolly pine in the northern portion. 1/ An analysis of reproduction plot data in the pine types is as follows:

General stocking classification	Longleaf and slash pine area (in the southern part)	Loblolly and other pine area (in the northern part)
	Percent of area	
Satisfactory (More than 900 well-distributed seedlings)	13	37
Fair (170 to 900 well-distributed seedlings, or 300 or more seedlings with fair distribution)	31	41
Poor (80 or more poorly distributed seedlings)	56	22
Total area	100	100

Clear-cut areas (involving about a third of a million acres, chiefly in the longleaf and slash pine types of the southern part) have less than 80 seedlings per acre and may or may not have seed trees. Many of these logged-over areas have had natural reforestation at one time or another, but it has been killed, usually by fire. In the future, some of the clear-cut areas may be reforested by natural seeding, if fires are controlled, for 37 percent of this area has three or more seed trees per acre, and 39 percent has one or two. The remaining 24 percent of the clear-cut area has no seed trees, and reforestation will depend upon seeding from the neighboring forest or upon planting.

The site quality or productivity of the forest, as indicated by the height in feet of dominant trees at 50 years (i.e., the site index), compares favorably with that of other Survey units in the lower South. Approximately 10 percent of the sites dominated by longleaf and slash pines have an index of 80 or more; 53 percent, 70; 36 percent, 60; and only 1 percent, 50 or less. Of the sites dominated by loblolly and shortleaf pines, 21 percent have a site index of 90 or more; 38 percent, 80; 28 percent, 70; and 13 per cent, 60 or less.

1/ See "Timber pines of the Southern United States" by Charles Mohr, U. S. Dept. of Agric., 1896. 160 pp. illustrated.

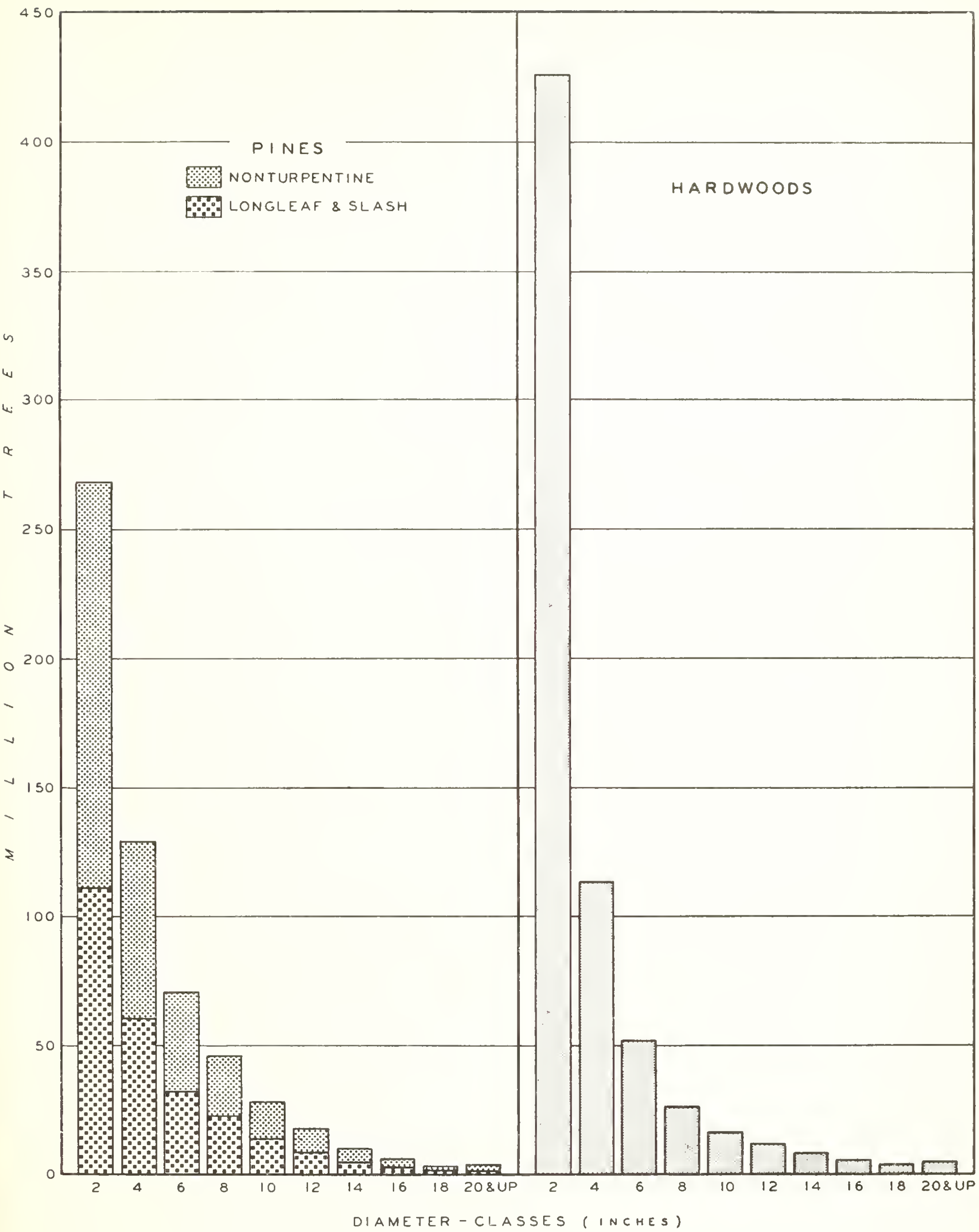


FIGURE 2 - STAND DIAGRAMS

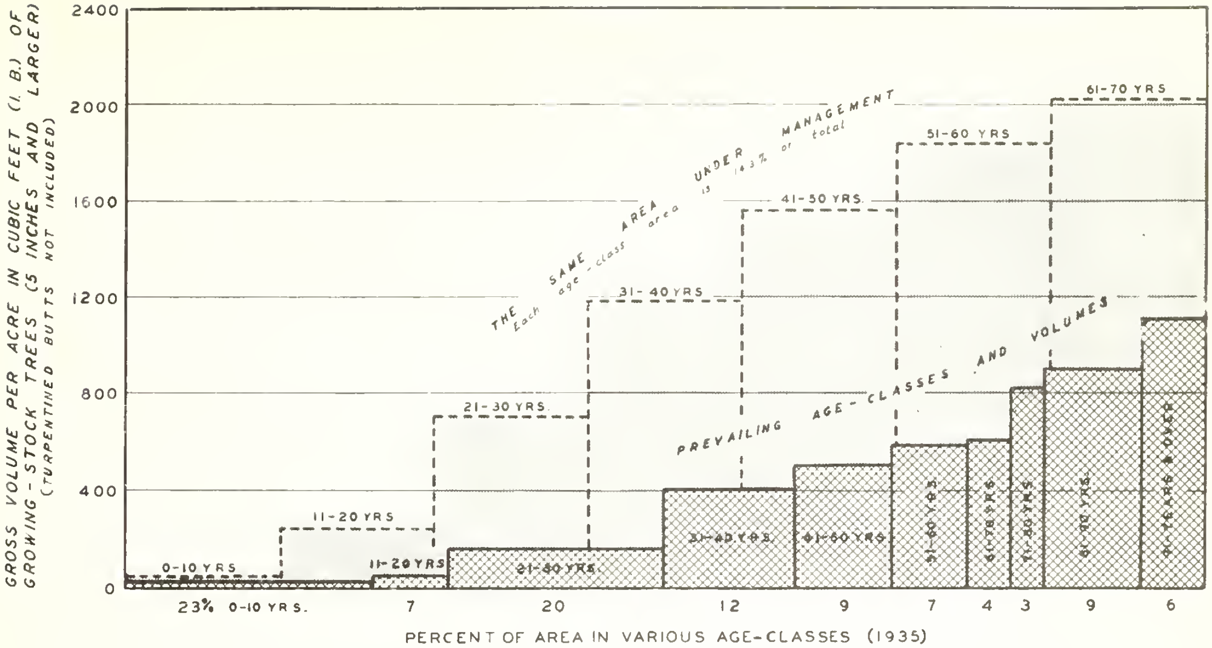
Figure 2 shows the total number of pine and hardwood trees (cypress is included with hardwood) by 2-inch diameter-classes on the entire area The fact that three-fourths of the trees are in the 2- and 4-inch classes indicates that at least the basis for future forest yields has been established. It also emphasizes the need for protection from fire, since without it the attrition by higher mortality will seriously reduce the future possibilities.

In order to compare the make-up of the present forest with that of a managed forest, charts showing the area and volume distribution by age-classes of the two forests are given in figure 3. Chart A is drawn for the $2\frac{1}{4}$ million acres of longleaf and slash pine types in the southern part, and Chart B for the $1\frac{1}{2}$ million acres of the loblolly and other pine types in the northern portion. Comparisons are made of age-class and volume distribution in the present forest with those of a theoretical forest managed on a rotation of 70 years——a period conceivably needed for the integrated production of lumber, poles, and pulpwood. The volume figures used are gross, since no deductions have been made for woods cull, although the volume in turpentined butts in the longleaf and slash pine trees is not included. As shown by the superimposed broken-line, the managed forest is divided into seven equal areas, one for each 10-year age-class; and its per-acre volumes are based upon the heaviest stocked 10 percent of the $\frac{1}{4}$-acre sample plots in the uncut stands now found on weighted-average sites. The pattern of the present forest (shown cross-hatched) is based upon a rough determination of the existing age-classes, with their areas and volumes per acre.

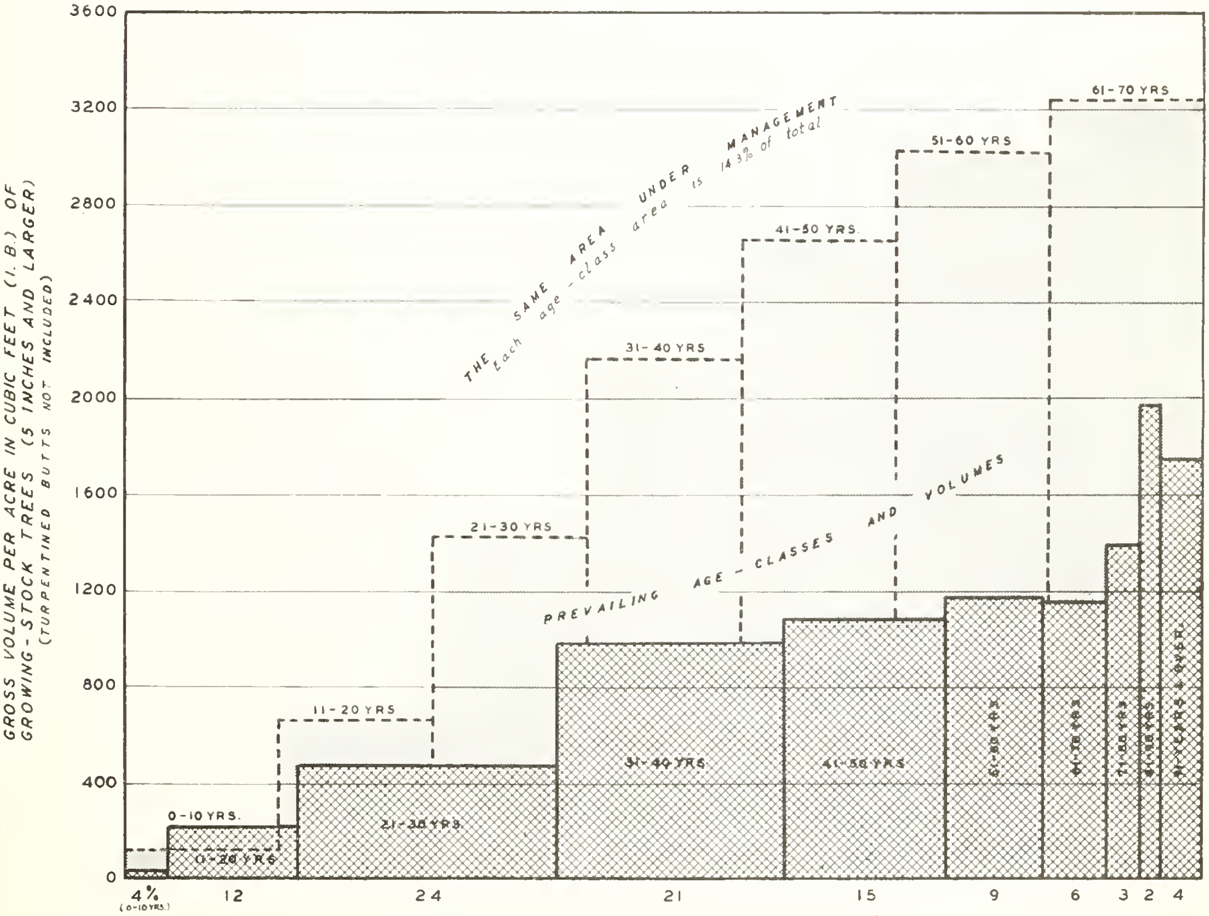
The comparison shown in Chart A for the longleaf-slash pine type-group discloses that the area occupied at present by the three younger age-classes, i.e., 0-10, 11-20,21-30, all of which are immature for any use except pulpwood from thinnings, is 50 percent of the type area instead of the 43 percent called for in an ideal age-class-by-area management plan. This is not a serious defect from the standpoint of long-time management, for with good treatment this area ultimately will come into production, but it accounts in some part for the comparatively low present output of the unit. The more serious defect shown by the comparison lies in the fact that in every age-class the stocking as shown by the cubic-foot volume of existing stands is only about one-third of what the land is capable under good management.

The comparison for the loblolly and other pine types (Chart B) discloses a fairly good distribution of age-classes by area, but the volumes-per-acre comparison indicates, for example, that for the 31- to 40-year age-class the present forest volumes per acre average less than half of those of corresponding stands of the managed forest.

It is interesting to note that the estimated potentiality under management of the loblolly and other pine types is considerably greater than that of the longleaf and slash pine types; for example, in the former, the estimated stand under management in the 61- to 70-year age-class approximates 3,200 cubic feet per acre, while the estimated stands in the same age-class in the latter type-group under management that includes turpentining do not greatly exceed 2,000 cubic feet per acre.



A - BASED ON THE LONGLEAF AND SLASH PINE TYPES (2,213,100 ACRES IN THE SOUTHERN PART)



B - BASED ON THE LOBLOLLY AND OTHER PINE TYPES (1,591,900 ACRES IN THE NORTHERN PART)

FIGURE 3 - PREVAILING AGE-CLASS AND VOLUME DISTRIBUTION COMPARED WITH THOSE ON THE SAME AREA UNDER MANAGEMENT.

Gum Naval Stores Industry and Resources [2]

Although only about 10 percent of the turpentine and rosin produced in the United States from gum and wood together comes from southwest Alabama, over 95 percent of the gum naval stores and all of the stump-distillation products that come from this territory are produced in the five southern counties that constitute Survey Unit Alabama #1.

Located in Alabama as far back as 1850, the gum naval stores industry at first depended upon the large old-growth trees, while in the present day it depends chiefly upon second-growth timber. The peak of production, which was reached about the period of the World War, was followed by a decline to a low point about 1925, coinciding closely with the exhaustion of the old-growth timber. Since 1925, there has been a slight increase owing to the fact that the second growth has reached working size, and according to the latest estimates, production of the area for the 1936-37 season (the turpentine year begins on March 1) was 46,400 units. [3]

In the 1936-1937 season for the entire area covered by this report, it is estimated that there were in operation more than 13 million cups, or some 1,300 "crops" of 10,000 cups each. The average yield per crop in 1936-37 was about 37 units, slightly less than the average for the whole naval stores belt. The total production in 1936 at Savannah prices was worth nearly 3 million dollars. About 855,000 man-days (10 hours each) of employment were provided, and about 110 stills were in operation. More than half of the operators were in Washington and Baldwin Counties, as shown by the map (fig. 4).

For the following analysis of the naval-stores resource situation, only the Survey Unit Alabama #1 is considered, since these five counties include over 80 percent of the turpentine area and over 95 percent of the production.

The section of southwest Alabama in which turpentine farming is actively carried on contains almost $2\frac{1}{2}$ million acres of forest land. Longleaf and slash pine stands occupy the greater part of the area, but there are intermixed areas occupied by non-turpentine pine and hardwood types, as well as areas of clear-cut forest land with or without reproduction in the seedling stage. The gum naval stores industry is based upon the use of the 233 million longleaf and slash pine trees that make up the greater part of the forest growing stock (table 5). Approximately 87 percent of these are second-growth trees less than 9 inches d.b.h. that have not been worked for turpentine.

2/ For additional information, see "Statistics on gum naval stores production," Forest Survey Release #17, Dec. 31, 1935, Southern Forest Exp. Sta., New Orleans, La. Also Gamble's International Naval Stores Year Book for 1937-38, "Gum naval stores operations of 1934-35 --their size and distribution and the employment provided by them," by Harry F. Smith and Elsa M. Rayl, Southern Forest Exp. Sta.
3/ A naval stores unit is made up of one 50-gallon barrel of turpentine and 3-1/3 500-pound (gross weight) barrels of rosin.

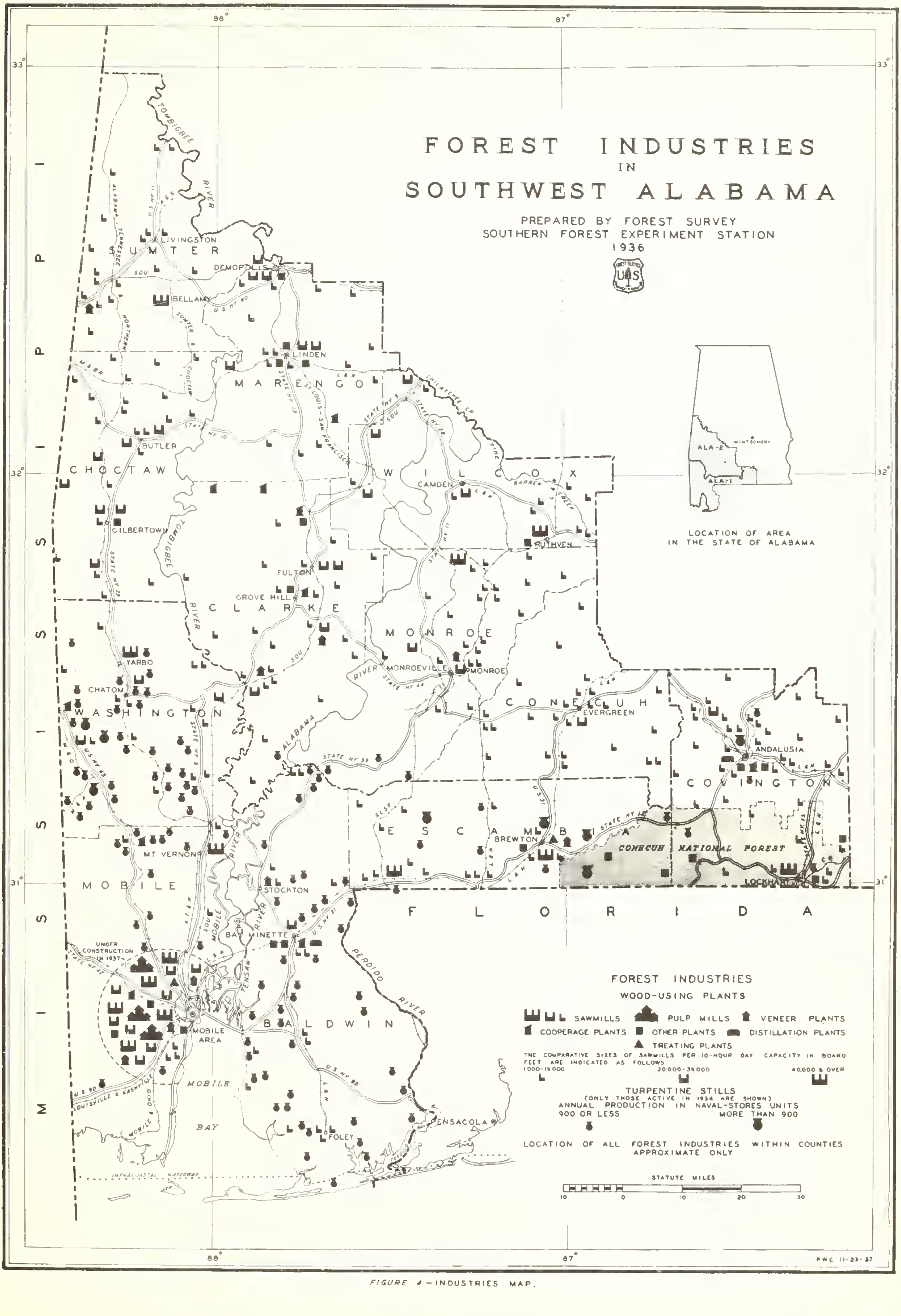


FIGURE 4 — INDUSTRIES MAP.

Table 5. - Longleaf and slash pine trees on the various turpentine areas during the season 1934-35

Turpentine area	Round trees		Working trees	Resting trees	Worked-out trees	All turpentine pines	
	1.0 to 8.9 inches	9 inches and over					
	M trees						Percent
Round-timber area	123,139	11,117	-	378	13	134,647	57.9
Working area:							
Front-faced	22,967	511	5,265	137	144	29,024	12.5
Back-faced	25,514	178	4,949	384	462	31,487	13.5
Resting and worked-out areas	30,311	1,783	-	3,692	1,560	37,346	16.1
Total turpentine area	201,931	13,589	10,214	4,591	2,179	232,504	100.0
Percent of total	86.9	5.8	4.4	2.0	.9	100.0	

The turpentine forest area may be divided into three broad classes: (a) round-timber areas, in which the present stand of turpentine timber has not been operated for naval stores; (b) working areas, in which the turpentine crops have been cupped, and chipping and dipping operations are under way; (c) resting and worked-out areas, in which the crops have been worked for front faces and are now being rested before being back-cupped or have already been back-cupped. These latter crops can now be converted into wood products. The round timber area constitutes 57 percent of the naval stores territory; the working area, 22 percent; and the resting and worked-out area, 21 percent.

The forest areas in the three broad turpentine classes described above are occupied by timber stands in all stages of development as to number and size of trees and number of potential turpentine faces per acre. These stands range all the way from seedling areas, with a few scattered potential faces on residual trees, to areas of trees of turpentine size with many potential faces per acre. In general, the stands are of the selection type with three or more well-marked age-classes present on nearly every acre. As an aid in visualizing this aspect of the situation, the proportion of the area in these various stand conditions is graphically shown in figure 5 for the turpentine area as a whole and also for each of the major subdivisions. "Well-developed" stands shown in the figure average 24 future faces per acre, of which 11 are back faces and 13 are faces that can be placed on round trees at least 9 inches d.b.h. The minimum number of potential faces for this classification is 8 per acre. In addition to these trees 9 inches d.b.h. or larger, the well-developed stands average 102 smaller turpentine trees per acre, most of which, with reasonable fire protection, will grow to turpentine size. As shown in the figure, well-developed stands occupy about 40 percent of the forest area of the active turpentine region.

"Advanced sapling" stands consist chiefly of trees in the 8-inch diameter-class, associated with a large number of smaller trees. Stands of this class, which occupy about 11 percent of the forest area, can be expected to reach the well-developed stage and be ready for intensive turpentining in 8 to 15 years.

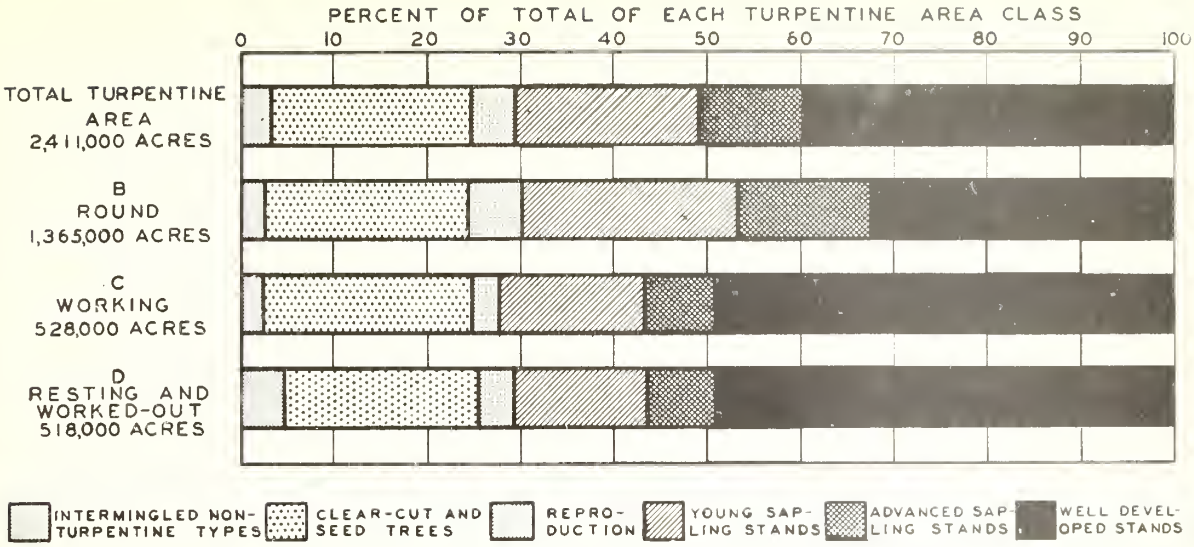


FIGURE 5 - CONDITION OF THE TURPENTINE AREA.

"Young sapling" stands, which are the next younger in order of development, are made up mainly of 2-, 4-, and 6-inch trees. There is a sufficient number of these trees now present to warrant the expectation that in 15 to 20 years, if protected from fire, these stands will be well enough developed in size and number of faces per acre to take their place as producers of naval stores. Young sapling stands at present occupy approximately 19 percent of the forest area of the local turpentine belt. The two remaining classes of stands, i.e., reproduction and clear-cut with or without seed trees, are in such early stages of development that they cannot be expected to be operable for 20 to 30 years, and then only if protected from fire and if not converted prematurely into pulpwood. These two young classes, together with the relatively small area in nonturpentine types, occupy about 30 percent of the forest area of the local turpentine belt.

An analysis of the inventory of the number of potential faces on the acreage of presently well-developed turpentine stands in round, working, and resting areas combined, indicates that there are sufficient future faces, assuming cupping to a 9-inch minimum diameter, to allow the placing of over 3 million new faces each year during the 8-year working cycle, 1935-1942. Such an income of new faces would be sufficient to maintain by annual recruitment a working body of turpentine crops approximately one and a half times the size of that being operated in the 1934-35 season. If the cupping practice is such as to include as much as one-third of the trees in the 8-inch diameter-class, the number of new faces with which to maintain the working body would be increased about 20 percent.

In the second 8-year cycle, 1943-1950, the analysis indicates that there should be an annual income of new faces amounting to about $3\frac{1}{2}$ million, assuming a 9-inch diameter limit. If one-third of the 8-inch class is counted in for cupping, the indicated annual income of new faces in this period would be over $4\frac{1}{2}$ million. In the third 8-year turpentine cycle, 1951-1958, the supply of young trees now on hand should, after discounting liberally for mortality on the basis of past experience, be sufficient in number and size to provide a further increase in the annual income of new faces and new trees with which to maintain turpentine operations.

All the above calculations of future supplies are based upon the assumption that the trees will not be cut for any purpose before they have been completely worked for naval stores, and that all the potential faces will be used. If the growing demand for pulpwood should cut heavily into the stock of round longleaf and slash pine; if the owners of any considerable amount of acreage should reserve their trees from turpentining in order to produce wood products exclusively; or if naval stores operators should, for any reason, change materially their woods practices, the supply of trees with which to maintain naval stores operations might be reduced considerably. There is a strong and wise tendency in the naval stores industry to increase the minimum diameter limit for cupping. Experience and the studies of the Southern Forest Experiment Station have shown that the working of trees under 9 inches d.b.h. generally is uneconomic. There is also a growing realization on the part of timber owners in the naval stores belt that a better income often can be obtained by managing for integrated wood products with naval stores as a supplementary yield than by operating for naval stores as the prime objective, with wood products as more or less of a salvage operation; this may have a tendency to change the future gum naval stores situation.

Table 6. - Net change in number of round trees 7 inches d.b.h. and larger and 9 inches d.b.h. and larger between Jan. 1, 1934, and Dec. 31, 1936

Item	1934		1935		1936	
	7 inches and larger	9 inches and larger	7 inches and larger	9 inches and larger	7 inches and larger	9 inches and larger
	Thousand trees					
Round trees as of Jan. 1	29,202	13,478	29,011	13,589	30,549	14,681
Increase due to growth of smaller trees	3,212	1,997	3,212	1,997	3,212	1,997
Decrease due to mortality	598	281	630	304	645	317
Net increase	2,614	1,716	2,582	1,693	2,567	1,680
Trees turpentined	2,539	1,446	718	409	1,499	854
Trees cut for products	266	159	326	192	299	157
Total industrial drain	2,805	1,605	1,044	601	1,798	1,011
Net change during year	-191	111	1,538	1,092	769	669
Round trees as of Dec. 31	29,011	13,589	30,549	14,681	31,318	15,350
Percent of number on Jan. 1, 1934	99.3	100.8	104.6	108.9	107.2	113.9

In table 6, the inventory as of 1934 is brought forward through 1935 and 1936 by the application of subsequent growth, mortality, and drain figures. The table indicates that the supply of round trees 7 inches d.b.h. and larger increased 7.2 percent between Jan. 1, 1934, and Dec. 31, 1936, and that during the same 3 years the supply of round trees 9 inches d.b.h. and larger increased nearly 14 percent.

Wood Naval Stores Industry and Resources

In 1936, two 4/ wood-distillation plants, both using the steam-solvent process, were making rosin, turpentine, pine oil, and other products from seasoned stumps and from the heartwood of dead, old-growth, longleaf pine trees. Approximately 59,000 tons of wood were consumed in 1936, with the industry providing 109,000 man-days of employment. The total production for the year amounted to about 7,000 barrels (50 gallons each) of turpentine, 36,000 barrels (500 pounds gross, each) of rosin and 5,000 barrels of pine oil, as well as other valuable commodities.

In 1934, the Forest Survey found that on 622,600 acres of forest land there was a stand per acre of at least 6 (average over 20) old-growth longleaf pine stumps at least 8 inches high; this stocking is usually considered heavy enough to warrant extraction (table 7). Over 91 percent of the stumpwood vol-volume is in the rolling hills, while most of the remainder is in the flatwoods. The southern portion of southwest Alabama has over four-fifths of the wood naval stores resources in the area under consideration.

Table 7. - Stand of merchantable stumps (blasting basis), averaging 6 or more per acre

Stumps per acre	Area	Topographic situation: Rolling uplands	Topographic situation: Flatwoods, swamps, bays, etc.	Total	Portion of total tonnage
	Acres	Thousand tons	Thousand tons	Thousand tons	Percent
6 to 13	212,900	399	27	426	16.0
14 to 25	238,300	888	65	953	35.8
26 and over	171,400	1,156	129	1,285	48.2
Total	622,600	2,443	221	1/ 2,664	100.0
Percent of total		91.7	8.3	100.0	

1/ In addition there are 64 thousand tons on 158,000 acres having 5 stumps or less per acre.

It is estimated that in 1934 there were suitable for blasting about 2,700,000 tons of stumps, averaging 6 or more per acre. 5/ The Survey made no attempt to estimate the amount of seasoned topwood, which is also used in the production of wood naval stores. There were 1,300,000 tons of stumps in

4/ A third plant began operation in 1937 at Mobile.
5/ If mechanical stump pullers, which are often impractical in hilly country, could be used instead of blasting, the stumpwood recovered would be increased about two-thirds.

areas running 26 or more stumps, or over 5 tons of material, per acre. Clear-cut reproduction, and second-growth under-sawlog-size forest conditions together, contain 30 percent of the stumpwood resource, the remainder being fairly equally divided between the second-growth sawlog-size and the old-growth partly cut conditions. A potential resource of about 4 million tons (not shown in the table) is in unseasoned stumps and in the stumps that at present are not considered usable, owing to their location in dense stands of young growth that might be damaged in the process of extracting stumps. As rapidly as the present stands of old-growth longleaf and slash pine trees are cut and the resulting stumps are seasoned for about 10 years, there will be an additional supply of appreciable volume.

Estimates of Timber Volume

Saw-timber volume

To be classed as saw timber by the Forest Survey, a tree must have the following minimum specifications: It must be living; if pine or cypress, it must be at least 9 inches d.b.h. outside bark, or, if hardwood, 13 inches; and it must have 50 percent or more of its gross volume in sound material, or contain at least one sound 12-foot butt log. This area contains less than 8 billion board feet of saw timber according to the Doyle rule, the scale used locally, or more than 12 billion board feet, as measured by the International $\frac{1}{4}$-inch rule, which closely approximates green lumber tally (table 8). The volume figures given are net, in that allowance has been made for woods cull caused by rot, fire-scar, crook, limbiness, etc., as well as for loss in manufacture due to sweep and hidden defects. Examples of cull factors applied to reduce the gross volumes are:

Timber	Percent cull
Longleaf, old growth	10
Longleaf, second growth	4
Slash pines - all conditions . . .	5
Loblolly - all conditions	7
Red gum - all conditions	8
Cypress - all conditions	15

A flexible top-diameter limit, depending upon merchantability, is used; no pine or cypress logs less than $5\frac{1}{2}$ inches in diameter inside bark at the small end, and no hardwood logs less than $8\frac{1}{2}$ inches, are included. The average top diameters actually used considerably exceed these minima.

The pines, with loblolly pine having the most volume, include over two-thirds of the saw timber (green lumber tally). Almost three-fourths of the longleaf and slash pine volume is in the southern unit of this area, while over 84 percent of the loblolly and other pine volume is in the northern unit. Red gum, red oaks, black gum, and white oaks are the most important of the hardwoods. Grouped together as "other" hardwoods are yellow poplar, hickory, bay, beech, elm, hackberry, ash, and other species of less importance, such as magnolia, sycamore, basswood, and maple. Almost three-fourths of the total hardwood volume is in the northern counties. Cypress has only a small volume, mostly in the southern counties.

Table 8. - Net board-foot volume expressed in both Doyle scale and in green lumber tally 1/

Species	Southern part of the area		Northern part of the area		Southwest Alabama	
	Doyle scale	Green lumber tally	Doyle scale	Green lumber tally	Doyle scale	Green lumber tally
	- - - - - - - - - - - - Thousand board feet - - - - - - - - - - - -					
nes:						
Longleaf	819,700	1,533,300	400,800	617,700	1,220,500	2,151,000
Slash	610,000	1,080,100	98,700	160,900	708,700	1,241,000
Loblolly	360,500	584,700	1,647,100	2,592,800	2,007,600	3,177,500
Other	93,100	159,200	833,200	1,383,300	926,300	1,542,500
Total pines	1,883,300	3,357,300	2,979,800	4,754,700	4,863,100	8,112,000
rdwoods:						
Red gum	133,800	178,900	598,500	809,500	732,300	988,400
Black gum	263,600	382,500	139,500	199,100	403,100	581,600
Red oak	144,300	188,000	443,400	566,700	587,700	754,700
White oak	52,100	69,300	178,000	237,000	230,100	306,300
Other	190,900	277,800	721,500	961,300	912,400	1,239,100
Total hardwoods	784,700	1,096,500	2,080,900	2,773,600	2,865,600	3,870,100
press	80,900	119,700	31,700	51,700	112,600	171,400
Total all species	2,748,900	4,573,500	5,092,400	7,580,000	7,841,300	12,153,500

Green lumber tally is based on the International $\frac{1}{4}$-inch rule, which it closely proximates.

Second-growth stands, which include 57 percent of the saw-timber volume, are nstantly becoming more important, although old-growth forest conditions, the partly t stands of which have a greater aggregate volume than the uncut, still contain as ch as 43 percent of the total saw-timber volume (table 9). About 34 percent of e total pine saw-timber volume is in old-growth stands; 59 percent of all the hard-od; and almost all the cypress. There is over three times as much pine in second owth conditions as hardwood and cypress combined.

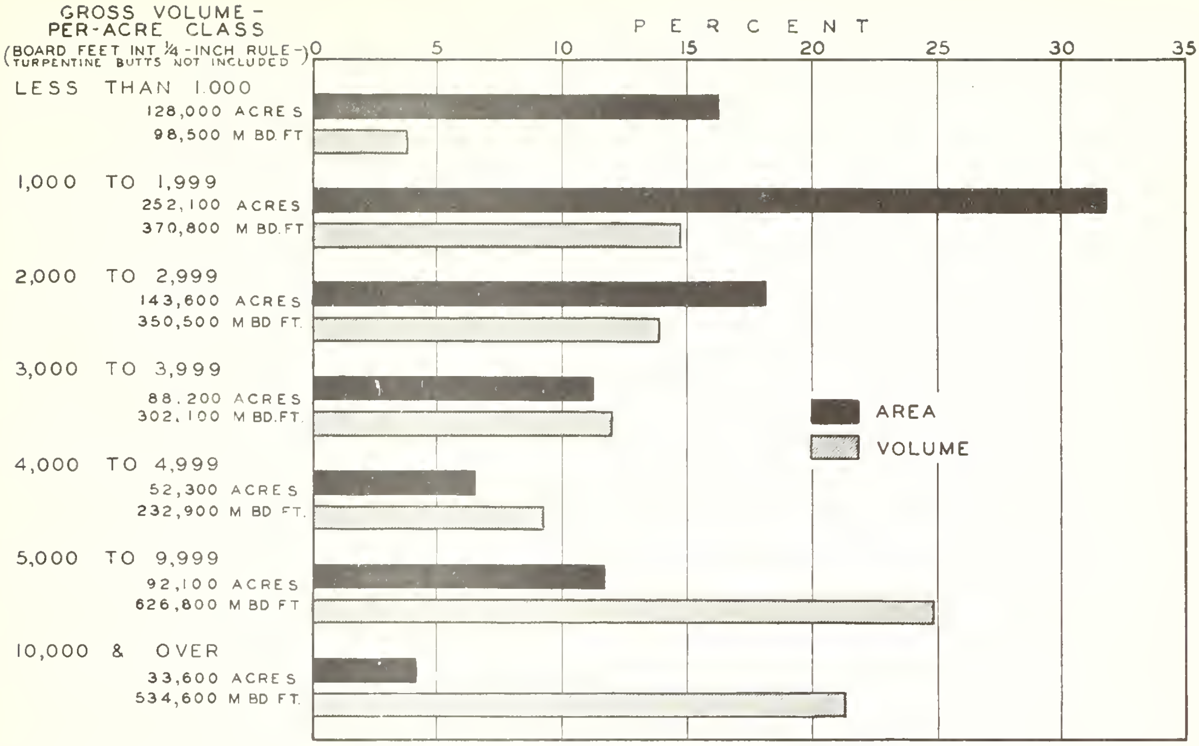
As a general rule, the old-growth trees are larger, and produce lumber of gher grades, than second-growth trees. In the two old-growth conditions combined, ees 17 inches d.b.h. and larger contain only 49 percent of the pine volume but er 61 percent of the cypress; and trees 19 inches d.b.h. and larger include arly 59 percent of the hardwood saw-timber volume. Hardwood and cypress, all nditions combined, have a greater portion of their volume in large trees than do e pines.

Table 9. - Diameter distribution of net board-foot volume (green lumber tally, based on International $\frac{1}{4}$-inch rule) in the various forest conditions

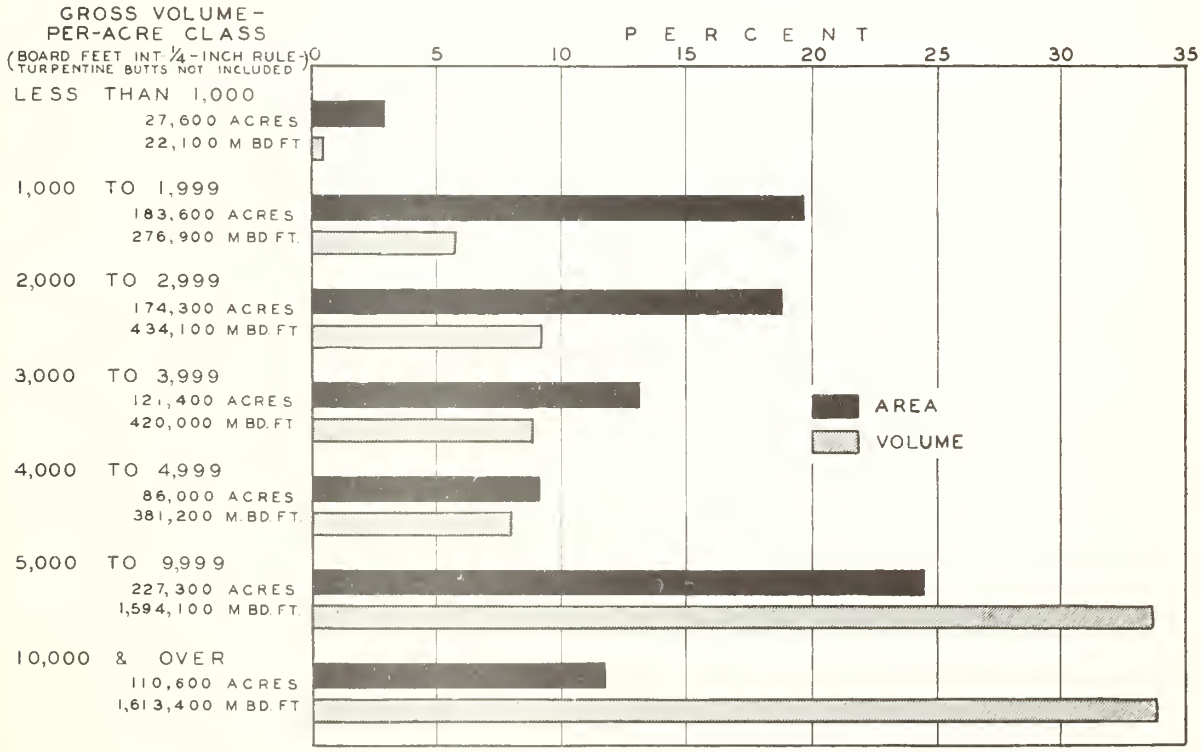
Species-group and diameter-class in inches	Old growth		Second growth		Total	Percent of total
	Uncut	Partly cut	Sawlog size	Under sawlog size 1/		
	- - - - - - - - Thousand board feet - - - - - - - - -					
Pines:						
10 - 12	168,900	386,400	2,011,000	362,600	2,928,900	36.1
14 - 16	315,600	557,100	1,603,400	110,600	2,586,700	31.9
18 - 20	339,100	380,400	721,700	26,500	1,467,700	18.1
22 & over	405,400	224,500	485,800	13,000	1,128,700	13.9
Total pines	1,229,000	1,548,400	4,821,900	512,700	8,112,000	100.0
Hardwoods:						
14 - 18	355,400	580,400	951,900	175,200	2,062,900	53.3
20 - 28	416,300	612,700	384,100	48,900	1,462,000	37.8
30 & over	168,900	138,000	36,500	1,800	345,200	8.9
Total hardwoods	940,600	1,331,100	1,372,500	225,900	3,870,100	100.0
Cypress	75,200	65,900	19,700	10,600	171,400	100.0
Total all species	2,244,800	2,945,400	6,214,100	749,200	12,153,500	
Percent of total	18.5	24.2	51.1	6.2	100.0	

1/ Includes a small amount in the reproduction and clear-cut conditions.

In addition to quality, the volume density or stand per acre greatly influences the economic value of the stands, owing to the fact that logging costs per unit vary somewhat inversely with the volume. Proportional area and volume of the sawlog-size conditions are classified according to volume of saw timber per acre in figure 6, charts A and B. The volumes are gross, no deductions having been made for the woods cull, but on the other hand in the longleaf and slash pine trees, no volumes in turpentine butts have been included. While there is room for error in the lowest volume-per-acre class because the estimates are based on $\frac{1}{4}$-acre plots, the combined data in the first two classes are stronger. Chart A, for the longleaf and slash pine types in the southern portion of southwest Alabama, shows that 48 percent of the area, but only 19 percent of the volume, is in stands that have less than 2,000 board feet per acre; and it follows that 52 percent of the area and 81 percent of the volume are in stands of 2,000 board feet or more. In the loblolly and other pine types in the northern part (chart B), the preponderance of heavy stands is even more striking; here 77 percent of the area and 94 percent of the volume are in stands having 2,000 board feet or more per acre.



A – BASED ON THE LONGLEAF AND SLASH PINE TYPES (789,900 ACRES IN SOUTHERN PART)



B – BASED ON THE LOBLOLLY AND OTHER PINE TYPES (930,800 ACRES IN NORTHERN PART)

FIGURE 6 – PROPORTIONAL AREA AND VOLUME OF THE SAWLOG-SIZE CONDITIONS, CLASSIFIED ACCORDING TO VOLUME OF SAW TIMBER PER ACRE.

Cordwood volume 6/

The entire net usable volume of all live trees 5.0 inches d.b.h. and larger, including the saw timber shown previously, amounts to 64 million standard cords (4 x 4 x 8 ft.) with bark included (table 10). The item, "upper stems of saw-timber trees", includes the cordwood above the sawlog portion up to a flexible top-diameter limit that varies with the quality but is not less than 4 inches, outside bark. For hardwoods and cypress the usable limbs are included, while for pine the upper stems but no limbs are included. "Sound trees under sawlog size" include the full stem (without limbs) of pine and cypress trees 5.0 to 8.9 inches d.b.h., and of hardwoods 5.0 to 12.9 inches d.b.h., all up to a variable top-diameter limit but never less than 4 inches. In the fourth column, under "cull trees," is given the usable volume that may be salvaged if these undesirable cull trees, including the scrub oaks, are utilized. In cordwood-volume estimates, deductions for material unfitted for use because of fire scar, crook, bad knots, and other defects amounted to 1 to 10 percent by volume for the sound trees, and 20 to 80 percent for the cull trees.

Table 10. - Net volume of all sound material, expressed in cords

Tree species-group	Source of material				Total
	Sawlog portion of saw-timber trees	Upper stems of saw-timber trees	Sound trees under sawlog size	Cull trees	
	Cords				
Pulping species:					
Pines:					
Longleaf (round)	4,398,900	815,800	2,838,600	72,100	8,125,400
& slash (turpentined)	3,199,200	665,500	721,900	61,100	4,647,700
Loblolly & other pines	10,343,600	1,871,600	3,621,500	1,024,500	16,861,200
Total pines	17,941,700	3,352,900	7,182,000	1,157,700	29,634,300
Hardwoods (pulping)	5,286,000	2,830,900	6,052,400	4,833,100	19,002,400
Cypress	400,500	132,500	93,200	97,700	723,900
Total pulping species	23,628,200	6,316,300	13,327,600	6,088,500	49,360,600
Nonpulping hardwoods	4,121,000	2,390,500	3,973,300	4,551,300	15,036,100
Total all species	27,749,200	8,706,800	17,300,900	10,639,800	64,396,700
Percent of total	43.1	13.5	26.9	16.5	100.0

6/ For more detailed information, see "Pulping and nonpulping cordwood volume in the southwest Alabama survey area." Forest Survey Release #16, Southern Forest Exp. St., New Orleans, La., Oct. 18, 1935.

Approximately 46 percent of all the cordwood volume is pine (loblolly and other pines aggregate a greater volume than longleaf and slash), and 31 percent is pulping hardwood and cypress, giving a total of 77 percent, or 49 million cords, suitable for pulping. The principal pulping hardwood species are the soft-textured red gum, black gum, tupelo gum, yellow poplar, bay, magnolia, etc. Red oaks, white oaks, and scrub oaks contain the bulk of the 23 percent in hardwood volume now classed as "nonpulping," although it should be recognized that future developments in pulp- and paper-making technique may facilitate the using of these species.

From the standpoint of the future of the forest, it is significant that about half of the cordwood volume is in trees in the 6-, 8-, 10-, and 12-inch diameter-classes---sizes that must produce the saw timber of the future. At the same time, these young trees are in the sizes most desired for pulpwood.

Figure 7 gives the cordwood volume in sound trees only, including upper stems of pine and upper stems and usable limbs of hardwood and cypress; cull trees are not included.

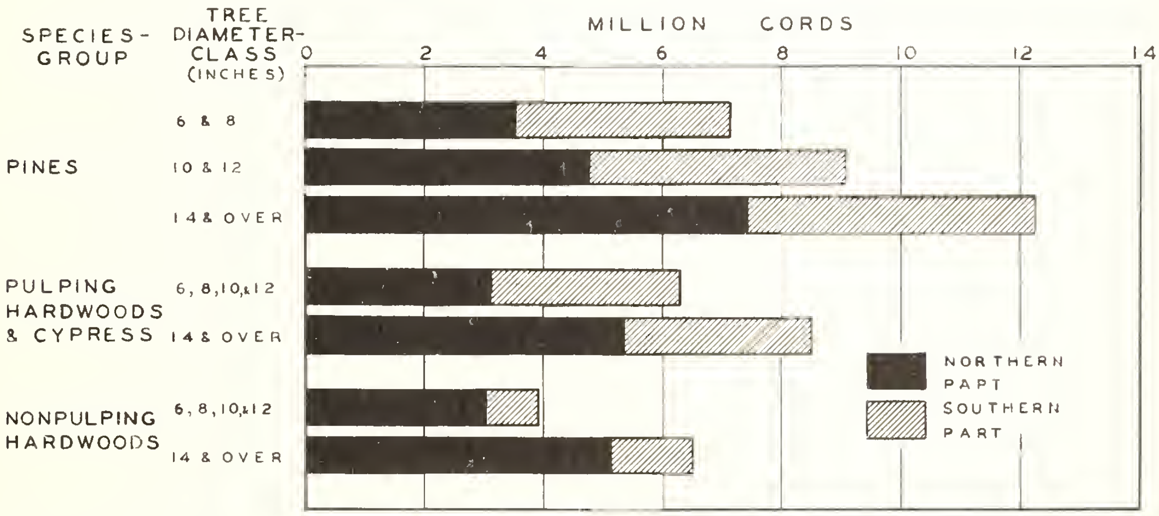


FIGURE 7- CORDWOOD VOLUMES OF PULPING AND NONPULPING SPECIES BY SIZE-CLASSES, SOUND TREES ONLY.

While the total volume of all usable material is over 64 million cords, only 48 million cords of this is in the sound-tree growing stock, because the growing stock, or the material for which increment was computed, does not include either the cull trees or the upper stems and limbs of hardwoods and cypress. Cull trees alone have a usable volume of almost 11 million cords, of which 6 million is in pulping species. The cordwood volume in cull pines alone, the main species now being cut for pulpwood, amounts to over a million cords. If this material were removed during the next 10 years, as it should be, it would take care of about half the requirements of two pulp mills 7/

7/ There is another pulp mill under construction at Mobile, but hardwoods may make up a large part of its cut.

and reduce correspondingly the drain on the growing stock during a period when such action would be most effective in building it up. In addition to the cull-tree volume, the worked-out turpentine pines contain over 700,000 cords of usable material. The removal of cull trees and trees that have been worked out for turpentine has always been a major problem for forest owners. The increasing market for pulpwood should make profitable this highly desirable stand-improvement measure.

Relative stands of growing stock per acre in cords for the various forest conditions and type-groups, computed by dividing total volumes by the corresponding areas, are usually greater in the northern than in the southern part of the area (table 11).

Table 11. - Average cordwood volumes per acre of growing stock

Location and forest type-group	Old growth		Second growth			All conditions 1/
	Uncut	Partly cut	Sawlog size: Uncut	Sawlog size: Partly cut	Under sawlog size	
	Cords (bark included)					
Southern part:2/						
Longleaf and slash pines	31.0	10.7	11.1	8.1	2.6	5.5
Loblolly and other pines	22.1	14.6	16.1	14.6	4.1	11.6
Hardwoods	20.3	14.0	12.8	12.8	2.2	8.0
Cypress	27.4	13.9	-	-	10.4	15.7
All types (weighted averages)	25.2	11.8	12.0	11.2	2.7	6.6
Northern part:						
Longleaf and slash pines	25.2	12.8	12.2	8.4	2.9	7.2
Loblolly and other pines	33.4	16.2	17.3	11.0	4.0	11.2
Hardwoods	25.7	14.2	13.2	10.6	4.1	10.3
Cypress	20.7	17.5	22.8	-	1.6	19.3
All types (weighted averages)	28.3	14.4	16.1	10.7	3.9	10.4

1/ Includes area of reproduction and clear-cut forest conditions in weighted average.
2/ For additional information, see "Volume on average acres in the principal units of the naval-stores region." Forest Survey Release #29, Southern Forest Exp. Sta., New Orleans, La., Oct. 30, 1937.

Poles and piles

The high price usually paid for poles and piles warranted special consideration of the trees that could be used for these products. It should be understood, however, that these trees were included in the saw-timber and cordwood inventories, because it is obvious that some of them will be used for lumber, pulpwood, and other products.

According to the estimate shown in table 12, which is believed to be conservative, there were in 1935 about 24 million trees suitable for poles and piles, based upon the specifications of the American Standards Association. Listed in order of occurrence were the round longleaf and slash pines, the loblolly and other pines, and the turpentined longleaf and slash pines. The last-mentioned group had scarred butts, the unusable parts of which were deducted in estimating the lengths. The southern counties included practically all of the longleaf and slash pine; the northern counties, the loblolly and other pine sticks. Approximately two-thirds of all pole and pile sticks were 20 or 25 feet long, and most of those remaining were 30 and 35 feet. Included in the column listed as "40 feet and over" are about 107,000 sticks at least 55 feet long. Approximately 59 percent of all the poles and piles are in trees 7.0 to 10.9 inches d.b.h.; 35 percent in trees 11.0 to 14.9 inches; and 6 percent in trees at least 15.0 inches, all diameters being taken outside of bark.

Table 12. - Pole and pile resources

Species-group	Length of poles and piles			Total	Portion of total
	20 and 25 feet	30 and 35 feet	40 feet and over		
	- - - - -	Thousand sticks	- - - -		Percent
Round longleaf and slash pines	7,504	2,103	659	10,266	42.2
Turpentined pines	3,429	1,485	296	5,210	21.4
Loblolly and other pines	5,237	2,445	1,155	8,837	36.4
Total	16,170	6,033	2,110	24,313	100.0
Percent of total	66.5	24.8	8.7	100.0	

Forest Increment

The net annual forest increment is the volume added by growth to the individual trees, plus the merchantable volume newly created by small trees developing into merchantable sizes during the year, and minus the losses due to natural mortality and the effect of turpentining. This net accretion of the forest represents, in a general way, the amount which forest industries could cut without depleting the total volume of the present growing stock. As previously explained, the climate in southwest Alabama is favorable for forest growth, and the sites are usually fair or good. Owing to past treatment, however, the stocking is generally poor, and, as a result, the net increment is only a fraction of what it could be under management.

In 1935, the gross growth amounted to 768 million board feet, green lumber tally (based upon the International $\frac{1}{4}$-inch rule), and the mortality was 107 million board feet, leaving a net increment (table 13) of 661 million board feet before deducting the commodity drain for the year. Over four-fifths of the increment occurred in second-growth stands, the trees of which are usually poorer for lumber production than those of the old growth.

Almost three-fourths of all the increment was pine. As the old-growth stands are disappearing, the forest industries, however, are adapting themselves to the inevitable change in the quality of their resources; an excellent example is the rapid expansion of the pulp and paper industry, for which second-growth timber is entirely satisfactory. Practically all of the longleaf and slash pine increment was in the southern portion of the area; most of the loblolly and other pine, in the northern part.

Table 13. - Net increment, 1935

Forest condition	Saw-timber material				All growing stock	
	Species-group			Total		
	Longleaf and slash pines	Loblolly and other pines	Hardwoods and cypress			
	Thousand bd.ft.,green lumber tally				Cords[1]	Thousand cu.ft.[2]
Old growth	36,500	22,700	62,000	121,200	409,200	28,760
Second growth:						
Sawlog size	86,000	211,400	79,500	376,900	1,201,700	86,520
Under sawlog size	66,400	64,400	27,600	158,400	907,600	62,880
Reproduction and clear-cut	3,400	200	500	4,100	33,800	2,320
Total all conditions	192,300	298,700	169,600	660,600	2,552,300	180,480
Total southern part	156,400	36,800	50,800	244,000	1,001,000	70,490
Total northern part	35,900	261,900	118,800	416,600	1,551,300	109,990

1/ Rough wood, including bark

2/ Inside bark.

In 1935 the net increment, before making deductions for commodity drain, amounted to about $2\frac{1}{2}$ million standard cords of rough wood (bark included), as shown in table 13. This included the growth upon the growing-stock trees 5.0 inches d.b.h. and larger, but no allowance was made for the growth of culls or for the upper stems and limbs of hardwood and cypress. Longleaf and slash pines made up 25 percent of the total net cordwood increment; loblolly and other pines, 39 percent; and hardwoods and cypress, 36 percent. It is roughly estimated that more than half the hardwood and cypress increment was in pulping hardwoods and cypress.

It may be estimated roughly that, in 1935, turpentining in the southern part of the area caused a loss in net increment of the longleaf and slash pines of approximately 75 million board feet, of which 43 million was the difference in growth between the turpentined trees and the faster growth these trees would have made if they had been left round, 28 million was the additional tree mortality caused by turpentining, and 4 million was lost in the unusable portions of turpentined butts.

The average increment per acre for 1935 in board feet, assuming that the stands were not influenced by cutting, compared very favorably with that in other parts of the South and, in general, was greater in the northern part of the area than in the southern part (table 14). For all the forest

Table 14. - Average net increment 1/ per acre, 1935

Forest condition	Saw-timber material: Species-group component: Longleaf and slash pine	Saw-timber material: Species-group component: Loblolly and other pine	Saw-timber material: Species-group component: Hardwood and cypress	Saw-timber material: Total	All growing stock 5 inches and larger
	Board feet 2/				Cords 3/
Southern part of the area					
Old growth	53	11	50	114	.42
Second growth:					
Sawlog size	112	41	24	177	.56
Under sawlog size	46	5	7	58	.33
Weighted average 4/	54	13	17	84	.34
Northern part of the area					
Old growth	17	41	84	142	.42
Second growth:					
Sawlog size	17	165	57	239	.76
Under sawlog size	9	58	20	87	.51
Weighted average 4/	13	98	44	155	.57
Southwest Alabama					
Old growth	38	24	64	126	.42
Second growth:					
Sawlog size	50	122	46	218	.69
Under sawlog size	30	29	12	71	.41
Weighted average 4/	34	54	30	118	.45

1/ Uninfluenced by cutting.

2/ Green lumber tally, based on the International ¼-inch rule.

3/ Rough wood, including bark.

4/ Includes the reproduction and clear-cut areas.

land, including reproduction and clear-cut areas, the average net increment per acre in 1935 was 118 board feet, or for all growing-stock trees 5.0 inches and larger, 0.45 cords of rough wood, including bark. The most rapid net increment (218 board feet per acre) occurred in the sawlog-size second-growth stands. Old-growth stands, uncut and partly cut conditions combined, which are usually slow growing, had an increment per acre of almost 126 board feet of saw-timber material. For the second-growth under-sawlog-size condition where only a few trees are large enough to be measured in board feet, the saw-timber increment averaged only 71 board feet per acre, but the cordwood increment, based upon all growing stock 5 inches d.b.h. and larger was 0.41 cords——almost equal to that of the old growth.

Forest Industries

Lumber industry

Lumbering, the most important wood-using industry, became active in southwest Alabama about 1870. In 1936, there were 261 sawmills, and the total lumber cut by these mills, regardless of whether the stumpage was within or without this area, amounted to nearly 467 million board feet (table 15). The total rated capacity of the mills per 10-hour day was $3\frac{1}{2}$ million board feet; and, based upon 250 working days per year, it is apparent that the sawmills had a cutting capacity almost twice their actual production. Since many of the small mills, however, are owned by farmers and are operated only during slack seasons, they seldom if ever reach a capacity cut. The average production per mill for 1936, all mills included, was 1.8 million board feet; for the large mills (i.e., those with a daily capacity of at least 40,000 board feet), 12.0 million board feet; for the medium-sized mills (20,000 to 39,000 board feet per day), 4.4 million feet; and for the small sawmills (with a daily capacity of 1,000 to 19,000 board feet per 10-hour day), 700,000 board feet. The majority of the large sawmills are in the southern part (Alabama Unit #1), while most of the medium-sized and small sawmills are in the northern part (Alabama Unit #2), as shown in figure 4. Pine made up over four-fifths of all the lumber cut, hardwoods made up most of the remainder, and only a small amount of cypress was cut.

Table 15. - Number and size of sawmills, and amount of lumber cut by species, 1936

Daily (10 hrs.) rated capacity	Number of sawmills	Lumber cut		
		Pine	Hardwood and cypress	Total
- Thousand board feet -		- - - - Thousand board feet - - - - -		
1 - 19	211	139,800	9,100	148,900
20 - 39	37	132,200	29,300	161,500
40 - 79 1/	13	116,700	39,700	156,400
Total	261	388,700	78,100	466,800

1/ Includes 2 mills with a daily capacity of at least 80 thousand board feet.

Other forest industries

While sawmills were the most numerous of all forest industries and provided by far the greatest employment, other forest industries were also important in this area (table 16). In 1936, in addition to sawmills, the well-integrated forest-products industries included about 110 gum naval stores stills, 2 pulp mills [8], 9 veneer mills, 2 wood-distillation plants, 10 cooperage plants, 2 wood-treating plants, and 21 miscellaneous mills such as shingle and bobbin mills. The two operating pulp mills used only pine, but one of the new mills is expected to use both pine and hardwood. Veneer mills making furniture and box stock were dependent upon magnolia, yellow poplar, and black, tupelo, and red gums, while the cooperage plants making slack and tight barrel stock used pines, white oaks, red oaks, and gums. As shown on the map (fig. 4), most of the nonlumber forest industries were in Alabama Unit #1, and many were in or near the city of Mobile.

Table 16. - Number of forest-products industries and man-days of employment, 1936

Industry or commodity	Number of plants	Man-days (10-hrs. each) of employment		
		Woods	Plant and office	Total
		- - - Thousand man-days - - - -		
Sawmills				
Small	211	165	319	484
Medium	37	207	321	528
Large	13	278	329	607
Total	261	650	969	1,619
Fuel wood 1/	-	1,141	-	1,141
Gum naval stores 2/	110	805	50	855
Pulpwood	2	178	252	430
Veneer	9	49	95	144
Wood distillation	2	86	23	109
Cross ties	-	74	-	74
Cooperage	10	17	18	35
Miscellaneous manufacturing	21	11	24	35
Poles and piles	-	33	-	33
Fence posts	-	28	-	28
Treating plants	2	-	21	21
Total		3,072	1,452	4,524

1/ Includes 124,000 man-days used in producing commercial fuel wood.
2/ Data as of 1934.

In 1936 all forest industries combined furnished about $4\frac{1}{2}$ million man-days of employment, of which lumber and other wood-products industries accounted for over $3\frac{1}{2}$ million, and naval stores, both gum and wood, almost 1 million. Since the harvesting, transportation, and manufacture of forest products is to a large degree a part-time occupation for the inhabitants of the area, it is

8/ Not included are a pulp mill under construction in 1937 and another one planned for 1938, both at Mobile.

difficult to translate the man-days of labor required into number of people actually employed, but it is probable that more than 50,000 men were employed in forests and mills full or part time during the year.

Commodity Drain from the Growing Stock

The total volume of wood removed from the sawlog-size trees of the growing stock of this area for use in industry and for domestic purposes in 1936 was the equivalent of 733 million board feet; or from all sound trees at least 5 inches d.b.h., about 163 million cubic feet, inside bark (table 17), or over 2 million cords of wood with the bark. This commodity drain, which should not be confused with the losses due to natural mortality, is the material removed, including (a) the material cut in the two Survey units for use in or shipment out of the area and (b) the waste incidental to the various logging operations. Material cut and utilized from the dead and cull trees is not included.

Table 17. - Commodity drain from sound trees, 1936

Commodity	Saw-timber material				Volume all material	
	Pine	Hard-wood	Cypress	Total	Rough wood	Inside bark
	- - - Thousand board feet - - - (green lumber tally)				M cords	M cu.ft.
Lumber	453,500	78,200	5,500	537,200	1,275.4	97,620
Fuel wood	51,000	33,500	-	84,500	464.9	33,200
Pulpwood	18,400	-	-	18,400	166.0	12,420
Veneer	600	29,600	-	30,200	56.3	4,340
Cross ties	13,600	9,600	1,000	24,200	60.4	4,600
Cooperage	4,500	2,700	-	7,200	20.1	1,540
Miscellaneous manufacturing	1,000	2,300	400	3,700	14.4	1,050
Poles and piles	15,500	-	600	16,100	40.0	3,070
Fence posts	-	600	100	700	11.3	780
Miscellaneous farm use	8,200	2,800	-	11,000	58.1	4,190
Total for southwest Alabama	566,300	159,300	7,600	733,200	2,166.9	162,810
Total southern part	194,700	40,500	2,400	237,600	733.8	55,400
Total northern part	371,600	118,800	5,200	495,600	1,433.1	107,410

Approximately two-thirds of the saw-timber drain of 733 million board feet came from the northern counties of this area, one-third from the five southern counties. Also of importance is the fact that the pine-tree component of the forest made up slightly more than three-fourths of the saw-timber drain. As is to be expected, the greater part of the saw-timber drain resulted from the manufacture of lumber. The cutting of fuel wood was responsible for 12 percent of the drain from saw-timber material, although it would be thriftier to take such low-priced commodities from the great supply of wood in undesirable trees now largely going to waste.

The part of the total commodity drain against the sound-tree growing stock of the forest that is drawn from nonsaw-timber material in trees under sawlog size and on upper stems of sawlog-size pine trees is not measured in board feet, and this amount is not included in the saw-timber drain discussed above. In 1936 this drain amounted to 48 million cubic feet, or the equivalent of 667,000 cords. The total commodity drain from both the saw-timber and the nonsaw-timber components of the growing stock was, as stated before, 163 million cubic feet, or the equivalent of over 2 million cords of wood with bark.

The total commodity drain for 1936 against the sound-tree growing stock is itemized in table 17 and allocated to the commodities for which the trees were cut.

Comparison of Increment and Drain

From the field inventory taken in 1934 and 1935, and from subsequent adjustments made for net increment and commodity drain, the following changes in growing stock are estimated to have taken place:

Date	Saw-timber growing-stock material: Pines	Hardwood and cypress	Total	All growing-stock material
	M board feet (green lumber tally)			M cubic feet (inside bark)
Jan. 1, 1935	8,112,000	4,041,500	12,153,500	3,453,990
Jan. 1, 1936	8,175,400	4,043,700	12,219,100	3,501,600
Jan. 1, 1937	8,095,500	4,046,700	12,142,200	3,524,110

From the figures given above, it is apparent that no important change has taken place in the forest growing stock during the 2-year period, Jan. 1, 1935 - Jan. 1, 1937; the saw-timber part has been reduced less than 0.1 percent, and the entire growing stock, including under-sawlog-size trees, has increased over 2 percent.

In 1936, the commodity drain of saw timber was nearly 77 million board feet greater than the net increment (table 18), and practically all the overcutting of this class of material occurred in the northern part of the area (fig. 8). For the pines (all pine species combined), the drain exceeded the net saw-timber increment; while for the hardwoods and cypress (combined for the entire area) the increment slightly exceeded the drain. In the old-growth stands, all species combined, the drain from saw-timber volume was nearly three times the corresponding net increment, while in the second-growth conditions there was a surplus increment of about 130 million board feet. Thus it is apparent that some of the large sawmills that now take practically all their cut from old growth may in time be forced to change to second growth. Some of the companies are anticipating this and are wisely practicing selective logging, designed to keep up the supply of high-grade material through continued growth and development of the younger trees of these stands.

Table 18. - Comparison of increment with commodity drain in board feet and cubic feet, 1936

Item	Saw- timber material: Pine	Saw- timber material: Hardwood and cypress	Saw- timber material: Total	All growing stock
	M bd. ft. (green lumber tally)			M cu.ft. (i.b.)
Growing stock, Jan. 1, 1936	8,175,400	4,043,700	12,219,100	3,501,600
Growth	563,300	200,400	763,700	216,680
Mortality	76,900	30,500	107,400	31,360
Net increment	486,400	169,900	656,300	185,320
Commodity drain	566,300	166,900	733,200	162,810
Net change in growing stock	-79,900	3,000	-76,900	22,510
Growing stock, Jan. 1, 1937	8,095,500	4,046,700	12,142,200	3,524,110

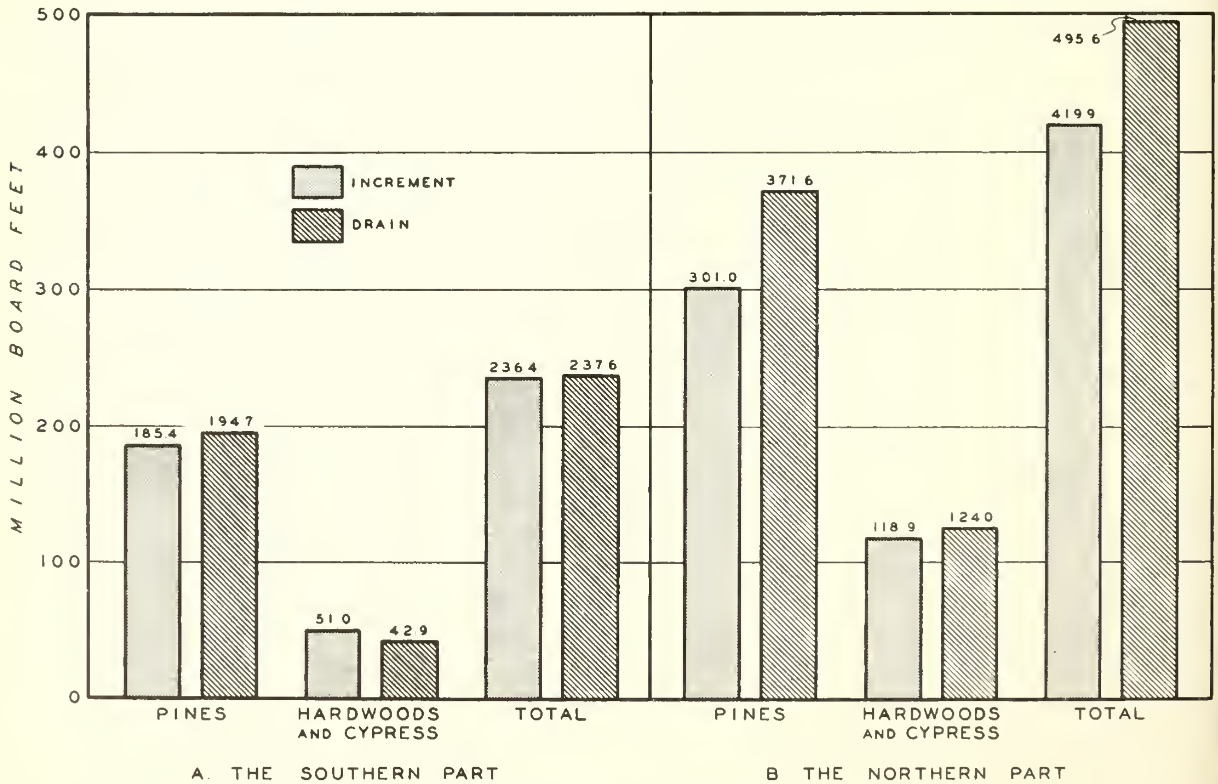


FIGURE 8 — COMPARISON OF NET INCREMENT OF SAWLOG-SIZE MATERIAL WITH THE COMMODITY DRAIN, 1936.

In spite of a mortality loss of 31 million cubic feet, the net increment in 1936 on all growing-stock trees 5.0 inches d.b.h. and larger, shown in cubic feet i.b., was almost 23 million cubic feet greater than the total commodity drain. The net increment was 30 percent greater than the commodity drain for the southern part of the area but only 5 percent greater for the northern part. It should be remembered, however, that these ratios are subject to change from year to year, and that the fluctuations are largely influenced by the demand for, and market price of, lumber and other products.

According to the best information available, the forest industries in this area operated in 1936 at a rate considerably higher than for any of the 5 preceding years. There will be a real threat to the integrity of the growing stock and to the future supply for forest industries if this already high rate of cutting is increased or continued without a corresponding increase in the forest increment. The situation demands that a strong effort be made by both public and private agencies to improve growing conditions and to augment both the quality and quantity of the forest growth.

Summary of Present Situation and Outlook for the Future

The forest in the economic picture

Southwest Alabama with more than 7 out of every 10 acres in forest is an important timber area. At the time of the survey, about one-seventh of the crop land and pasture land, or about 300,000 acres, was idle or abandoned, and it is likely that a large part of this will revert to forest growth. Forest industries create an income for payrolls, taxes, and capital profits second only to that of agriculture. About 260 sawmills, 110 turpentine stills, 2 pulp mills, 9 veneer mills, 10 cooperage plants, and other forest industries provided in 1936 about $4\frac{1}{2}$ million man-days of employment (10 hours each). The security and prosperity of these industries, of a very large proportion of the working people of the territory, and of the railroads, the port of Mobile, ship and barge lines, and other transportation facilities, depend in large measure upon the continued productivity of the forests. Furthermore, the local governments, both state and county, must continue to look to the forests of the region as a source of tax income.

Deficiencies in the present forest

The chief reason why the present forest yields are less than half of the capacity of the site is that the stocking (i.e., the number of desirable trees per acre) is less than half of what it should be. A half-stocked forest is similar to a field of corn with alternate rows missing. In addition to being lightly stocked, many of the trees are culls; fires have often been carelessly or purposely set and allowed to spread in the stands, with the result that many of the small trees needed to restock the area have been killed, and a large proportion of the survivors have been damaged so badly as to restrict their use for all except the very lowest class of commodities. Also many forest owners have reduced both the quality and quantity of their growing stock by severe turpentining, by continually overdrawing on the productive capacity of their stands, and by cutting the best and leaving the worst.

Measures for improvement

With fire protection, abundant natural reforestation generally can be expected within a short time in most of the poorly stocked stands. Organized fire protection should be extended to every forest holding in the area and should be made more effective not only through increased detection and suppression facilities but also through intensive education among landowners of all classes and the public generally concerning the need for fire protection. The funds available under the Clark-McNary Act should be greatly increased in order to put this all-important work upon an effective, state-wide basis.

Artificial reforestation may be necessary to restore quickly some of the clear-cut lands to a high degree of forest productivity, but the adoption of selective-logging practices or the systematic leaving of adequate seed trees, with protection from fire, usually will make artificial reforestation on recently logged areas unnecessary.

Non-conservative measures of turpenting, such as deep-chipping, over-cupping, and working small trees, in the long run have proved unprofitable to the landowner and operator alike and have deteriorated many of the longleaf and slash pine stands. Some of the operators are changing to more conservative practices, and a more widespread adoption of better methods will do much to check the retarded tree growth and the increased mortality caused by turpentining, and will make possible greater yields of both gum and wood products.

The presence in the stands of cull trees and worked-out turpentine trees is retarding both the growth and restocking on a large part of the area. These two classes of undesirable trees, which together contain over 11 million cords of sound material, should be cut wherever possible, and utilized for lumber, poles, pulpwood, firewood, or other products. Their removal and utilization not only will supplement the current wood supply and encourage faster growth of the remaining trees, but also will leave space for oncoming crops of new trees of good quality. Closer utilization in cutting for forest products should be practiced, since with the expanding markets for pulpwood, much of the waste now left in the woods to rot could be consumed profitably.

An integration of the demands of the various forest-products industries is obviously a prerequisite for close and profitable utilization. Industries cutting lumber, poles, piles, and veneer depend upon high-quality stumpage and, in their own interest, landowners and timber users should use great discrimination in the use of forest products and should sell only low-quality material for pulpwood, fuel wood, and similar products. Similarly the pulpwood, cross-tie, and other industries dependent upon relatively low-grade material in order to avoid direct competition with other industries and thus keep costs of their supply at a low figure, should meet their needs as much as possible from culls, worked-out turpentine trees, and other trees and parts not suitable for higher-priced products. Landowners will profit by recognizing quality grades in their trees and by selling their material for the commodities paying the highest price.

To get these essential forest-improvement measures put into practice on a large scale, an intensive and expanded program of forestry education and cooperation is essential. Almost all of the forest acreage is in private holdings, most of which are small. For the owners of small tracts, greatly expanded forestry extension work along the lines of the present agricultural educational activities under the Smith-Lever Act seems the best method of approach. Personal contacts, demonstration areas, sample marking, elementary forestry courses in the schools, etc., will build up an appreciation of good forestry and its possibilities, as well as train individuals in the latest methods of fire protection, planting, thinning, selective logging, and other phases of forest management.

In summing up the forest-ownership situation, it is recalled that only 3 percent of the forest land is in public ownership; 25 percent is in farm woodlands; and 72 percent is in privately owned industrial forests (i.e., owned by sawmills, pulp mills, etc.) or in investment forests. A study of the forest practices on privately owned non-farm forest land recently made by the Division of State and Private Forestry of Region 8 of the Forest Service discloses that for 123 known properties (which in the aggregate cover 2,462,000 acres) approximately 68 percent of the forest land is "handled under good forestry practices for continuous forest crops"; 24 percent under practices that are "poor" but that leave the land productive; and only 8 percent is in "lands not left productive".

Although the present forest increment generally does not warrant an expansion in utilization, additional industries are needed for the full economic development of this area. The people need the payrolls which would come with expanded industry, for the unemployment census taken Nov. 16-20, 1937, classes about 24,000 people in this area as unemployed and wanting work. A new pulp mill is under construction, and the site has been purchased for still another. Recent developments in the use of southern tree species for paper, rayon, and other products have given added value to the forests of southwest Alabama. If the growing stock is to be maintained, however, only the net increment can be cut and, using 1936 as a basis, it is seen that the forest increment approximately balances the commodity drain. The only way, therefore, to supply permanently the needs of an expanded forest industrial structure is by increasing the net increment. By fire protection, planting, stand-improvement cuttings, better utilization, and the adoption of more conservative methods of turpentining and logging, this should not be difficult to do; and since the stands respond readily to improvement under forest management, there is thus a real opportunity to build up the poorly-stocked forest so that it will produce possibly twice its present yields.

FOREST SURVEY RELEASE NO. 36 OCTOBER 3, 1938

FOREST RESOURCES

of the

OUACHITA MOUNTAIN REGION OF ARKANSAS

A Progress Report

by

THE SOUTHERN FOREST SURVEY

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FOREWORD

The nation-wide Forest Survey, being made by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is : (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies can be formulated for the effective use of land suitable for forest production.

This release is based on a field survey made April 25, 1936, to June 13, 1936, and on a field canvass of forest industrial plants to determine forest drain, which was completed during March, 1937. It should be regarded only as a progress report since it contains Forest Survey data that will be included in complete reports to be published later, and that, although considered reliable, are subject to correction or amplification as the work of computation proceeds. Item 4 above, which is being studied on a national basis, is not discussed in this report.

In the presentation of these survey data, it is to be noted that owing to the sampling method used in collecting them, the greater the number of samples in any given classification the more accurate are the data for that classification. Hence classes that are of infrequent occurrence and relatively small in quantity generally cannot be determined with as high a degree of accuracy as classes that occur more frequently and in substantially greater quantities. Small tabular items are to be taken as showing, not the exact magnitude of the classes involved, but their relative magnitude in comparison with those of other classes.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

Staff Assignment

In Charge of Field Work and Preparation of Report
James W. Cruikshank - Associate Forest Economist

In Charge of Computations
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Note: The Southern Forest Experiment Station hereby wishes to acknowledge the clerical assistance received from the Works Progress Administration in the preparation of this Release.

FOREST RESOURCES OF THE OUACHITA MOUNTAIN REGION OF ARKANSAS

General Description of the Unit

The Ouachita Mountain region of Arkansas is a rugged, timbered area extending fanwise from Little Rock westward to the Oklahoma state line. The Arkansas River forms the northern boundary, and the southernmost ridges of the Ouachita Mountains approximate the southern limits of the area (map, fig. 3). It includes all of 9 counties and part of 3 others, totaling 4,917,700 acres. All but a very small portion of the Ouachita National Forest within the State of Arkansas is included in this unit. The cities of Little Rock and Fort Smith, both on the Arkansas River, are important industrially, while Hot Springs is widely known as a health resort.

Omitting Pulaski County, in which Little Rock is located and where the population is largely urban, agriculture furnished employment to about 42 percent of those working in 1930. Although a large proportion of the population was engaged in farming, a majority of the farmers drew a part of their support from forests and forest activities. About 500 families were partly dependent upon the National Forest for support in 1936. The Survey (made in 1936) found that 69 percent of the unit area was forest land, 16 percent was in cultivation, and that over much of the area farms and forests bear an intimate relation to each other.

Topographically, the area includes a part of the Arkansas Valley and the Ouachita Mountains, which together make up the Ouachita Province of the Interior Highlands of Arkansas. The portion of the Arkansas Valley lying within the unit is about 35 miles wide at Fort Smith but gradually becomes narrower, until at the northeast corner of Perry County the Arkansas River cuts through the hills to Little Rock and the Mississippi Delta. The Valley is a rolling plain, 300 to 600 feet above sea level, broken by several ridges and broad-topped mountains; Magazine Mountain, the highest in the State, rises as high as 2,823 feet. The Ouachita Mountains are made up of numerous ridges, most of which run in an east-west direction. Near Little Rock the ridges lack uniform direction and have elevations of only 500 to 700 feet above sea level, but progressing westward the ridges and mountains become higher; Rich Mountain achieves an elevation of about 2,900 feet just across the line in Oklahoma. The area is drained by the Arkansas, Ouachita, Saline, Petit Jean, Fourche La Fave, and Little Missouri Rivers, all of which flow southward or eastward. Stream flow is erratic and rapid runoff from the uplands cause local flood problems of considerable magnitude.

Four main-line railroad systems serve the unit, and are located chiefly along the boundaries. The interior of the unit is served only by branches of these main lines, supplemented by a few local railroads originally constructed for transporting forest products. Owing to the character of the terrain, the lack of diversified industrial development, the scarcity of the population, and the large area in National Forest, in the future the railroad mileage probably will decrease rather than increase. Except on the Ouachita National Forest, highway development is limited to a few through routes not all of which are paved. On the National Forest, many roads constructed by the Civilian Conservation Corps have opened up numerous forest areas hitherto difficult of access. The Corps of Engineers defines as navigable streams in the unit, the Arkansas, 25 miles of the Petit Jean, and 27 miles of the Fourche La Fave, but much expensive channel improvement will be required to make these year-round waterways.

In 1930 the human population was about 315,000, nearly half of whom lived in the three largest cities of the unit: Little Rock, Fort Smith, and Hot Springs. Since 1910 these cities have had a steady growth, while the rural areas have been decreasing in population. Between 1920 and 1930 there was a population decrease of 3 to 22 percent in all counties in the unit except Pulaski and Garland. During the same period Pulaski County had an increase of over 25 percent, while Garland County, in which Hot Springs is located, had an increase of 40 percent. For the unit as a whole, 35 percent of the population is rural; 20 percent lives in towns of less than 2,500 and 45 percent in cities.

According to the Census of 1935 there were 24,900[1/] farms in the unit. These farms contained 1,870,000 acres, of which 40 percent were in woods. The average farm contained 75 acres, with 29.5 acres in cropland, 29.8 acres in woodland, 11.3 acres in open pasture, and 4.4 in miscellaneous uses. Number of farms and total land in farms increased slightly between 1930 and 1935, although land available for crops decreased. General farming is practiced, with cotton, corn, live stock, fruit, and truck crops produced in every county. Appreciable quantities of Irish potatoes are grown for market in Sebastian and Logan Counties, while Sebastian, Pulaski, and Scott Counties produce large quantities of strawberries.

The largest area of land in single ownership is the Ouachita National Forest, where 1,035,830 acres were under Federal Forest Service administration on June 30, 1937. National and State Parks contain 8,600 acres. The Farm Security Administration owned about 130,000 acres near Magazine Mountain in 1938, but steps are being taken to transfer this land to the Forest Service. Farm lands amounted to about 1,870,000 acres in 1935. Of the 24,900 individual farms, 53 percent were operated by their owners, 36 percent by tenants, and 11 percent by sharecroppers. At the present time there are only three large lumber companies operating in this area, and at least two of these own extensive acreages of timber land.

Tax delinquency is somewhat greater here than in the more productive Coastal Plain Counties to the south. Land in tax default for 3 or more years and forfeited to the State amounted to about 5 percent of the gross land area on Jan. 1, 1934.

Table 1 shows that nearly 70 percent of the land area of the unit is used for timber production. It is probable that the idle and abandoned farm land, totaling over 6 percent of the area, will also revert to forest land unless the demand for agricultural products increases greatly.

1/ Includes all the farms in Pulaski County, and excludes all those in Franklin and Conway Counties.

Table 1. - Land area classified according to land use

Land	Area	Proportion of total area
	- - - - Acres - - - -	- - - Percent - - -
Forest:		
Productive	3,376,900	68.7
Nonproductive	1,600	negl.
Total forest	3,378,500	68.7
Nonforest:		
Agricultural:		
In cultivation:		
Old cropland	778,400	15.8
New cropland	24,000	0.5
Out of cultivation:1/		
Idle	196,600	4.0
Abandoned	113,500	2.3
Pasture	253,400	5.2
Total agriculture	1,365,900	27.8
Other nonforest	173,300	3.5
Total nonforest areas	1,539,200	31.3
Total forest and nonforest	4,917,700	100.0

1/ Potential forest land.

Description of the Forest

Shortleaf pine is the predominant species in the forest, generally occurring in pure stands on the lower slopes of the east-and-west ridges. On the upper elevations of these slopes, and in the narrow valleys, the pines are mixed with various hardwoods, of which the white oak is the most valuable. Pure stands of upland hardwoods, made up of such species as red oak, white oak, hickory, and red gum, are found throughout the unit but occupy most extensive areas in Sebastian, Franklin, Logan, and Yell Counties (fig. 3). In the river bottoms, which have a relatively small acreage, red gum is the most abundant species, although water oak, white oak, ash, and hickory are common.

Since a large proportion of the land area is forested, timber stands are found in all of the topographic situations represented in the unit. It is common practice, however, to cultivate the more fertile stream bottoms and the abutting gentle slopes, leaving the rocky ridges with their thin soils and steep slopes in forests, so that the amount of forest land in the valleys is relatively low. Table 2 gives the acreage of the four type-groups and their occurrence by topographic situation.

Table 2. - Forest area classified according to forest type-group and topographic situation

Forest type-group	Slope: 10 percent or less	Slope: More than 10 percent: North	Slope: More than 10 percent: South	River bottom	Total	Proportion of total
	Acres					Percent
Pine	520,300	489,100	549,100	4,800	1,563,300	46.3
Pine-hardwood	285,300	275,800	235,800	6,400	803,300	23.8
Upland hardwood	382,900	326,100	192,600	-	901,600	26.7
Bottomland hardwood	-	-	-	108,700	108,700	3.2
Total all types	1,188,500	1,091,000	977,500	119,900	3,376,900	100.0
Percent of total forest area	35.2	32.3	28.9	3.6	100.0	

Shortleaf pine is the dominant species in the pine type-group, but small quantities of loblolly are present in the extreme southern part of the unit where the location is low and moist enough to favor its development. Almost one-third of the pine type-group acreage is stocked with stands of old-growth timber and about half with second-growth sawlog-size stands (table 3). In the pine-hardwood type-group, shortleaf is also the leading pine species, while forked-leaf white oak and post oak are the most common hardwoods. In this type-group, sawlog-size stands are found on 46 percent of the type-group area, while 54 percent is stocked with young stands not yet of saw-timber size. Only 14 percent of this area is in old-growth stands.

The upland hardwood type-group has nearly three-fourths of its area stocked with stands which are at present below saw-timber size. Some of these are located at the higher elevations along the ridge tops, and because soil and climatic conditions are unfavorable to rapid growth they may remain below sawlog size for many years; less than one-fifth of the type-group area is occupied by stands classified as old growth. The bottom-land hardwood type-group is limited to slightly over 100,000 acres; 21 percent of this acreage supports old growth stands, 28 percent second-growth sawlog-size stands, and 51 percent stands below sawlog size.

Table 3. - Forest area classified according to forest condition and forest type-group

Forest condition	Pine	Pine-hardwood	Upland hardwood	Bottom-land hardwood	Total all types	Proportion of total
	Acres					Percent
Old growth:						
Uncut	371,600	66,300	89,600	8,800	536,300	15.9
Partly cut	86,300	49,600	66,300	13,600	215,800	6.4
Total	457,900	115,900	155,900	22,400	752,100	22.3
Second growth:						
Sawlog size:						
Uncut	597,800	171,100	64,700	17,600	851,200	25.2
Partly cut	215,000	81,500	38,400	12,800	347,700	10.3
Under sawlog size	281,400	430,800	600,200	52,800	1,365,200	40.4
Reproduction	6,400	3,200	42,400	3,100	55,100	1.6
Total	1,100,600	686,600	745,700	86,300	2,619,200	77.5
Clear-cut	4,800	800	-	-	5,600	.2
Total all conditions	1,563,300	803,300	901,600	108,700	3,376,900	100.0
Percent of total forest area	46.3	23.8	26.7	3.2	100.0	

The species composition of the four type-groups shown in table 3 is graphically presented in figure 1, where the net cubic volumes of each of the four species groups — (1) pines, including a negligible quantity of cedar, (2) gums and other pulping hardwoods, (3) oaks, including scrub oak, and (4) hickory and other nonpulping species —— are expressed as a percentage of the total net cubic volume in the individual type-group. The pine component of the pine type-group makes up nearly 89 percent of the type-group volume, and most of this is shortleaf pine. In the pine-hardwood type-group, over half the cubic volume is shortleaf pine with forked-leaf white oak the most conspicuous hardwood. The most abundant species in the upland hardwood type-group are the oaks, in which red, forked-leaf white, and post oaks occur in descending order, with hickory next in abundance. Red gum and water oaks are the most common species in the bottom-land hardwood type-group.

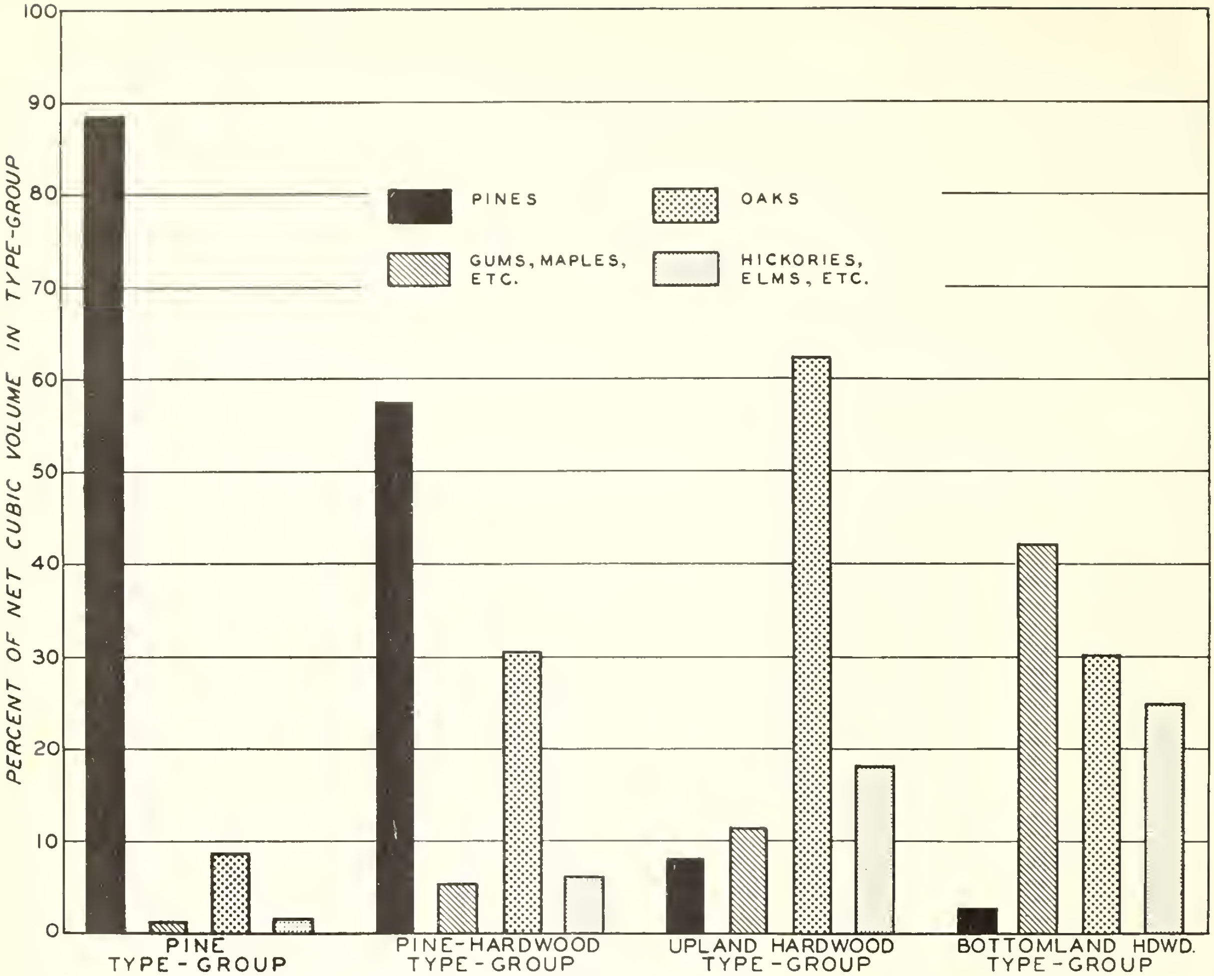

FIGURE 1 – SPECIES COMPOSITION OF FOREST TYPE-GROUPS.

In figure 2 the age-class and volume distribution on the present pine and pine-hardwood forest area is compared with that of a hypothetical managed forest of the same general type handled on a rotation of 80 years. A rotation of this length should produce saw timber, poles, piles, and pulpwood in the mountainous Ouachita region, where growth is somewhat slower than in the Coastal Plains to the south. As shown in the figure, the managed forest is divided into 8 equal areas, each containing one 10-year age-class. The per-acre volumes are based upon the present best stocked 10 percent of the uncut forest stands of weighted average site in the pine and pine-hardwood types. The portion of the figure showing the prevailing age-classes and volumes represents a rough division of the 2,366,600 acres in the present forest into areas characterized by the dominance of certain age-classes, on the basis of their occurrence in the present forest. The volume per acre shown for a specific age-class is the average of all the stands, good and poor, in that class.

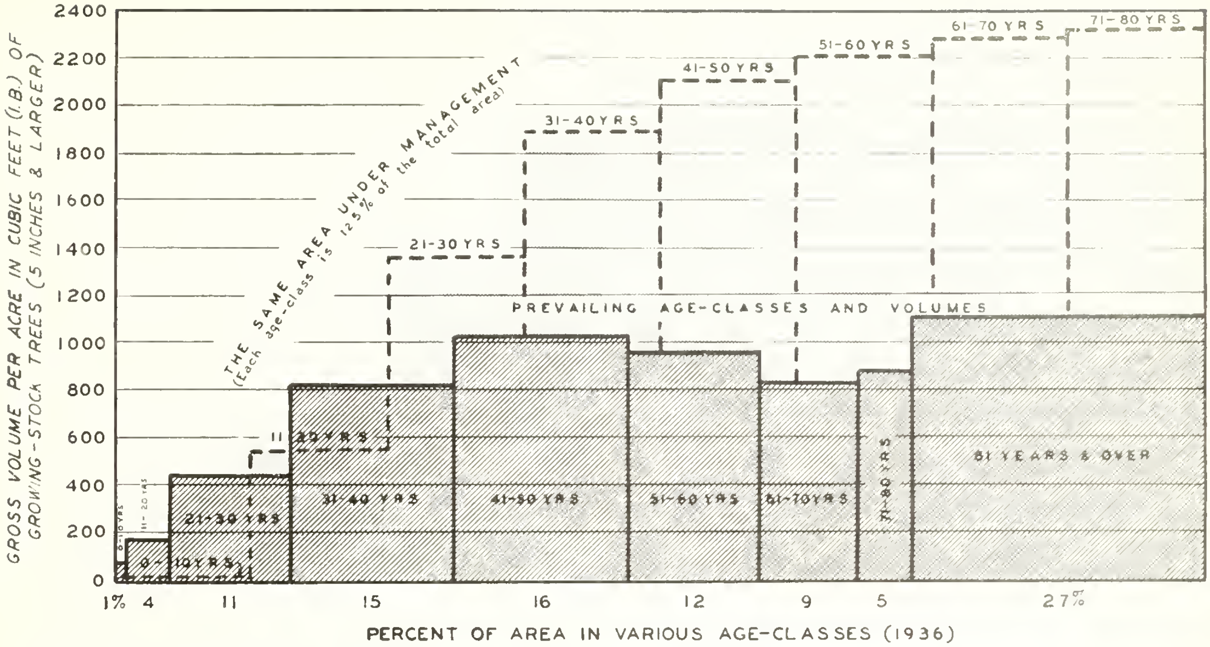

FIGURE 2 - **PREVAILING AGE-CLASS AND VOLUME DISTRIBUTION COMPARED WITH THAT ON THE SAME AREA UNDER MANAGEMENT** (BASED ON PINE AND PINE-HARDWOOD TYPE-AREA OF 2,366,600 ACRES).

A study of figure 2 brings out the following points concerning the present pine and pine-hardwood forest: (1) It is deficient in stocking, in that it contains only 55 percent of the volume shown in the managed stand; (2) the distribution of age-classes by area is irregular, in that the area in the youngest age-class is only one-twelfth of what it should be, while the area in the 80-year-and-over age-class is not needed for an 80-year rotation; (3) the areas in the five age-classes between 21 and 70 years closely approximate those of the managed forest. Theoretically, an approach to the ideal distribution by area of the age-classes might be achieved gradually through cutting half the area in the oldest age-class in the next 10 years, and converting these areas into the young age-classes needed at the other end of the rotation.

Volume Estimates

Board-foot volume

The estimate of the volume in sound saw-timber trees is given in table 4, expressed in terms of board feet, as measured by the Doyle log rule. Hardwoods included in this estimate were at least 13.0 inches in diameter at breast height (d.b.h.) outside bark, and pines 9.0 inches; and all trees contained at least one 12-foot butt log, or had 50 percent of their gross volume in sound material. Top diameters varied with the limits of usable material, but no hardwood logs less than 8.5 inches in diameter at the small end nor any pine logs less than 5.5 inches were included. Deductions were made for woods cull, such as rot, fire-scar, crook, limbiness, and similar defects, as well as for loss in sawing at the mill due to sweep and hidden defects, so that the volumes given here may be considered net log scale.

The total volume of 4,201,300,000 board feet is shown by species-group and forest condition in table 4. Eighty percent of the total volume is pine, over half of which is in old-growth stands. In the hardwoods also, over half the volume is in old-growth stands, with white and red oaks the leading species. Although not shown in table 4, it is interesting to know that two-thirds of the pine volume is in trees 13.0 inches d.b.h. or over. It is impossible to say definitely how much of the total board-foot volume can be considered available for utilization at the present time, as the mountainous topography and scarcity of transportation facilities make logging difficult in certain areas. In the Ouachita National Forest, which includes about 30 percent of the forest land in the unit, the management policy requires the distribution of the cutting of the existing saw-timber volume over a long period of time; consequently, only a part of the area and volume can be depended upon to supply the immediate needs of the existing industries. In the next 10 years, probably not more than 350 million board feet of Forest Service timber will be cut. This will be replaced by an equal or greater amount through the increment of the reserved growing stock left on the areas cut over, and will be supplemented by the increment accumulating on areas now classed as inoperable because of thin stands or temporary inaccessibility.

Although the Doyle rule is the legal rule of Arkansas, a more correct measure of the actual recoverable volume is obtained with the International $\frac{1}{4}$-inch rule, which, as used in this report, is the equivalent of green lumber tally. According to table 5, the volume is nearly 7 billion board feet when measured by this rule, an over-run of 65 percent above the Doyle scale.

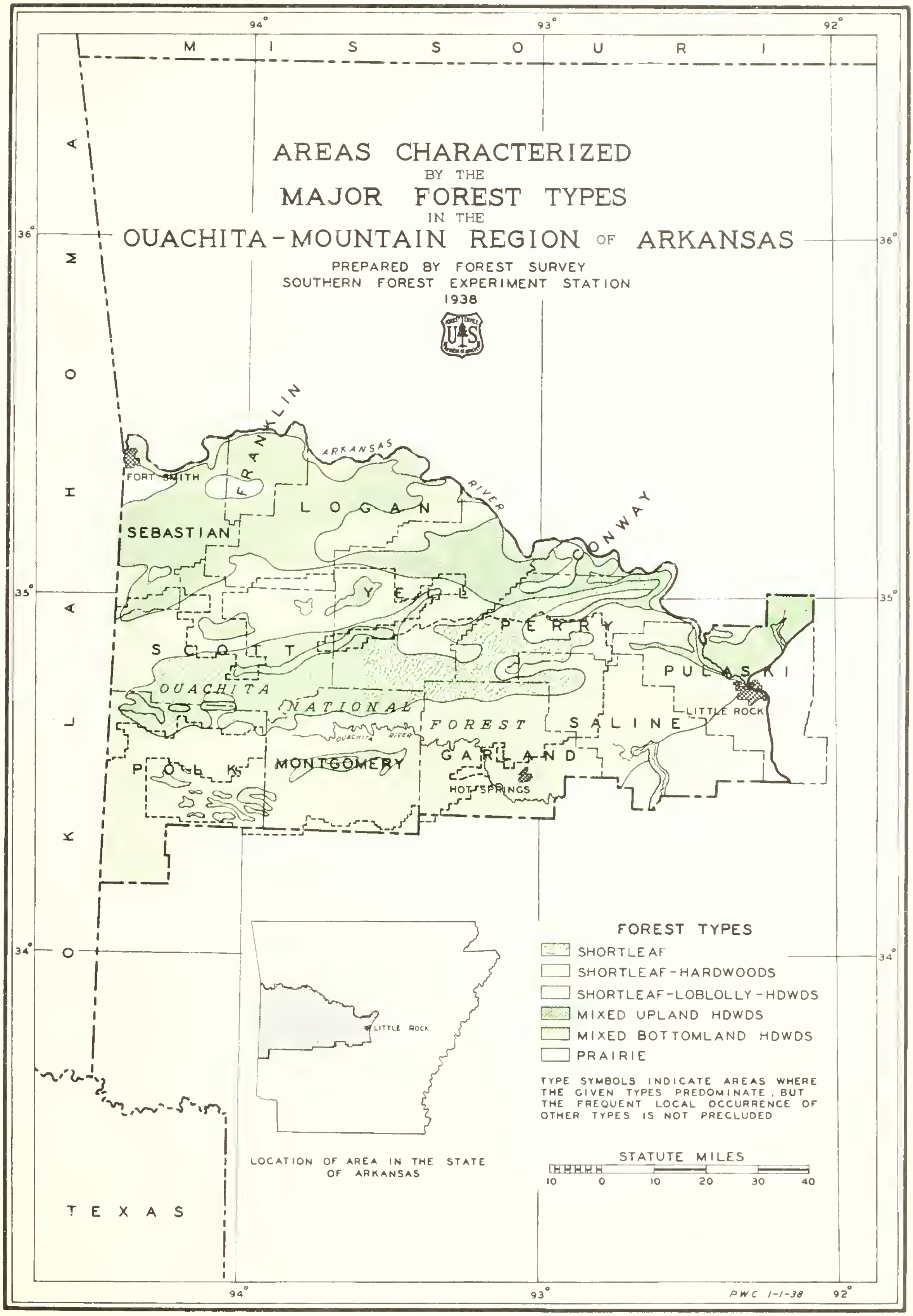

FIGURE 3 - FOREST TYPE MAP.

Table 4. - Net volume (Doyle) classified according to species-group and forest condition

Species-group	Old growth		Second growth		Total	Proportion of total
	Uncut	Partly cut	Sawlog size	Under sawlog size 1/		
	Thousand board feet					Percent
Pines:						
Shortleaf	1,576,400	232,300	1,265,100	96,800	3,170,600	75.5
Loblolly 2/	1,700	900	198,800	2,600	204,000	4.8
Total pines	1,578,100	233,200	1,463,900	99,400	3,374,600	80.3
Pulping hardwoods:						
Red gum	14,400	23,600	56,400	3,800	98,200	2.3
Black and tupelo gums	14,200	9,000	18,100	6,000	47,300	1.1
Other	5,300	9,200	4,800	900	20,200	.5
Nonpulping hardwoods: 3/						
Red oaks	63,400	43,700	82,000	22,000	211,100	5.1
White oaks	93,300	37,200	50,500	32,800	213,800	5.1
Post oaks	31,400	33,000	44,600	30,700	139,700	3.3
Hickories	13,600	9,600	14,500	7,800	45,500	1.1
Others	13,200	7,800	23,300	6,600	50,900	1.2
Total hardwoods	248,800	173,100	294,200	110,600	826,700	19.7
Total all species	1,826,900	406,300	1,758,100	210,000	4,201,300	100.0
Percent of total	43.5	9.7	41.8	5.0	100.0	

1/ Includes 2.5 million feet on areas classified as reproduction and clear-cut.
2/ Includes 1.7 million board feet of cedar.
3/ Species not commercially pulped at present, although certain species have been used experimentally.

The old-growth stands occupy only 22 percent of the forest area, but they contain 46 percent of the board-foot volume shown in table 5. Of this volume in old-growth timber, amounting to nearly 3¼ billion board feet, 82 percent is pine, 3 percent is red and black gum, and 15 percent is oak, hickory, and other miscellaneous species. Analyzing the volume per acre by type-groups, it is found that in the old-growth uncut condition, the pure pine type-group averages 5,820 board feet per acre, the pine-hardwoods average 3,380, the upland hardwoods 2,060, and the bottom-land hardwoods 5,150 board feet, lumber tally.

Table 5. - Net volume, lumber tally, classified according to species-group and forest condition (based on International $\frac{1}{4}$-inch rule)

Forest condition	Pines	Red and black gums etc.	Red and white oaks etc.	Total
		Thousand board feet		
Old growth:				
Uncut	2,275,500	46,300	294,700	2,616,500
Partly cut	358,600	57,300	178,700	594,600
Second growth:				
Sawlog size	2,900,700	120,100	315,100	3,335,900
Under sawlog size 1/	221,700	16,900	149,400	388,000
Total all conditions	5,756,500	240,600	937,900	6,935,000

1/ Includes areas classified as reproduction and clear-cut.

Second-growth stands occur on 78 percent of the forest area and contain 54 percent of the board-foot volume, amounting to 3-3/4 billion board feet, lumber tally. About 84 percent of this volume is pine, 4 percent red and black gums, and 12 percent oaks and other hardwood species. Average stands per acre are considerably lower than in the old-growth condition; for example, in the uncut second-growth sawlog-size stands of the pure pine type-group, the average volume per acre is 3,530 board feet, in the pine-hardwoods it is 2,170 board feet, in the upland hardwoods 1,460, and in the bottom-land hardwoods 2,260. The uncut second-growth stands thus have 29 percent (in the upland hardwoods) to 56 percent (in the bottom-land hardwoods) less volume per acre than the old-growth stands. Although the second-growth stands have a smaller volume per acre, the proportions of the species represented are very similar to those in the old-growth stands.

Figure 4 presents graphically the frequency of occurrence of various volumes per acre, based on stands in the sawlog-size conditions in the pine and pine-hardwood types. Gross volumes used are measured by the International $\frac{1}{4}$-inch rule. The two volume-per-acre classes stocked with less than 2,000 board feet per acre are weak statistically when considered separately, but when combined they are a reliable basis for the statement that 30 percent of the area contains less than 2,000 feet per acre and has 10 percent of the volume; the more heavily stocked stands on the remaining area (70 percent) contain 90 percent of the volume. It is significant that more than half the total volume is found in stands of at least 5,000 board feet per acre, occurring on about one-fourth of the forest area.

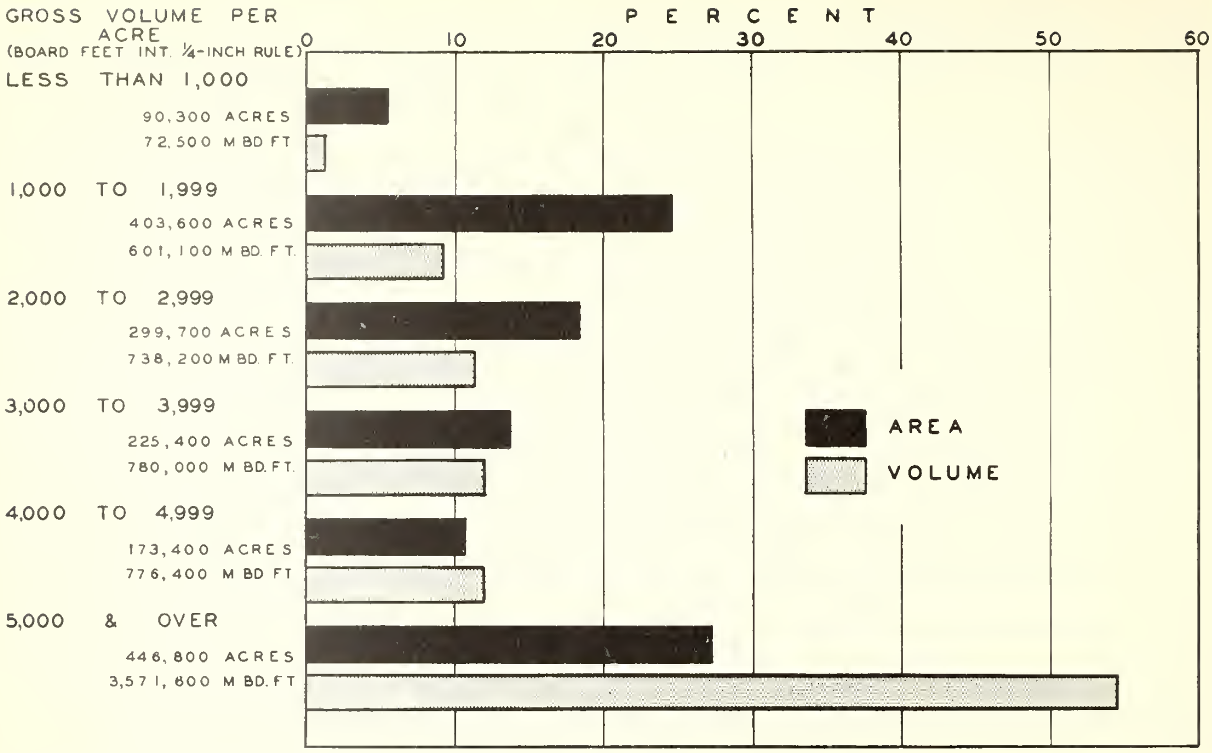

FIGURE 4 — PROPORTIONAL AREA AND VOLUME OF THE SAWLOG-SIZE CONDITIONS IN THE PINE AND PINE-HARDWOOD TYPES, CLASSIFIED ACCORDING TO VOLUME OF SAW TIMBER PER ACRE.

Cordwood volume

The estimate of cordwood volume, as shown in table 6, includes the entire stand of sound trees at least 5.0 inches d.b.h., outside bark, and in addition the net sound volume in cull trees 5.0 inches d.b.h. or larger. These volumes are expressed in terms of standard cords (4 x 4 x 8 feet), containing 90 cubic feet of wood and bark in the case of pine and cypress, and 80 cubic feet in that of hardwoods. The volume shown in table 6 under "sound trees sawlog size" includes only the merchantable sawlog portion of saw-timber trees, while the remaining portion of the stem (i.e., the upper stem) taken to a variable diameter, but not less than 4 inches, is given under "upper stems of sawlog-size trees." In pines the "upper stems" include only the stem, but in the hardwoods the usable limbs to a 4-inch minimum diameter are also included. "Sound trees under sawlog-size" include no limbs but do include the full stems of both pines and hardwoods to a variable usable top-diameter (not less than 4.0 inches). The volume shown under "cull trees" is the estimated sound usable portion in their stems. Deduction from the volume of all trees is made for woods cull, such as rot, fire-scar, crook, bad knots, and other defects. Although the volume shown for "upper stems" and cull trees is not being generally used, it is a potential source of supply.

In table 6 the total volume of sound material amounts to nearly 22 million cords of pine, 2-2/3 million cords of pulping hardwoods, and about 14 million cords of nonpulping hardwoods. In the pines, 58 percent of the material is in the merchantable portion of saw-timber trees, 7 percent in the upper stems of these same trees, 33 percent in trees below sawlog size, and 2 percent in the sound portion of the sound and rotten cull trees. In the hardwoods considered suitable for commercial pulping, it is noteworthy that 31 percent of the sound material is found in cull trees. The volume of the nonpulping hardwoods expressed in cords is largely found in sound trees below sawlog size (37 percent) and in the sound portions of the cull trees (34 percent).

Table 6. - Net volume in various classes of sound material, expressed in cords of rough wood

Species-group	Sound trees sawlog size	Upper stems of sawlog-size trees	Sound trees under sawlog size	Cull trees	Total all classes	Proportion of total
	Cords					Percent
Pines	12,680,600	1,481,100	7,343,100	330,500	21,835,300	58.6
Hardwoods:						
Pulping	609,300	319,200	879,100	811,200	2,618,800	6.8
Nonpulping	2,634,100	1,492,000	5,207,800	4,769,200	14,103,100	36.6
Total hdwds.	3,243,400	1,811,200	6,086,900	5,580,400	16,721,900	43.4
Total all species	15,924,000	3,292,300	13,430,000	5,910,900	38,557,200	100.0
Percent of total	41.3	8.5	34.8	15.4	100.0	

Although the total volume for all species given in table 6 includes the saw-timber portion of sawlog-size trees, amounting to 41 percent of the total cordwood volume, it is not likely that any large amount of this saw-timber material will be utilized as pulpwood. At the present time there are no pulp mills within the unit. The nearest mill is located at Camden, 65 miles south of the unit. Should a demand for pulpwood develop, it would be sound policy to limit cutting in saw-timber stands to those trees which are of slow growth and of poor form and quality, reserving the better individuals for saw timber, poles, or other products more valuable than pulpwood.

The total supply of material on hand, over $38\frac{1}{2}$ million cords, seems at first appraisal to be sufficient to meet the needs of present industrial establishments and provide for new requirements, but it must be remembered that only the increment on forest growing stock is the correct long-time basis for industrial development. Then, too, present industrial installations have a considerably greater combined capacity than their present cut and may need any apparent surplus of material now existing.

The net volume of sound trees measured in cords is shown in figure 5, classified according to species-group and diameter-class. This sound volume includes the full stems of pines and hardwoods under sawlog size but at least 5.0 inches d.b.h., the full stems of merchantable pines to a minimum variable 4-inch top, and the saw-timber portion of sawlog-size hardwoods. The volume in cull trees, scrub oaks, and tops and limbs of merchantable hardwoods is not included.

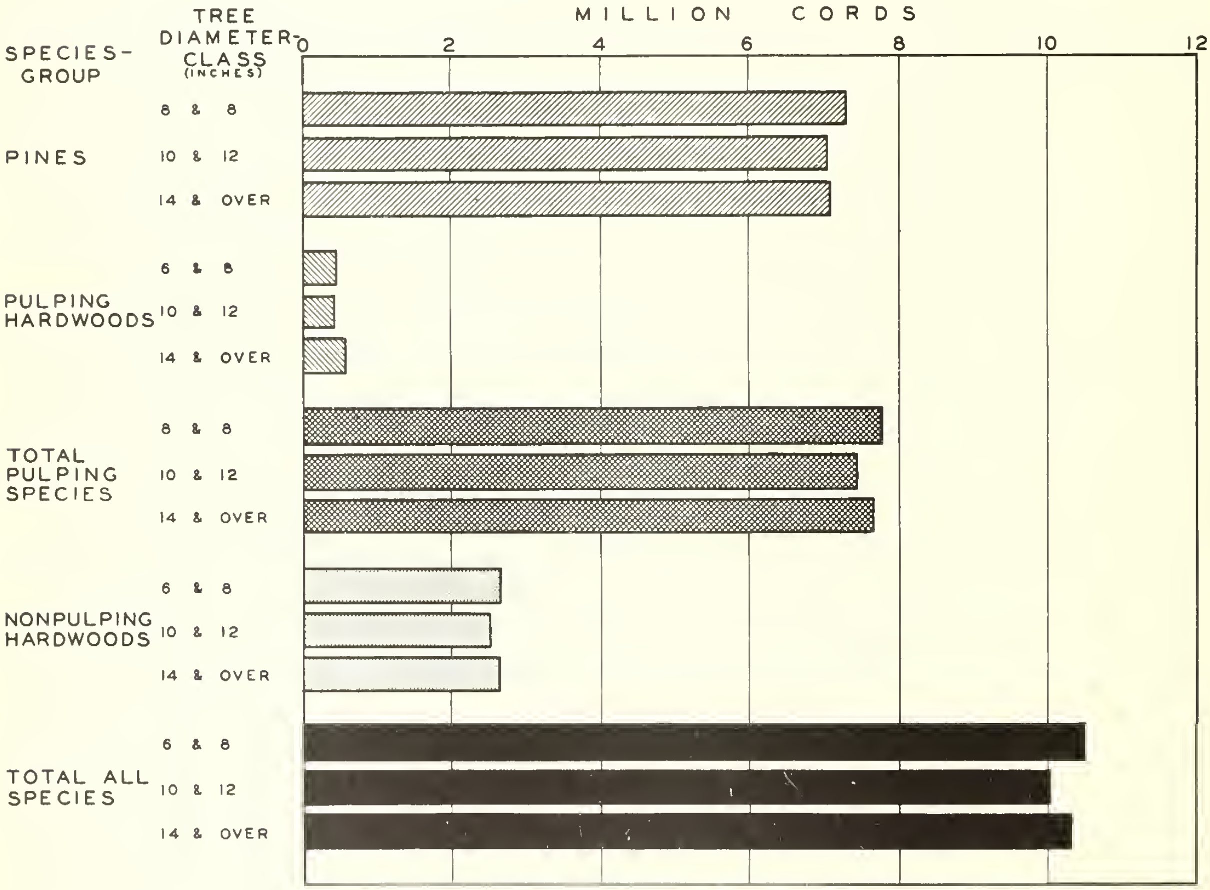

FIGURE 5— CORDWOOD VOLUMES OF PULPING AND NONPULPING SPECIES.

Pine poles and piles

The statistics relating to the supply of timber for pine poles and piles have already been presented in some detail[1/], but the following table summarizes the available information on this question.

Table 7. - Total number of pine poles or piles classified according to length and diameter

D.B.H. of trees (outside bark)	Pole or pile length (feet)						Total	Proportion of total
	20	25	30	35	40	45 or over		
Inches	- - - - - - - - -			Thousand sticks	- - - - - - - -			Percent
7.0- 8.9	5,007	835	513	64	-	-	6,419	40.9
9.0-10.9	3,335	991	729	104	52	-	5,211	33.2
11.0-12.9	1,226	967	645	194	194	-	3,226	20.6
13.0-14.9	77	246	178	155	85	31	772	4.9
15.0-16.9	-	1	26	23	12	6	68	.4
17.0-18.9	-	-	-	-	-	-	-	-
Total	9,645	3,040	2,091	540	343	37	15,696	100.0
Percent of total	61.5	19.4	13.3	3.4	2.2	.2	100.0	

Forest Increment

The volume of a forest stand is in a continuous state of change. The older trees grow in diameter and height, thus increasing their volume, while the younger ones are constantly attaining measurable volume. Negative volume changes occur when trees die, and when decay or injury cause loss of material in living trees. Forest increment is the balance between these various factors, and generally represents an increase in volume, although a decrement may occur in over-mature stands or in stands subject to the ravages of fire, insects, or wind.

Increment per acre of uncut stands

The values given in table 8 represent the net increment per acre in the various forest conditions, all forest types combined, of the stands in the unit, assuming no cutting during the year 1936. On the land in private ownership, the increment per acre may exceed the values given in the table, while on the National Forest land, with its poor sites, the increment is commonly less than is presented here. In recent years, over 500,000 acres of the Ouachita National Forest has been silviculturally improved by girdling the cull hardwoods. With expansion of this and other management practices, and with continued progress in fire prevention, it is reasonable to expect that the increment per acre can be increased materially on both private and public lands.

1/ "Pole and pile timber in the Pine-Hardwood Region-West" Forest Survey Release #28, Sept. 25, 1937, Southern Forest Exp. Sta., New Orleans, La.

The increment given in board feet occurred only on saw-timber material, while cubic-foot and cordwood volumes include the increment on the usable lengths of all pines above 5.0 inches d.b.h., under-sawlog-size hardwoods, and the saw-timber portion of hardwoods 13.0 inches d.b.h. and larger. No calculations of increment were made for cull trees or limbs of any species. Cordwood volumes include bark, but cubic-foot values are for wood only.

Table 8.- Average per-acre increment in 1936, in the various forest conditions (undisturbed by cutting)

Forest condition	Pine component			Hardwood component			Total per acre		
	Bd.ft.	Cu.ft.	Cords	Bd.ft.	Cu.ft.	Cords	Bd.ft.	Cu.ft.	Cords
Old growth:									
Uncut	68	15.9	.20	-1	-.8	-.01	67	15.1	.19
Partly cut	62	19.7	.25	6	1.9	.03	68	21.6	.28
Second growth:									
Sawlog size:									
Uncut	178	38.7	.50	9	3.9	.06	187	42.6	.56
Partly cut	113	24.8	.32	16	5.3	.08	129	30.1	.40
Under sawlog size	40	15.8	.21	4	3.1	.05	44	18.9	.26
Reproduction and clear-cut	2	.3	.01	negl.	.1	negl.	2	.4	.01
Weighted averages	88	22.5	.30	5	2.8	.04	93	25.3	.34

Forest increment of the unit

To determine the increment of forest stands subject to various degrees of cutting, it is necessary to deduct the proportion of growth on timber removed during the year, as well as allow for mortality and other natural losses. Table 9 shows the amount of wood that was added by growth during 1936, taking these factors into account. The values given in this table, however, do not represent the net amount by which the inventory of the growing stock increased during the year, as an almost equal amount of timber was cut and utilized during the same period, nearly offsetting the net growth.

In 1936 the total board-foot increment on the 7 billion feet of growing stock (lumber tally) amounted to 308,800,000 feet, of which 16 percent was in old-growth stands with an average stocking of 4,270 board feet per acre, and 65 percent was in second-growth sawlog-size stands that averaged 2,780 feet per acre. Stands at present under sawlog size, but averaging 280 feet per acre in scattered trees, produced 19 percent of the increment; this amounted to more than 60 million board feet.

In pine stands, the increment was positive in all conditions, both in board feet and cubic feet. In the hardwoods, all but the old-growth uncut stands increased their volume. In these mature hardwood stands the effect of mortality was to reduce the stand volume faster than new wood was added through growth, so that during 1936 there was a loss of 800,000 board feet or 460,000 cubic feet of material. It is problematical how much of this volume is an actual loss to the forest industries, as some of it occurs in trees and species that are not in immediate demand for commercial utilization. It is reasonable to suppose, however, that a large proportion of the trees that die in old-growth stands are large, mature, high-quality trees that might have been salvaged if they had been utilized when their declining growth rate indicated that their financial maturity was reached.

Table 9. - Forest increment in board feet and cubic feet in the various forest conditions, 1936

Forest condition	Saw-timber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	- Thousand board feet -			- Thousand cubic feet -		
Old growth:						
Uncut	35,800	-800	35,000	8,340	-460	7,880
Partly cut	12,800	1,200	14,000	4,100	380	4,480
Second growth:						
Sawlog size	186,900	12,700	199,600	40,970	5,010	45,980
Under sawlog size	55,300	4,800	60,100	21,450	4,170	25,620
Reproduction and clear-cut	100	negl.	100	20	10	30
Total all conditions	290,900	17,900	308,800	74,880	9,110	83,990

The increment is expressed in standard cords (4 x 4 x 8 ft.) in table 10. This material is identical with that given in cubic feet in table 9, except that bark is included. In converting cubic feet to cords, factors of 90 cubic feet of wood and bark per cord were used for pine and cypress and 80 for hardwoods.

Table 10. - Forest increment in 1936, expressed in cords of rough wood, in the various forest conditions

Forest condition	Pine	Hardwood	Total
	- - - Cords - - -		
Old growth:			
Uncut	106,200	-6,900	99,300
Partly cut	52,600	5,600	58,200
Second growth:			
Sawlog size	530,200	77,800	608,000
Under sawlog size	283,900	65,300	349,200
Reproduction and clear-cut	300	100	400
Total all conditions	973,200	141,900	1,115,100

Sawmills

Small, frequently moving, portable sawmills are the prevailing type in this area. In 1936, as determined by a field canvass of the entire unit, there were at least 157 sawmills with a capacity of less than 20 M board feet per day; many of these actually have a capacity of less than 10 M per day. It is estimated that these small mills operated at 40 percent of capacity during 1936, producing 51 percent of the lumber cut in the unit. These small mills are scattered throughout the unit (fig. 6) but tend to be concentrated near the larger towns and the main railroad lines. Usually the rough lumber produced is assembled at central concentration yards, where the product of several mills may be finished and kiln dried.

Four mills were found with capacities between 20 and 39 M board feet per day. All of these mills were cutting chiefly pine. They represent a fairly stable type of mill as contrasted with the smaller, portable mills. In 1936 they operated at about 40 percent of capacity and produced only 7 percent of the lumber cut.

There were three sawmills with a daily capacity of more than 40 M board feet. Two of these are large pine mills, operating in old-growth pine, each with facilities for cutting in excess of 100 M board feet per day. The other mill cuts hardwood entirely, producing about 60 M board feet per day when operating at full capacity. The two pine mills operated at more than 90 percent of capacity in 1936, while the hardwood mill cut at about 70 percent; during that year these three mills cut 42 percent of all the lumber produced in the unit.

Table 11. - Number of sawmills and extent of employment, classified according to size of mill, 1936

Daily (10 hrs.) rated capacity 1/	Mills 2/			Employment provided		
	Pine	Hardwood	Total	In woods	In mill	Total
Thousand board feet	- - - - - Number - - - - -			Thousand man-days - -		
Under 20	157	-	157	88	172	260
20 - 39	4	-	4	14	29	43
40 - 79	-	1	1	negl.	27	27
80 and over	2	-	2	101	142	243
Total	163	1	164	203	370	573

1/ The rated capacity indicated size of mill rather than actual average daily production.

2/ The data given here on the number of mills in the smallest class are estimates based upon all available records, supplemented by a field check.

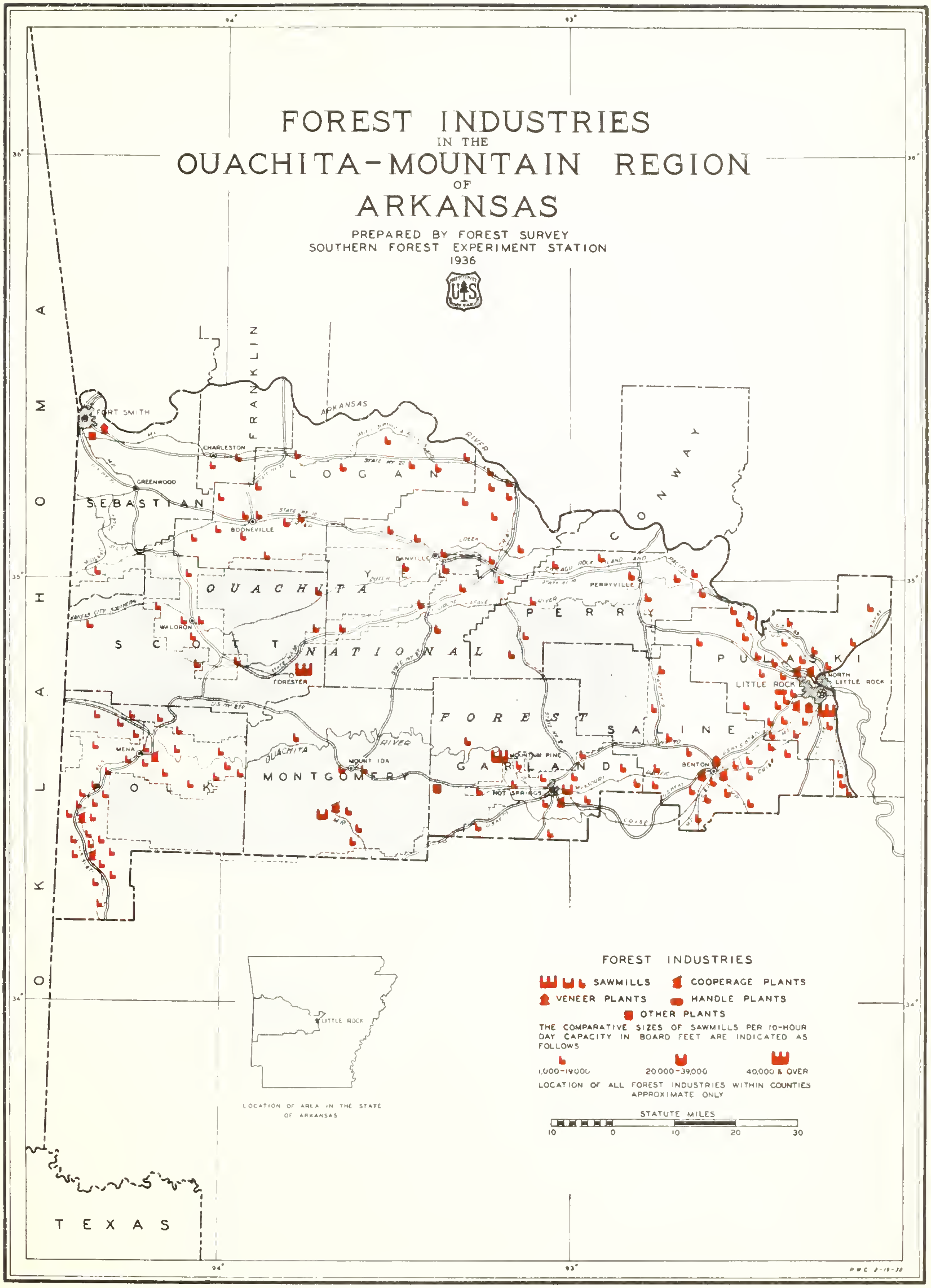

FIGURE 6 - FOREST INDUSTRIES MAP

Other forest industries

Among the forest industries, cooperage plants rank next in numerical importance after sawmills. In 1936 there were 11 such plants in the unit, with consumptive capacities varying from 10 to 60 cords per day; they operated at about 60 percent of capacity for the year. Practically all of these plants, using white oak chiefly, make bourbon, oil, and other tight cooperage staves. None of the plants own forest land; all buy their timber, most of it delivered on the yard. The total wood used by these plants in 1936 amounted to 38,000 cords, of which 40 percent came from this unit and the remainder from adjoining Survey units, mostly in Arkansas.

There are 3 veneer plants in the unit, located at Little Rock, Benton, and Fort Smith. Their daily capacities vary from 6 to 9 M board feet green lumber tally; their combined production in 1936 amounted to 70 percent of capacity. Red and black gum, and cottonwood are the chief species used. Two of the plants secure about half their wood requirements from this unit, while the other plant draws its entire supply from southwest Arkansas outside the unit. The bolts used, which are large and of good quality, are usually purchased delivered at the mill yard.

Miscellaneous establishments include 2 hardwood dimension plants, 5 furniture plants, and 10 shingle mills. Hand-made products obtained directly from the forest include hewed cross ties, pine poles and piles, mine props, fence posts, and fuel wood. Most of the cross ties are purchased by local railroads, while the poles and piles are shipped to adjacent treating plants, and to plants in the North and East. Some fence posts are produced for sale to commercial treating plants, but most of them, as is the case with fuel wood, are for local use. The mine props are used mainly in the coal mines centering around Poteau, Ark. Plants outside the unit but drawing raw material from it include one handle mill and one excelsior mill. Some dogwood is also shipped to Memphis, Tenn., for manufacturing shuttle blocks.

Table 12 gives a summary of the production and employment data occasioned by the forest industries in 1936. The amount of material shown as produced or used by the sawmills and by the veneer and cooperage plants represents the production of these plants regardless of the source of their wood supply, while the material shown for the remaining commodities comes entirely from the Survey unit. The woods employment shown is based upon the material cut from within the unit, while the mill employment is the total labor furnished by the mills within the unit, irrespective of the source of the wood supply.

Table 12. - Production and employment, 1936

Kind of plant or commodity	Number of plants	Amount produced or used	Employment provided		
			In woods	In mill	Total
		M bd. ft.	- - Thousand man-days - -		
Sawmills	164	196,400	203	370	573
Veneer	3	4,000	4	15	19
		M pieces			
Cross ties	-	524	76	-	76
Poles and piles	-	23	6	-	6
Fence posts	-	1,129	16	-	16
		M cords			
Cooperage	11	38	18	67	85
Fuel wood	-	393	412	-	412
Miscellaneous 1/	17	2/45	73	8	81
Total	195		808	460	1,268

1/ Includes 2 hardwood dimension plants, 5 furniture plants, and 10 shingle mills.

2/ Includes material used for mine props, excelsior, shingles, and shuttle blocks.

Employment

Table 12 shows that the total employment furnished by the forest industries during 1936 amounted to 1,268,000 man-days. If 250 days is considered a working year, this is equal to 5,100 man-years, but since most employees work only part time in the forest industries, the actual number of men employed is much greater than is thus indicated. The sawmill industry contributed 45 percent of the total labor, and if a wage of $2.00 per man-day was paid, this industry returned over a million dollars to wage earners within the unit. If the timber supply and economic conditions should warrant capacity operation of the present sawmills, the return in wages would be approximately doubled. In 1936, the cut on the Ouachita National Forest amounted to about 25,000 M board feet, lumber tally, providing 66,000 man-days of employment. The allowable cut (approximately 60 percent of the increment) is about 35 million board feet, which would provide about 92,000 man-days of labor annually.

Utilization Drain

Although table 9 shows that the increment in the unit amounted to nearly 309 million board feet of sound material during 1936, this does not represent the net amount by which the timber stand increased in volume during the year. Wood used in 1936 by the forest industrial plants or consumed in the form of fuel wood, fence posts, cross ties, poles, and piles, amounted to 277 million board feet and nearly equaled the volume of increment. This utilization drain includes the material cut from the growing stock —— both the sound usable material left in felled trees after logging as well as that utilized —— but does not include any material cut from limbs or from dead or cull trees. In table 13, the utilization drain is shown by commodity, with the drain on the saw-timber section of the tree, including both the utilized and wasted portions, expressed in board feet. The volumes given in cubic feet inside bark include drain on saw-timber material, upper stems of sawlog-size pines, and small trees under sawlog size but at least 5.0 inches d.b.h.

Table 13. - Utilization drain from sound trees, 1936

Commodity or use	Saw-timber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	- Thousand board feet -			- Thousand cubic feet -		
Lumber	211,500	3,900	215,400	38,110	600	38,710
Cross ties	11,800	16,500	28,300	2,030	2,710	4,740
Poles and piles	2,800	100	2,900	510	10	520
Veneers	-	2,900	2,900	-	420	420
Cooperage	800	10,000	10,800	160	1,460	1,620
Misc. manufactures	100	100	200	1,010	2,140	3,150
Fuel wood	7,000	3,100	10,100	3,090	4,730	7,820
Fence posts	-	2,100	2,100	310	400	710
Misc. farm use and land clearing	3,100	900	4,000	1,570	740	2,310
Total	237,100	39,600	276,700	46,790	13,210	60,000

Comparison of Increment and Drain

Table 14 is a summation of the effect of growth, mortality, and utilization drain upon the board-foot growing stock during 1936. The values are expressed in lumber tally.

Table 14. - Balance between increment and drain of saw-timber material

Item	Pines	Hardwoods	Total
	- - - - - Thousand board feet - - - - - -		
Net growing stock, Jan. 1, 1936	5,756,500	1,178,500	6,935,000
Growth, 1936	316,700	52,900	369,600
Mortality, 1936	25,800	35,000	60,800
Forest increment, 1936	290,900	17,900	308,800
Utilization drain, 1936	237,100	39,600	276,700
Net change in growing stock, 1936	53,800	-21,700	32,100
Net growing stock, Jan. 1, 1937	5,810,300	1,156,800	6,967,100

As shown in the above table, the pine growing stock increased by about 54 million board feet during 1936; while the hardwoods showed a decrease of nearly 22 million feet. Apparently there is an adequate pine supply for present industries, but this is not the case. Approximately 90 percent of the pine board-foot drain was caused by the lumber industry, and about half of this lumber drain was from old-growth timber cut by two large mills within the unit and two ajacent to the unit in the south. Reference to table 9 shows that increment in old-growth pine is slightly less than 50 million board feet, which means that in 1936 these four mills were cutting the old-growth timber twice as fast as it was growing. While the drain in the second growth amounted to only 50 percent of the increment, a part of the surplus increment may be needed by the present lumber industry to supplement its waning supply of old-growth timber. Also some part of the surplus increment in second-growth pine should be reserved from cutting to build up the growing stock. It is doubtful whether the large pine mills will continue their operations on the present basis after the old-growth timber is gone. The Forest Service has been trying for several years to work out a cooperative plan with these large operators, in which their operations would be placed on a sustained-yield basis through the utilization of some of the old-growth timber on the Ouachita National Forest, but the practical attainment of such a plan seems difficult. Present Forest Service policy recognizes the needs of the smaller but more permanent concentration plants such as those located at Booneville, Waldron, Eagleton, Mena, Norman, and Hot Springs, since in this way real assistance is given to the local industries and people in maintaining permanent operations.

The hardwoods are being overcut, both in the old-growth and second-growth stands. In addition to the fact that the drain exceeds the increment, is the disquieting truth that a large proportion of the hardwood drain is centered upon a very few species and on only their highest-quality trees, while the increment shown is on all species. In 1936, for example, 25 percent of the total board-foot drain of hardwood was for cooperage, practically all of which was of high-quality white oak. Cross ties accounted for an additional 42 percent of the drain, and a large proportion of these were cut from white oak and the better red oaks. As a result of this concentration of drain on a few species. there has been a constant tendency for the hardwood stand to degenerate in quality.

The comparison of increment and drain, for the total sound-tree growing stock above 5.0 inches d.b.h. is expressed in cubic feet (inside bark) in table 15. Here also the net result is to increase the growing stock, since the gain in the pine growing stock more than balances the loss in the hardwoods. The actual situation is comparable to that described above for board feet. In 1936 there was no pulpwood drain from the unit, but it is likely that a demand for pulpwood will develop from the pulpmills in the southern part of the State.

Table 15. - Balance between increment and drain in cubic feet

Item	Pines	Hardwoods	Total
	- - - Thousand cubic feet (i.b.) - - -		
Net growing stock, Jan. 1, 1936	1,664,570	605,650	2,270,220
Growth, 1936	83,380	28,330	111,710
Mortality, 1936	8,500	19,220	27,720
Forest increment, 1936	74,880	9,110	83,990
Utilization drain, 1936	46,790	13,210	60,000
Net change in growing stock, 1936	28,090	-4,100	23,990
Net growing stock, Jan. 1, 1937	1,692,660	601,550	2,294,210

Summary and Outlook for the Future

In the area covered by this report, agriculture is a submarginal industry. At present nearly 70 percent of the land area supports forest growth, and it is probable that this percentage will increase in the years to come. Forests long have been the chief use of the land. This use must be continued if the land is to contribute its share to the support of the people. Permanent yields of forest products are essential in a planned economy based upon the timber resource, and this unit is fortunate in that 30 percent of the forest area is in public ownership, managed for the express purpose of assuring a continuous wood supply.

Although in 1936 the forest increment amounted to 32 million board feet more than the drain, the situation is not entirely satisfactory. On the National Forest the present allowable cut is set at about 60 percent of the increment, because the portion of the growth accruing upon the recently purchased heavily cut-over land is not considered in calculating the increment or in setting up the immediate cutting budget; furthermore, a portion of the increment on the area to be logged is being reserved to build up the growing stock which is now below normal. These two measures are desirable, in that eventually the forest stand will be increased materially and a greater annual yield will result, particularly when those stands now omitted from the cutting budget become merchantable. The conservative Forest Service policy of management on the Ouachita Forest will insure a continuous supply of timber on only one-third of the forest land of the unit; it cannot in so doing provide for the future supply on the remaining two-thirds now in private ownership. The forest industries dependent upon this portion of the unit must adopt forest management policies designed to perpetuate their timber supply or eventually face a reduction in operations. While clear-cutting is by no means the rule on all private land, several of the larger owners have cut such a large proportion of their forest capital that it will be difficult, if not impossible, for them to maintain a continuous operation. The cutting practice on practically all private land is open to improvement if the supply of timber is to be maintained or increased.

A disquieting result of the too rapid harvesting of the timber on private land is its effect upon regular employment. During 1936, a large proportion of the labor used by the forest industries in the unit was employed directly in the utilization of timber held in private ownership. Continued over-cutting on private land inevitably will reduce the opportunity for future employment in the forest industries and, unless needed adjustments are made, it is probable that within a relatively few years at least two large operators will cut-out, leaving two towns virtually abandoned.

One means of prolonging the life of these large operations lies in perfecting cooperative agreements between the Forest Service and the private operators for the coordinated management of National Forest and private timberland in sustained-yield working circles. Local conditions, such as the remaining supply of timber in private ownership, location of plants in relation to National Forest timber and to existing or proposed transportation facilities, and the financial status and management policies of the individual companies, all affect the feasibility of such a plan and must be thoroughly evaluated in its practical application. On the other hand, it is questionable whether the Forest Service should increase its cut to keep these two large operations going awhile longer, or whether it should handle its present forest land conservatively with the ultimate object of providing needed employment for smaller but more stable operations, when the large mills finally cut out. Actual conditions in the unit seem to justify the adoption of the latter course.

While the National Forest has a definite responsibility in the maintenance of forest industries in the unit, the owners of private timberlands have even a greater one. The National Forest can only partly ameliorate the situation; in the long run the maintenance of the greater part of the forest growing stock rests directly upon the private operators and timberland owners who control the forest practices on two-thirds of the forest land in the unit. The cutting practices of the present sawmill industry, however, are not conducive to the establishment of sustained yield on private lands. About 40 percent of the pine lumber produced is cut by two large companies, which, because of various factors, are operating on a liquidating basis. Also, of the 164 sawmills in the unit, 157 are small portable mills, only a few (if any) of which hold forest land in sufficient quantity to justify growing successive crops of timber; nor do they have, as a rule, the financial stability to buy lands as the basis for such management. The small mills are, in reality, simply an outlet or market for the timber of the land owners, and it is incumbent upon the land owner to regulate the cutting of his forest if he expects to manage it for a continuous supply of material.

When the foregoing facts are considered —— those relating both to private and to National Forest land —— it appears that a reduction in the cut of lumber must occur eventually in this unit if there is no marked change for the better in the management of private forest land. The cut on the National Forest will be maintained on a sustained-yield basis and will be relatively constant throughout a given cutting cycle although it can be increased eventually. Generally it will be allocated so that a certain number of plants can be maintained continuously, but these favored plants will, of necessity, equal only a small part of those now operating in the unit. Those sawmills dependent entirely upon old-growth timber in private ownership probably will be forced to close down upon the exhaustion of the virgin stands, although there may be an opportunity to maintain reduced operations using second-growth timber and producing material of lower quality. With the large mills out of production the numerous small portable mills can continue to cut second-growth timber at the present rate, or even at a greater rate, on private land for a long time.

In order to help meet the demand for continuous employment and to divert to another part of the growing stock some of the excessive industrial drain now largely concentrated on the best trees and most valuable species, new plants are needed to make use of the low-quality material so abundant in the forests of the unit. Utilization of the inferior hardwoods offers the best opportunity from a supply standpoint, but there is also an opportunity to increase the use of small low-quality trees removed as thinnings from pine stands. Such material is suitable for the manufacture of rayon, paper, liner board, building board, or plastics.

If the situation is to be improved, several measures must be given wide-spread application. Basic to any timber-growing program is the need for a comprehensive and effective system of fire control. On publicly owned lands, fires are held within reasonable limits. On the private land, the State, in cooperation with the Federal Government, is rapidly extending a fire-control system. If the forests are to be built up to their full productivity, it is necessary that <u>all</u> forest land in the unit should receive adequate protection from fire at the earliest date possible.

Another essential need is a program of education, carried to the timberland owner, the forest operator, and the general public, designed to acquaint all concerned with the profits, principles, and applications of good forest practice. The existing forestry Extension Service should be expanded and organized so that it can carry forward its share of this work. The Arkansas State Forestry Commission, which recognizes the need of education and of assistance to private owners and operators, has recently organized a department for the exclusive purpose of bringing forestry methods directly to them. The work of this department should be expanded and continued. The Ouachita National Forest serves as an excellent demonstration area in good forest practices, but there is a place for strategically located State Forests to serve as demonstration areas in addition to the National Forest.

A planting program to reforest all, or the greater part, of the 310,000 acres of idle and abandoned fields is needed. Most of the fields are suitable only for pine, but those located in the more fertile stream valleys may meet the requirements of white oak and other hardwoods. The State Forestry Commission should provide planting stock at reasonable cost and, through its field officers, should encourage and advise private owners who wish to build up their forest acreage by planting.

With the general application of fire control and improved forestry practices throughout the unit, there will be a gradual increase in the stand per acre and a resulting increase in the increment. The opportunity for increasing the forest crop is apparent; figure 2 shows that the present average stand contains only 55 percent of the volume of a managed stand, indicating that through management the increment could be nearly doubled. This can be attained, however, only by the continuous and concentrated efforts of public agencies and of private owners and operators.

FOREST SURVEY RELEASE NO. 37 OCTOBER 18, 1938

FOREST RESOURCES

of

SOUTHEAST OKLAHOMA

A Progress Report

by

THE SOUTHERN FOREST SURVEY

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New Orleans, La.

FOREWORD

The nation-wide Forest Survey, being conducted by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is : (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies may be formulated for the effective use of land suitable for forest production.

This release is based on a field survey made April 25, 1936, to June 13, 1936, and on a field canvass of forest industrial plants to determine forest drain, which was completed during March, 1937. It should be regarded only as a progress report since it contains Forest Survey data that will be included in complete reports to be published later, and that, although considered reliable, are subject to correction or amplification as the work of computation proceeds. Item 4 above, which is being studied on a national basis, is not discussed in this report.

In the presentation of these survey data, it is to be noted that owing to the sampling method used in collecting them, the greater the number of samples in any given classification the more accurate are the data for that classification. Hence classes that are of infrequent occurrence and relatively small in quantity generally cannot be determined with as high a degree of accuracy as classes that occur more frequently and in substantially greater quantities. Small tabular items are to be taken as showing, not the exact magnitude of the classes involved, but their relative magnitude in comparison with those of other classes.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

Staff Assignment

In Charge of Field Work and Preparation of Report
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Note: The Southern Forest Experiment Station hereby wishes to acknowledge the clerical assistance received from the Works Progress Administration in the preparation of this Release.

FOREST RESOURCES OF SOUTHEAST OKLAHOMA

General Description of the Unit

The portion of Oklahoma treated in this report consits of Haskell, Le Flore, Latimer, Pushmataha, and McCurtain Counties, in the extreme southeast corner of the State (see fig. 3). Since these counties embrace practically all of the Ouachita Mountain system in Oklahoma, their topography is rougher than that of any other section of the State. Of the 4,026,200 acres in the five counties, forest land occupies 73.5 percent. Agriculture, coal mining, and lumbering are the chief industries. Poteau and Idabel, which are the largest towns, each contain less than 5,000 people. Because of the relatively low soil productivity, agricultural use of the land fluctuates rapidly with changing economic and climatic conditions. In general, the most promising economic use of the major part of the land seems to lie in growing timber, a fact recognized by the Federal Government, which has over 140,000 acres of forest land under management in the part of the Ouachita National Forest that is in Le Flore County.

One of the important factors affecting the development of the area is its rugged topography. With the exception of the fairly broad alluvial valleys along the Arkansas and the Red Rivers, the land surface is characterized by parallel northeast-southwest ridges, which increase gradually in height toward the east, until a maximum elevation of 2,900 feet is attained near the Oklahoma-Arkansas line. These ridges, which are generally narrow, with steep slopes and sharp crests, are covered with thin and unproductive soil. The stream valleys between the ridges offer the best opportunity for successful agriculture, but their area is limited. In the northern half of the unit, drainage is by way of such streams as the Canadian, Sansbois, Brazil, and Poteau, which flow northward into the Arkansas River on the northern boundary. The Red River flows southeastward along the southern boundary and receives from the southern half of the unit the run-off carried into it by the Kiamichi and Little Rivers with their tributaries. Based upon a preliminary reconnaissance by the Soil Conservation Service in 1934, about 70 percent of the unit is subject to severe sheet erosion, with moderate sheet erosion occurring on a large part of the remaining land.

Transportation facilities are less adequate in this area than in any other part of Oklahoma, owing largely to the rugged topography and the scarcity of population. Three Federal highways cross the unit as well as several State highways, but paving is restricted to a few miles adjacent to some of the larger towns. Using a sampling process, the Bureau of the Census determined in 1930 that 90 percent of the farms were located on dirt roads. The first railroad to penetrate the region was the St. Louis and San Francisco, which started operation in 1886. The major part of the railroad construction was finished by 1910, since which time the mileage has remained relatively constant. At present there are seven railroad systems operating in the unit, but their distribution leaves a large part of the area without convenient rail service.

Between 1820 and 1840 a considerable number of Choctaw Indians were transferred to this part of Oklahoma. According to the Census of 1930, the Indian population was about 7,000; while the total population numbered 120,000, only 5 percent of which was classified as being in towns of over 2,500. In the period from 1930 to 1935, about 5,000 persons moved from a non-farm residence to a farm home; and the transitory nature of the farm population is evidenced by the fact that 70 percent of all the farm operators had moved at least once during this period.

About 60 percent of the people are engaged in farming, in many cases supplementing their incomes by part-time work in the woods. The Agricultural Census of 1935 shows that farm operators received pay for about 382,000 man-days of labor not connected with their farms. A large part of this employment was in the forest industries, which in 1930 provided the chief income to nearly 10 percent of the wage-earners in the area. Also, the sale of forest products provided additional income; in 1934 this amounted to almost $30.00 per farm on those farms reporting sales. Coal mines in Latimer, Haskell, and Le Flore Counties furnished some employment, and have been responsible for the growth of such towns as Poteau, Wilburton, and Red Oak.

Data gathered by the Agricultural Census of 1935 show that there has been a 5 percent increase in number of farms since 1925. The average farm contained 82 acres, of which 32, or nearly 40 percent, were forest land. Although the acreage in farms has increased about 23 percent since 1925, the amount of cropland actually harvested has decreased 20 percent during this period. Crop failure increased from 8,000 acres in 1924 to 58,000 acres in the dry year of 1934, when crops failed on 12 percent of all the land planted. General farming is practiced, with cotton, corn, cattle, and forage crops the chief products. The acreage in cotton has been reduced from 208,000 acres in 1929 to 136,000 acres in 1934, when the yield amounted to only 0.17 bales per acre, owing in part to drought conditions and in part to the general low productivity of the soil. Le Flore County grew over 4,000 acres of Irish potatoes for market in 1934; while McCurtain County harvested 1,400 acres of potatoes that year and 369,000 bushels of corn.

The acreage of land held in public ownership is relatively small. The portion of the Ouachita National Forest situated in Oklahoma contains 144,000 acres. There are also 21,000 acres in State Parks and County Game Preserves. School lands may total as much as 4,000 acres. In private ownership is the 1,315,000 acres of land in farms, divided into 16,100 individual tracts, only 32 percent of which are operated by their owners, while 60 percent are operated by tenants and 8 percent by share croppers. In many cases the ownership of these farms is difficult to determine, owing to the prevalence of chronic tax delinquency. Any program for promoting good forest practice in this unit must take into account the fact that over half a million acres of woodland is managed by 16,100 operators, only 32 percent of whom are actual owners of the land. Lumber companies own large blocks of land, a single company owning at least one-half million acres. Coal companies own some land but also hold extensive leases. A large part of the leased land was originally the tribal property of the Choctaw Indians, who received a royalty for each ton of coal mined, but the present status of the ownership and acreage of the coal lands has not been determined.

The area in tax default for 3 years or longer as of August 1934, amounted to 28 percent of the total area of the unit. The situation was extremely bad in Latimer County, where a large part of the gross area was in default. As a rule, more tax default occurs on small farm holdings than on land owned by lumber companies or other corporations. Aggravating the excessive delinquency, is the high rate of interest (12 percent) charged upon overdue taxes. If taxes once become delinquent, it is often impossible for many of the small farmers to ever catch up with the accumulating taxes, interest, and costs, owing to their narrow margin of profit, which is all too frequently wiped out by adverse climatic or economic conditions.

In table 1, the acreage of land is classified according to the prevailing type of land use, as determined by the Forest Survey in 1936. It is noticeable that nearly three-fourths of the unit is forest land, while idle and abandoned land, much of which will revert to timber, is found on an additional 5 percent of the area.

Table 1. - Land area classified according to land use

Land use	Area		Proportion of total area	
	Acres		Percent	
Forest:				
Productive	2,961,000		73.5	
Nonproductive	-		-	
Total forest		2,961,000		73.5
Nonforest:				
Agricultural:				
In cultivation:				
Old cropland	588,300		14.6	
New cropland	26,300		.7	
Out of cultivation:				
Idle	141,700		3.5	
Abandoned	62,900		1.6	
Pasture	192,700		4.8	
Total agricultural	1,011,900		25.2	
Other nonforest	53,300		1.3	
Total nonforest areas		1,065,200		26.5
Total forest and nonforest		4,026,200		100.0

Description of the Forest

The forests of the unit are composed of a number of species. Most common is the shortleaf pine, which occurs in practically pure stands on almost a quarter of the forest area and in mixture with oaks and hickories on an equivalent area. The pine and pine-hardwood stands are closely intermingled and together constitute the characteristic forest of the Ouachita Mountains. In Haskell County, the northern part of Le Flore County, and in McCurtain County south of Broken Bow, the uplands support a stand composed chiefly of post and red oaks, hickories, some forked-leaf white oak, and other miscellaneous hardwood species. In the river bottoms, notably those of the Arkansas, Canadian, and Red Rivers, the more abundant species are water oaks, red gum, hickories, elms, maple, and sycamore.

Forests occur on all the topographic situations that exist in the unit. There is, however, a concentration of agricultural use in the more fertile stream valleys and level benches between the ridges, resulting in a greater proportion of the ridge land being forested. Even though such is the case, table 2 shows that 48 percent of the forests are on slopes of not more than 10 percent and should therefore be easy to log.

Table 2. - Forest area classified according to forest type-group and topographic situation

Forest type-group	Slopes			River bottom	Total	Proportion of total
	10 percent or less	More than 10 percent				
		North	South			
	Acres					Percent
Pines	271,500	177,600	246,000	2,400	697,500	23.5
Pine-hardwoods	318,500	175,100	183,200	9,500	686,300	23.2
Upland hardwoods	835,200	289,800	219,700	-	1,344,700	45.4
Bottom-land hardwoods	-	-	-	232,500	232,500	7.9
Total all types	1,425,200	642,500	648,900	244,400	2,961,000	100.0
Percent of total forest area	48.1	21.7	21.9	8.3	100.0	

The stands included in the pine type-group (table 3) are practically "pure" pine. Shortleaf pine is the dominant species, but a minor amount of loblolly pine also is present, particularly along the streams, as well as a small quantity of oak and hickory. Old-growth stands are more extensive in this type-group than in any other, occurring on 28 percent of the type area. Second-growth sawlog-size stands occupy 64 percent, leaving only 8 percent of the area of this type-group in stands below merchantable size. Shortleaf is also the leading species in the pine-hardwoods type-group, but the combined volume of the hardwoods nearly equals that of the pine. This type-group has 13 percent of its area in old-growth stands, 32 percent in second-growth sawlog-size stands, and 55 percent in stands below sawlog size. Much of the pure pine type-group described above may become a pine-hardwoods type upon the removal of the merchantable pines, which under present markets would tend to reduce the value of the stand.

The upland hardwoods type-group is quite extensive in this unit, occurring on 45 percent of the forest land. It is characteristically a forest of small, low-quality trees, as stands below sawlog size occupy 75 percent of the type-group area. The stands on the 25 percent of the area classified as bearing sawlog-size stands are generally upon the more fertile soils, where moisture conditions favor increased growth. The bottom-land hardwoods type-group is located upon some of the most fertile land in the unit. Old-growth timber in scattered tracts occupies 24 percent of the acreage in this type-group, sawlog-size second growth 30 percent, and young second growth 46 percent.

Table 3. - Forest area classified according to forest condition and forest type-group

Forest condition	Pines	Pine-hardwoods	Upland hardwoods	Bottom-land hardwoods	Total all types	Proportion of total
	Acres					Percent
Old growth:						
Uncut	153,700	51,000	55,700	22,300	282,700	9.5
Partly cut	42,200	37,400	52,600	32,600	164,800	5.6
Total	195,900	88,400	108,300	54,900	447,500	15.1
Second growth:						
Sawlog size:						
Uncut	237,200	128,200	113,000	34,300	512,700	17.3
Partly cut	208,600	93,200	114,600	36,600	453,000	15.3
Under sawlog size	53,400	369,400	939,500	100,300	1,462,600	49.4
Reproduction	2,400	7,100	1/ 69,300	1/ 6,400	85,200	2.9
Total	501,600	597,900	1,236,400	177,600	2,513,500	84.9
Total all conditions	697,500	686,300	1,344,700	232,500	2,961,000	100.0
Percent of total forest area	23.5	23.2	45.4	7.9	100.0	

1/ Includes 800 acres of clear-cut condition

The species composition of the several type-groups is portrayed in figure 1, in which the net cubic volume in each of the four species-groups is expressed as a percentage of the total net cubic volume in the type-group. The species-groups as combined are: (1) pines, chiefly shortleaf but including a small amount of loblolly and cedar; (2) red, black, and tupelo gums with other pulping hardwoods; (3) oaks, including scrub oak; and (4) hickories, elms, sycamore, ash, etc. In both the pine and pine-hardwood type-groups, post oak is the most common hardwood, with red oaks a close second. In the upland hardwoods type-group, the more abundant species are post oak, red oak, hickories, forked-leaf white oak, and scrub oak. This latter species makes up 9 percent of all the volume in this type-group, exceeding both the pines and gums in quantity. In the bottom-land hardwoods type-group, over half of species-group (4) above is made up of various elms.

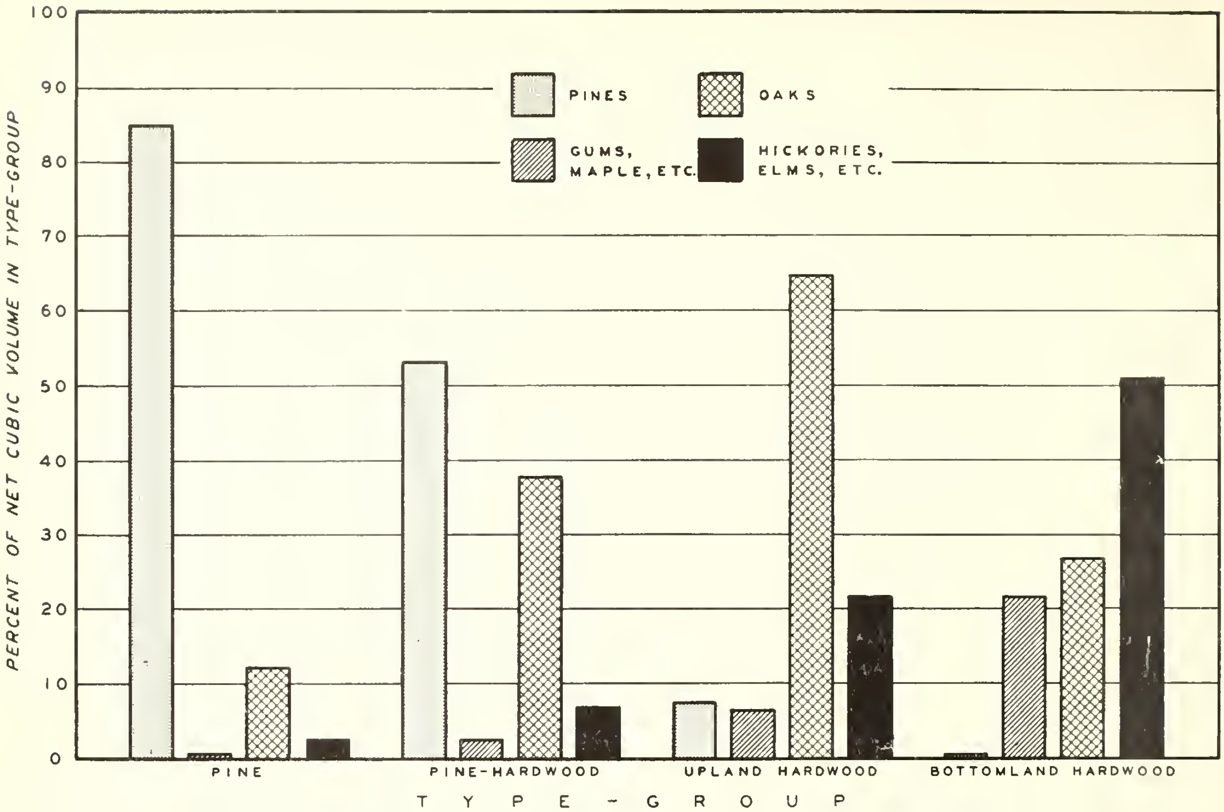

FIGURE 1 – SPECIES COMPOSITION OF FOREST TYPE-GROUPS.

An appraisal of the average basal area [1] per acre in the second-growth sawlog-size pine types indicates that the stocking, when measured in this way, is low. In these stands in Oklahoma, the basal area is less than 40 square feet per acre, while in nearby Texas basal areas of comparable pine stands average 70 square feet per acre. The poorer forest sites which are due in part to the lower fertility of the Oklahoma soil, may prohibit a normal stocking equal to that possible in Texas, but the opportunity for improvement is indicated in figure 2, which shows that the volume of the average stand is about half of what it might be with reasonable care.

Figure 2 is a comparison of the age-class and volume distribution in the present pine and pine-hardwood forest, totaling 1,383,800 acres, with the corresponding distribution in a forest managed on a 90-year rotation. The present forest is divided into areas dominated by specific age-classes, with their extent indicated by percentages along the horizontal axis of the figure, while

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1/ The basal area is the sum of the areas of the cross sections of the trees at breast height, and in this report is expressed in square feet.

the managed forest is divided into nine equal areas, each containing one 10-year age-class. The volumes per acre shown for the given age-classes of the unmanaged forest are the averages of all the stands in the respective classes, while those of the managed forest are based upon the best stocked 10 percent of the uncut forest stands of weighted-average site in the pine and pine-hardwood types. The volumes used for the managed forest do not necessarily equal the ultimate volume attainable under management, but since they have actually been produced by the better-stocked stands now growing in the unit, they serve as a conservative measure of the potential growth of the forest.

If the managed forest is a close approach to the ideal, as related to volume per acre and area distribution of the age-classes, it is apparent that the present stand has certain deficiencies that should be remedied if maximum, continuous production is to be achieved. Among these are: (1) the present stocking is much less than it should be, as it is only 50 percent of the volume of the managed stands; (2) the distribution of age-classes is unsatisfactory, in that the area in stands over 80 years of age is about three times what it should be, while the area of stands below 21 years of age is only one-fifth of what is desirable; and (3) the presence of such a large area (37 percent) of mature timber is a threat to the early establishment of sustained yield in the unit, since these stands are ripe and ready for complete harvesting. If this large area is clear-cut within the near future, it will leave the forest still further out of balance from the standpoint of age-class distribution. The solution of this problem might involve selective logging of the old-growth stands, in which a part of the trees would be left under improved growing conditions as a nucleus of the next cut.

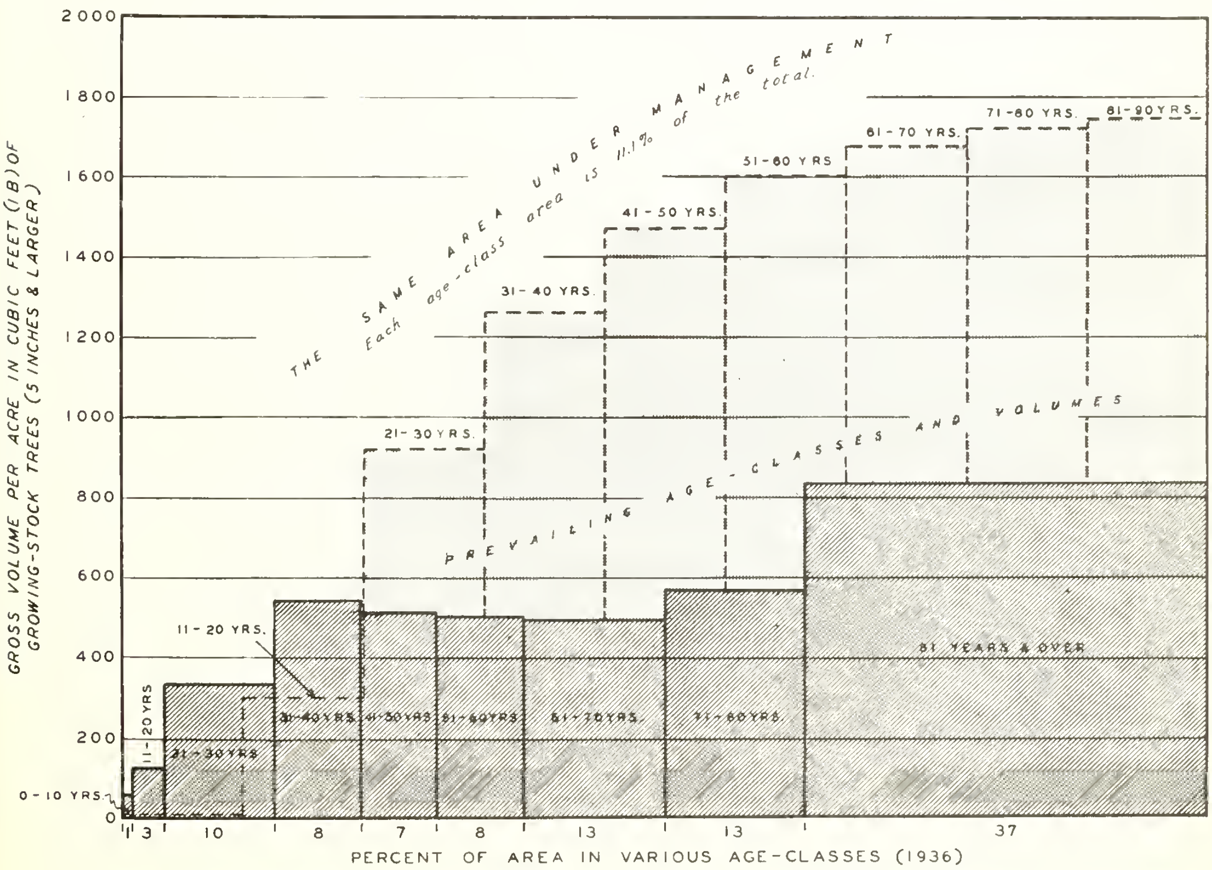

FIGURE 2 - PREVAILING AGE-CLASS AND VOLUME DISTRIBUTION COMPARED WITH THAT ON THE SAME AREA UNDER MANAGEMENT (BASED ON PINE AND PINE-HARDWOOD TYPE-AREAS OF 1,383,600 ACRES).

Volume Estimates

Board-foot volume

The estimate of the volume in sound saw-timber trees is given in table 4, expressed in terms of board feet as measured by the Doyle log rule. To be included in this estimate, hardwoods must be at least 13.0 inches in diameter at breast height (d.b.h.) outside bark, and pines 9.0 inches; also each tree must contain at least one 12-foot butt log, or have 50 percent of its gross volume in sound material. Top diameters vary with the limits of usable material, but neither hardwood logs less than 8.5 inches in diameter at the small end nor pine logs less than 5.5 inches were included. Deductions were made for woods cull, such as rot, fire-scar, crook, limbiness, and similar defects, as well as for loss in sawing at the mill due to sweep and hidden defects. The volumes given here, therefore, can be considered <u>net</u> log scale.

Table 4. - Net volume (Doyle) classified according to species-group and forest condition

Species-group	Old growth		Second growth		Total	Proportion of total
	Uncut	Partly cut	Sawlog size	Under sawlog size		
	Thousand board feet					Percent
Pines:						
Shortleaf 1/	645,200	122,800	629,500	71,700	1,469,200	65.1
Pulping hardwoods:						
Red gum	15,500	15,400	21,600	2,200	54,700	2.4
Black and tupelo gums	9,400	13,100	9,800	3,000	35,300	1.6
Others	3,200	4,900	8,900	2,700	19,700	.9
Nonpulping hardwoods: 2/						
Red oaks	54,900	41,000	108,600	16,200	220,700	9.8
White oaks	58,900	22,400	37,900	9,100	128,300	5.7
Post oaks	24,100	25,000	98,400	22,200	169,700	7.5
Hickories	7,500	17,600	20,500	13,500	59,100	2.6
Others	21,000	19,700	47,100	12,300	100,100	4.4
Total hardwoods	194,500	159,100	352,800	81,200	787,600	34.9
Total all species	839,700	281,900	982,300	3/ 152,900	2,256,800	100.0
Percent of total	37.2	12.5	43.5	6.8	100.0	

1/ Includes 29,600 M board feet of loblolly pine and 1,900 M board feet of cedar.
2/ Includes species not commercially pulped at present, although some have been used experimentally.
3/ Includes 2.5 million feet on the area classified as reproduction.

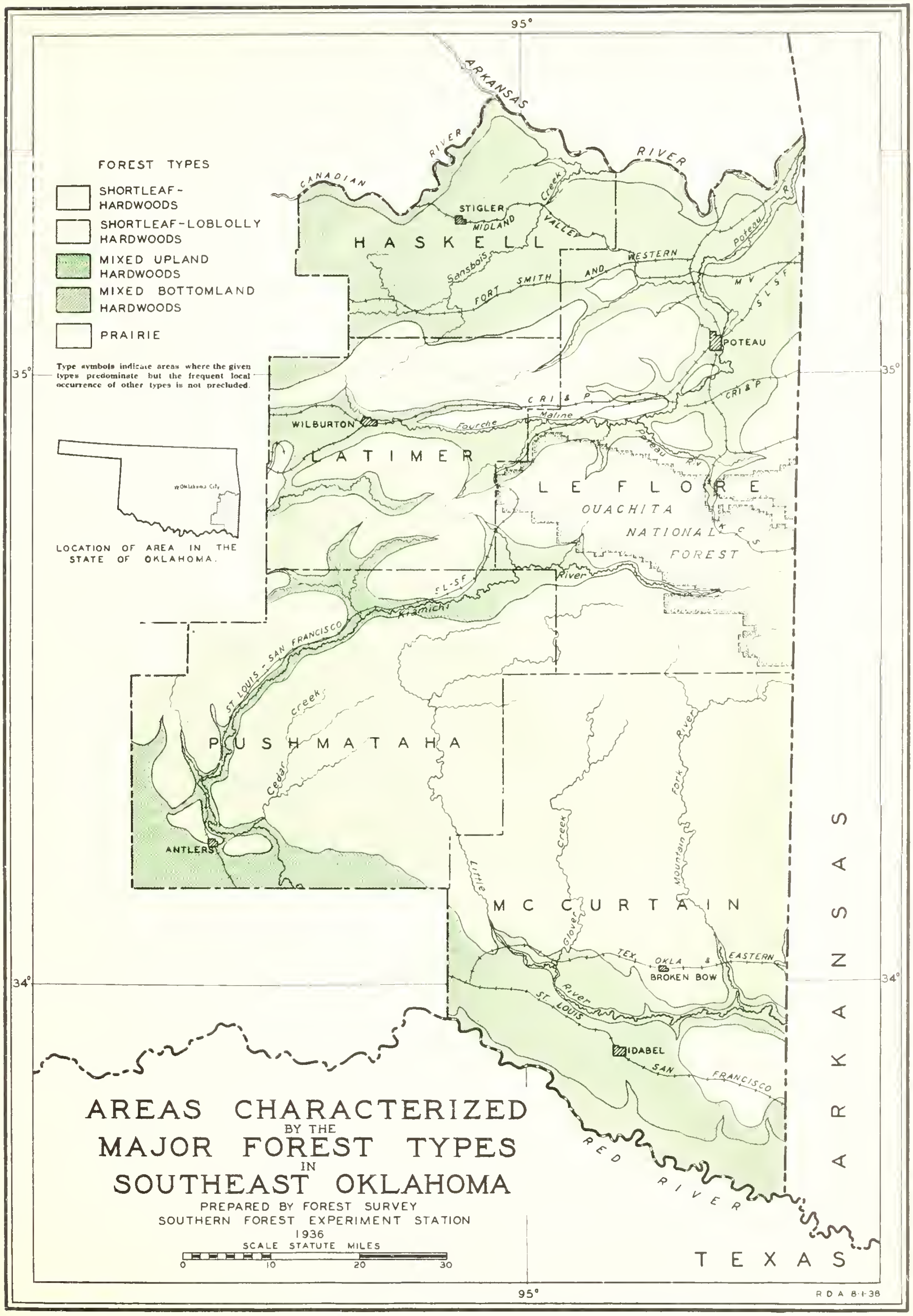

FIGURE 3 – FOREST TYPE MAP.

Table 4 shows that the total volume is 2,256,800,000 board feet, 65 percent of which is pine and the remainder mixed hardwoods. More than half of the pine volume is found in old-growth stands, a large proportion of which belongs to a single lumber company. About 66 percent of the total pine volume is in trees 13.0 inches d.b.h. or over. The total hardwood volume is estimated to be 787,600,000 board feet, 45 percent of which is in old-growth stands. Much of the hardwood saw timber is of low quality; only 36 percent of the volume is in trees larger than 18.9 inches d.b.h. The greatest volume is in the red oaks, with that in post oak nearly as great. The most valuable, considering quality and volume, is the 128,300,000 board feet of white oak.

While the Doyle rule is generally used by lumbermen in southeast Oklahoma, a more accurate measure of the board-foot volume is obtained with the International $\frac{1}{4}$-inch rule, which, as used throughout this report, is the equivalent of green lumber tally. The volume by this rule, as presented in table 5, is nearly 3-2/3 billion board feet, or 60 percent more than when measured by the Doyle rule.

Table 5. — Net volume, lumber tally, classified according to species-group and forest condition (based on International $\frac{1}{4}$-inch rule)

Forest condition	Pines	Red and black gums, etc.	Red and white oaks, etc.	Total
	- - - - - - - -	Thousand board feet	- - - - - - - - - -	
Old growth:				
Uncut	954,500	39,000	225,500	1,219,000
Partly cut	193,100	43,000	168,000	404,100
Second growth:				
Sawlog size	1,208,600	59,300	447,100	1,715,000
Under sawlog size 1/	158,100	12,600	112,000	282,700
Total all conditions	2,514,300	153,900	952,600	3,620,800

1/ Includes 4.9 million feet on the area classified as reproduction.

Analysis of the data in tables 3 and 5 brings out the fact that a large proportion of the volume is concentrated upon a relatively small part of the forest area. Although the old-growth condition occupies only 15 percent of the forest area (table 3), it contains 1,623,100,000 board feet, or 45 percent of the total volume (table 5). Volumes per acre, while not high, average 4,310 board feet for all types in old-growth uncut stands. In the pure pine type-group of the old-growth uncut condition, the average stand per acre is 5,670 board feet; in the pine-hardwoods, 2,930 board feet; in the upland hardwoods, 2,060 feet; and in the bottom-land hardwoods, 3,690 board feet.

The second-growth stands occupy 85 percent of the forest area, but contain only 55 percent of the board-foot volume; they therefore have a much smaller volume per acre than the old-growth stands. In the second-growth uncut sawlog-size condition, the average stand, all types combined, is 2,070 board feet; while the pure pine type-group averages 2,800 board feet, the pine-hardwoods 1,670 feet, the upland hardwoods 1,060 feet, and the bottom-land hardwoods 1,850 board feet. Although the second-growth stands have a smaller volume per acre, the relative board-foot volume by species is much the same as in the old-growth condition.

Accessibility is not a determining factor in the utilization of the timber stands, as modern logging methods function efficiently in the most rugged topography of this unit. More important is the presence of sufficient volume per acre to warrant logging operations at the present time, while leaving the stand in good condition for further production.

In figure 4 the distribution of the 2,887,400 M board feet (gross volume) on the 951,500 acres in the sawlog-size conditions of the pine and pine-hardwood type-groups is shown according to volume-per-acre classes. Stands with less than 2,000 board feet per acre occur on 46 percent of the area and contain 19 percent of the volume. Although practically all of these light stands have sufficient volume to support a logging operation now, greater yields will be obtained in the future if present cutting is restricted to thinnings, and the removal of dying and cull trees, leaving the better trees to increase in volume and quality. About 41 percent of the total volume is found in stands of more than 5,000 board feet per acre, concentrated on less than 150,000 acres largely in private ownership.

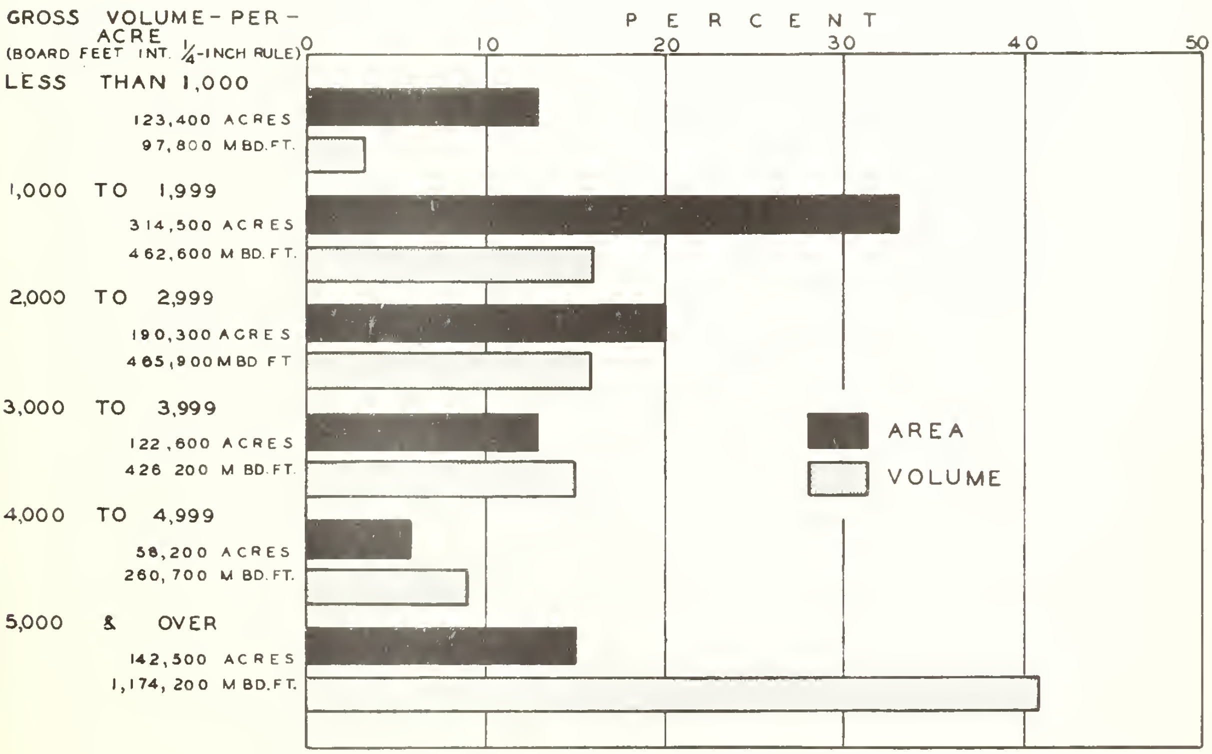

FIGURE 4 - PROPORTIONAL AREA AND VOLUME OF THE SAWLOG-SIZE CONDITIONS IN THE PINE AND PINE-HARDWOOD TYPES, CLASSIFIED ACCORDING TO VOLUME OF SAW TIMBER PER ACRE.

Cordwood volume

The estimate of cordwood volume, as shown in table 6, includes the entire stand of sound trees at least 5.0 inches d.b.h., outside bark, and in addition the net sound volume in cull trees 5.0 inches d.b.h. or larger. These volumes are expressed in terms of standard cords (4 x 4 x 8 feet), containing 90 cubic feet of pine or cypress wood with bark, and 80 cubic feet of hardwood including bark. The volume shown under "sound trees sawlog size" includes only the merchantable sawlog portion of saw-timber trees. The portion of the stem above the sawlogs is given under "upper stems of sawlog-size trees," which in pines includes only the stem to a variable diameter but not less than 4 inches, while in hardwoods the usable limbs are also included to a 4-inch minimum diameter. Although "sound trees under sawlog size" include no limbs, they do include the full stems of both pines and hardwoods to a variable, usable top-diameter (but not less than 4.0 inches). The volume shown under "cull trees" is the estimated, sound, usable portion of such trees. Deduction from the volume of all trees is made for woods cull, such as rot, fire-scar, crook, bad knots, and other defects. While the volume shown for "upper stems" and cull trees is not used generally, it is nevertheless a potential source of supply.

Table 6. - Net volume in various classes of sound material, expressed in cords of wood with bark.

Species-group	Sound trees sawlog size	Upper stems of sawlog-size trees	Sound trees under sawlog size	Cull trees	Total all classes	Proportion of total
	- - - -	- - - -	Cords	- - - -	- - - -	Percent
Pines	5,537,200	637,900	1,852,600	85,500	8,113,200	33.3
Hardwoods:						
Pulping	386,600	210,200	520,700	319,200	1,436,700	5.9
Nonpulping	2,629,900	1,488,400	5,167,000	5,543,000	14,828,300	60.8
Total hdwds.	3,016,500	1,698,600	5,687,700	5,862,200	16,265,000	66.7
Total all species	8,553,700	2,336,500	7,540,300	5,947,700	24,378,200	100.0
Percent of total	35.1	9.6	30.9	24.4	100.0	

Pine makes up only one-third of the total cordwood volume in the unit. Sawlog-size trees contain the bulk of the pine cordwood volume, with 68 percent in the merchantable portion and 8 percent in the upper stems. Trees below sawlog size contain 23 percent of the cordwood volume, while the sound portion of sound and rotten cull trees, comprising only 1 percent of the total cordwood volume, is relatively unimportant. Pulping hardwoods are comparatively scarce in this unit, as only 6 percent of the total volume is in these species. On the other hand, the nonpulping hardwoods comprise three-fifths of all the volume in the unit. That they are predominantly small, low-quality trees is clearly illustrated by table 6, which shows that 72 percent of all the nonpulping hardwood volume is in sound trees under sawlog size and in cull trees.

According to present standards, the supply of cordwood in this unit is not particularly favorable for the establishment of a pulp industry. A large part of the pine volume is in old-growth timber that is being converted into high-grade lumber. If the lumber industry is to continue operating in this area, it is essential that the growing stock of younger trees be reserved from cutting to provide for a future supply of saw timber. While there is a considerable quantity of small, low-quality, nonpulping hardwoods, chiefly oaks, extensive research will be necessary to develop suitable manufacturing methods and new products before any great amount will be utilized.

In figure 5 is indicated the cordwood volume of sound trees, classified by species-group and diameter-class. Sound-tree volume, as used here, includes the full stems of pines and hardwoods below sawlog size but at least 5.0 inches d.b.h.; the full stems of merchantable pines to a variable (minimum 4-inch) top; and the saw-timber portion of sawlog-size hardwoods. The volumes shown here differ from those given in table 6 in that the sound volume in cull trees (including scrub oaks) and in tops and limbs of merchantable hardwoods is not included.

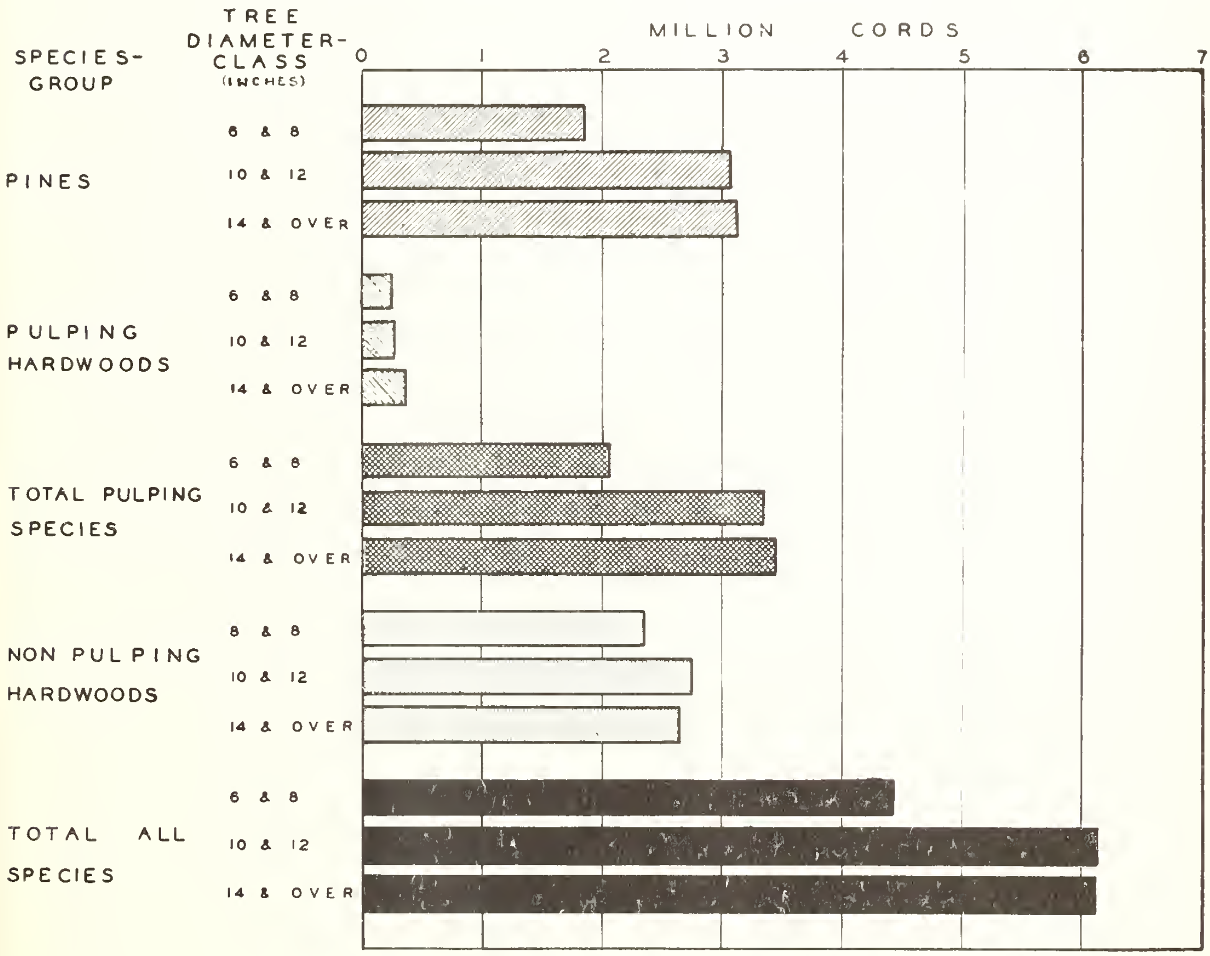

FIGURE 5 - CORDWOOD VOLUMES OF PULPING AND NONPULPING SPECIES.

Pine poles and piles

Included in previous volume estimates are a large number of pine trees that can be used for poles or piles. The number available for poles or piles in the various size- and length-classes is given in table 7, where the absence of trees suitable for the longer lengths is noticeable. For a more detailed presentation of the pole and pile situation, reference should be made to Forest Survey Release No. 28,[2] which is particularly valuable in comparing the pole and pile stands of this unit with those in nearby units.

Table 7. - Total number of pine poles or piles classified according to length and diameter

D.B.H. of trees (outside bark)	Pole or pile length (feet)					Total	Proportion of total
	20	25	30	35	40 or over		
Inches	Thousand sticks						Percent
7.0 - 8.9	619	137	48	-	-	804	20.2
9.0 - 10.9	664	285	74	31	-	1,054	26.5
11.0 - 12.9	487	409	144	66	-	1,106	27.8
13.0 - 14.9	118	283	129	58	-	588	14.7
15.0 - 16.9	20	129	102	42	-	293	7.4
17.0 - 18.9	-	43	67	27	-	137	3.4
Total	1,908	1,286	564	224	-	3,982	100.0
Percent of total	47.9	32.3	14.2	5.6	-	100.0	

Forest Increment

The annual increment of a forest stand is the net usable growth that results after mortality is subtracted from gross growth. It is measured by determining the difference in volume of the stand at the beginning and end of the year, before deducting the utilization drain for the year.

Forest increment of the unit

The actual volume changes in the forest growing stock due to increment are presented in table 8. It should be realized that the growing stock of the unit did not increase at the end of the year by the amount of the increment, since the volume of wood removed by the forest industries was considerably greater than the increment, with a consequent reduction in the forest stand.

2/ "Pole and pile timber in the Pine-Hardwood Region——West," Forest Survey Release #28, Sept. 25, 1937, Southern Forest Exp. Sta., New Orleans, La.

The increment on the pine growing stock of $2\frac{1}{2}$ billion board feet amounted to 94,300,000 board feet (lumber tally) in 1936 — a volume increase of almost 4 percent for the year. The old-growth pine stands produced 18 percent of the pine increment, sawlog-size second-growth stands produced 59 percent, and under-sawlog-size stands 23 percent.

In the hardwoods the increment on the 1.1 billion board feet of growing stock amounted to nearly 11 million board feet, equivalent to a volume increase of less than 1 percent. In the old-growth stands the loss due to mortality exceeded the annual increment by over 2 million board feet, leaving a net loss in growth. Very desirable would be a series of improvement cuttings in the old-growth hardwoods, with the object of anticipating mortality, in order that increment and mortality might both be used to satisfy drain requirements.

Table 8. - Forest increment in board feet and cubic feet in the various forest conditions, 1936

Forest condition	Saw-timber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	- - - M board feet - - -			- - - M cubic feet (inside bark)		
Old growth	16,900	-2,100	14,800	3,340	-2,300	1,040
Second growth:						
Sawlog size	56,000	2,100	58,100	12,370	160	12,530
Under sawlog size	21,300	10,900	32,200	8,050	3,240	11,290
Reproduction and clear-cut	100	negl.	100	40	negl.	40
Total all conditions	94,300	10,900	105,200	23,800	1,100	24,900

The increment is expressed in standard cords (4 x 4 x 8 feet) in table 9. All cordwood volumes in this report include bark, while all cubic-foot volumes are of wood only.

Table 9. - Forest increment in 1936, expressed in cords, in the various forest conditions

Forest condition	Pine	Hardwood	Total
	- - - - - - - - - -	Cords - - - - - - - - - -	
Old growth	42,400	-34,800	7,600
Second growth:			
Sawlog size	158,800	2,600	161,400
Under sawlog size	105,500	50,900	156,400
Reproduction and clear-cut	500	negl.	500
Total all conditions	307,200	18,700	325,900

Increment per acre of uncut stands

The per-acre growth capacity of the several forest conditions is shown in table 10. The increment given in board feet occurred only on saw-timber material; while cubic-foot and cordwood volumes include the increment on the usable length of all pines and under-sawlog-size hardwoods above 5.0 inches d.b.h., and the saw-timber portion of hardwoods 13.0 inches d.b.h. and larger. No increment on cull trees or limbs of any species is included.

Table 10. - Average increment per acre (undisturbed by cutting) in the various forest conditions, 1936

Forest condition	Pine component			Hardwood component			Total per acre		
	Bd.ft.	Cu.ft.	Cords	Bd.ft.	Cu.ft.	Cords	Bd.ft.	Cu ft.	Cords
Old growth:									
Uncut	49	9.1	.11	-13	-6.9	-.10	36	2.2	.01
Partly cut	25	6.1	.08	13	-1.7	-.03	38	4.4	.05
Second growth:									
Sawlog size:									
Uncut	70	15.6	.20	-2	-1.2	-.02	68	14.4	.18
Partly cut	48	10.3	.13	8	1.9	.03	56	12.2	.16
Under sawlog size	15	5.5	.07	7	2.3	.04	22	7.8	.11
Reproduction and clear-cut	2	.4	.01	negl.	negl.	negl.	2	.4	.01
Weighted averages	33	8.2	.10	4	.5	.01	37	8.7	.11

Forest Industries

Sawmills

By far the greater part of the lumber produced in Oklahoma is cut by sawmills operating in this unit. A field canvass of each county in the unit showed that in 1936 at least 75 mills, mostly in Le Flore, Pushmataha, and McCurtain Counties (fig. 6), were actively engaged in manufacturing lumber (table 11). Their total output, which averaged 70 percent of capacity production, was 157 million board feet lumber tally, 90 percent of which was pine. All the saw timber cut by these mills, with minor exceptions, came from within the unit boundary, and as far as could be determined, very few logs, if any, were shipped to mills outside the unit. The 24 sawmills located in McCurtain County produced about 87 million board feet of lumber during 1936, or slightly more than half the total production reported to the Census for the entire State.

Table 11. - Number of sawmills and extent of employment, classified according to size of mill, 1936

Daily (10 hrs) rated capacity 1/	Mills 2/			Employment		
	Pine	Hardwood	Total	In woods	In mill	Total
M board feet	- - - - - - Number	- - - - -	- - - - - -	Thousand man-days	- - - -	- - - -
Under 20	68	1	69	47	93	140
20 - 39	2	1	3	10	17	27
40 - 79	-	-	-	-	-	-
80 and over	3	-	3	102	202	304
Total	73	2	75	159	312	471

1/ The rated capacity indicates size of mill rather than actual average daily production.

2/ The data given here on the number of mills in the smallest class are estimates based upon all available records, supplemented by a field check.

The field canvass showed that 69 of the mills were small portable outfits, cutting less than 20 M board feet per day. These mills, whose average cut is nearly 800 thousand board feet per year, produced in 1936 about a third of all the lumber produced in the unit that year, operating at about 50 percent of their capacity. Most of the lumber cut by these small mills was finished at concentration yards at Poteau, Antlers, Clayton, Moyers, and Broken Bow, where the higher grades were also kiln dried.

Only 3 mills with a rated capacity of 20 to 39 M board feet per day were reported. One cut pine entirely, one cut both pine and hardwood, and the third cut hardwood entirely. The mill cutting only pine also operated a concentration yard, handling the rough lumber of several small portable mills. Both the mills cutting pine are equipped with circular saws, planer, and dry kiln; while the hardwood mill has a 6-foot band saw. The combined cut of these 3 mills, operating at about 40 percent of capacity was slightly over 8 million feet, or about 5 percent of all the lumber produced in the unit.

Sixty percent of the lumber cut in the unit is produced in three large mills, each of which has a total rated capacity of more than 80 M board feet per day. Two of the mills cut pine entirely, while the other operates one side as a hardwood mill of 30 to 40 thousand board feet capacity. Practically all of their timber is secured from stands classified as old growth. Animal skidding is employed, while the logs are hauled by truck an average of 10 miles and by railroad about 30 miles. These three plants operated at very near full capacity in 1936.

Other forest industries

Within the past few years there has been a decided expansion of the cooperage industry in the unit. In 1936 there were 7 cooperage plants operating, at least 5 of which were built since late 1935. Each of the 7 plants has a daily consumptive capacity of about 20 standard cords of white oak, which is used entirely for the production of tight-cooperage staves. A majority of the plants buy their timber delivered on the yard, but some buy standing timber and have it logged by contractors. These plants secured all of their requirements (amounting to 14,000 cords in 1936) from within the unit, while 2 plants in Arkansas drew an additional 3,000 cords from the unit during the same period.

The only other forest industrial plants found in the unit in 1936 were 3 shingle mills, although it is probable that there are more of these plants, which are small and difficult to locate. The 3 mills reported that they used a total of about 200 cords of wood, all from within the unit.

The production of cross ties, poles and piles, mine timbers, fence posts, and fuel wood required about 40 percent as much wood as the sawmill and cooperage industries combined. Slightly over a half million cross ties were produced in 1936, about 60 percent of which were hardwood; local railroads were the chief consumers. Only a few pine poles and piles were cut, mainly for local use. About 29,000 cords of mine timbers were cut for the coal mines of Haskell and Le Flore Counties and of adjacent coal-producing areas. All of these mine timbers were from trees below sawlog size, and 75 percent of the material was cut from hardwoods. It is estimated that 3,686,000 fence posts were produced, 96 percent of which were hardwood; 70 percent of these were used to fence land within the unit, 29 percent were commercial hardwood posts sold chiefly in the western part of the State, and 1 percent were commercial pine posts sold to treating plants either in Hugo or in Kansas City. Fuel wood, produced chiefly for home consumption by rural dwellers, was estimated to be 212,000 cords. Also a small quantity of wood shipped to veneer mills in Arkansas and Texas supplies a minor amount of woods employment.

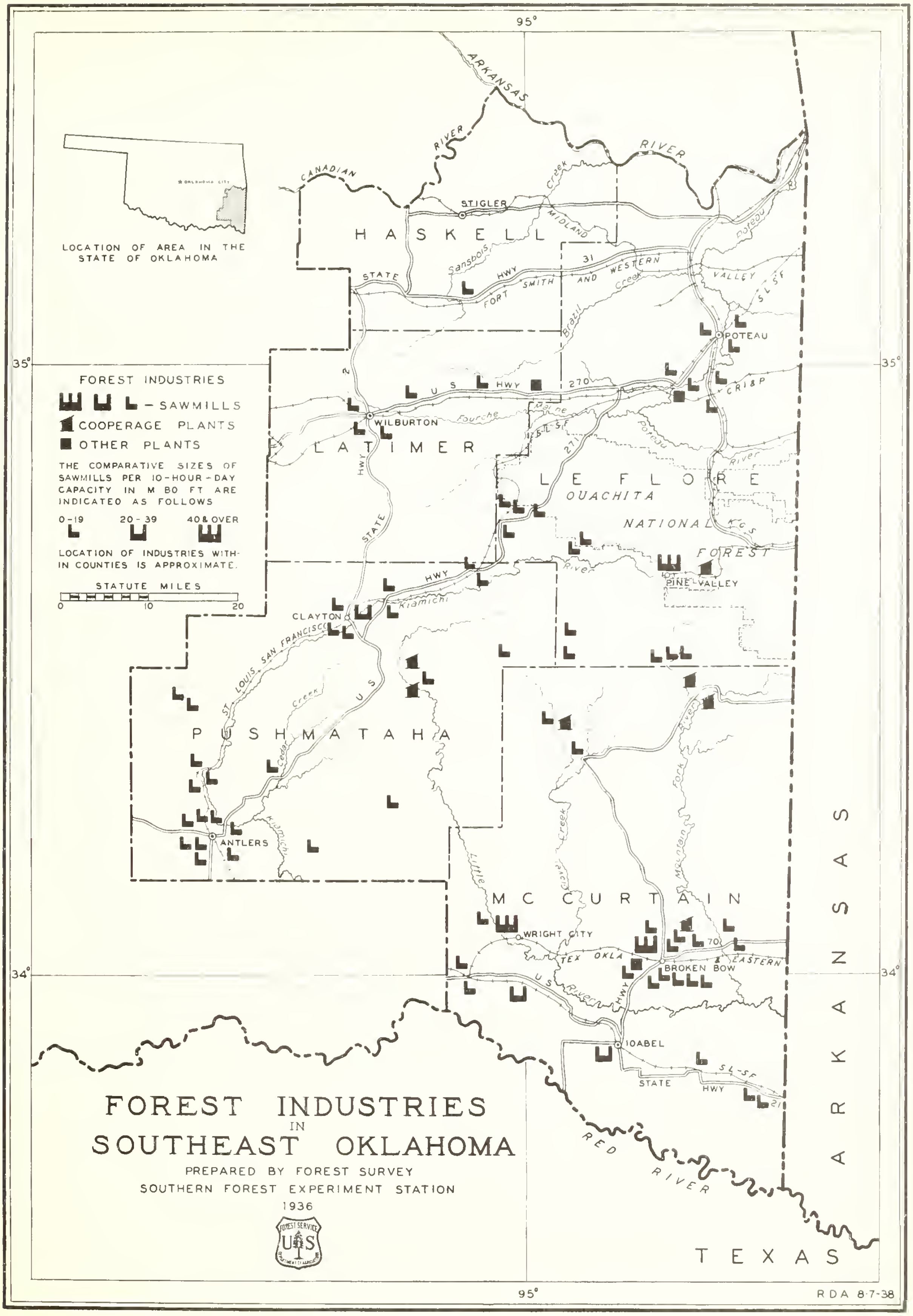

FIGURE 6 - FOREST INDUSTRIES MAP.

The production of the various forest industries, together with the incidental employment provided by them, is given in table 12. All the material produced or used, either in plants or as commodities, was taken from the forests of the unit. The mill employment is the total labor furnished by the mills within the unit, while the woods employment is based upon the material cut from within the unit, regardless of where it is manufactured. In this particular area, all the commodities listed in table 12, except a small quantity of veneer, are manufactured locally.

Table 12. - Production and employment data, 1936

Kind of plant or commodity	Number of plants	Amount produced or used	Thousand man-days of employment		
			In woods	In mill	Total
Sawmills	75	157,300 M bd.ft.	159	312	471
Veneer	-	negl.	negl.	-	negl.
Cross ties	-	517 M pieces	75	-	75
Poles and piles	-	4 M pieces	1	-	1
Fence posts	-	3,686 M pieces	47	-	47
Cooperage	7	14 M cords	16	11	27
Fuel wood	-	212 M cords	264	-	264
Miscellaneous 1/	3	2/ 29 M cords	48	negl.	48
Total	85		610	323	933

1/ Includes 3 shingle mills.
2/ Includes material used for mine props.

Employment

According to table 12, the total employment furnished by the forest industries during 1936 amounted to 933,000 man-days. This employment was distributed over a large proportion of the rural population, as many of the individuals do not work full time in the forest industries. If full-time employment were the rule and if each individual worked 250 days per year, 3,700 workers would be required. The sawmills furnished half of the total employment provided by the forest industries in the unit and nearly three-fourths of that for which wages were received. Of the 471,000 man-days furnished by this industry, 65 percent was furnished by the three mills having a capacity of more than 80 M board feet per day. Unless conditions change materially, these large mills will continue to need an equivalent amount of labor for at least the next 10 years. Aside from the sawmill industry, the production of fuel wood and fence posts required the largest expenditure of labor, accounting for a third of the total. Very little actual cash income is derived from the production of these commodities, however, as they are produced chiefly for home consumption.

Utilization Drain

Unfortunately, the drain upon the forest growing stock was cut without considering the amount of increment that was added to the stand during the year. A comparison of table 8 with table 13 shows that the total increment was 105,200,000 board feet while the drain was 208,900,000 feet, so that the growing stock decreased by 3 percent during the year. Table 13 also shows the amount of wood used by the individual forest industries or for the various commodities. The material expressed in board feet includes drain on the saw-timber section of the tree, both the used and wasted portions; while the volumes given in cubic feet include drain on saw-timber material, upper stems of sawlog-size pines, and trees below saw-timber size but at least 5.0 inches d.b.h. No material cut from limbs or from dead or cull trees is included in either case.

Table 13. - Utilization drain from sound trees, 1936

Commodity	Saw-timber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	M board feet (lumber tally)			M cubic feet (inside bark)		
Lumber	150,200	13,300	163,500	26,570	1,900	28,470
Cross ties	11,200	15,400	26,600	1,910	2,680	4,590
Poles and piles	100	-	100	30	-	30
Veneer	-	300	300	-	50	50
Cooperage	-	10,400	10,400	-	1,480	1,480
Misc. manufactures	negl.	100	100	500	1,480	1,980
Fuel wood	4,300	1,000	5,300	1,910	2,540	4,450
Fence posts	-	-	-	100	1,540	1,640
Misc. farm use and land clearing	1,900	700	2,600	770	800	1,570
Total	167,700	41,200	208,900	31,790	12,470	44,260

Comparison of Increment and Drain

Table 14 presents a summary of the effect of growth, mortality, and utilization drain upon the board-foot growing stock during 1936, expressed in lumber tally. The only conclusion to be drawn from it is that the forests of the unit are being greatly overcut, since total drain is twice as great as the increment.

Table 14. — Balance between increment and drain of saw-timber material

Item	Pines	Hardwoods	Total
	- - - M board feet (lumber tally) - - -		
Net growing stock, Jan. 1, 1936	2,514,300	1,106,500	3,620,800
Growth, 1936	120,800	56,700	177,500
Mortality, 1936	26,500	45,800	72,300
Forest increment, 1936	94,300	10,900	105,200
Utilization drain, 1936	167,700	41,200	208,900
Net change in growing stock, 1936	-73,400	-30,300	-103,700
Net growing stock, Jan. 1, 1937	2,440,900	1,076,200	3,517,100

As these are end figures, however, a further appraisal of the situation may lead to a better understanding of the relation between increment and forest use. In the pine species, it is estimated that nearly 100 million board feet, or 59 percent of the total annual drain, was cut from old-growth timber. In table 8, the increment in old-growth pine is seen to be only 17 million board feet; therefore timber of this quality is being removed nearly 6 times as fast as it is growing. With this large reduction in the forest capital occurring annually, it is estimated that the major portion of the old-growth pine timber will be cut in the next 10 to 15 years. Whether this will mean the end of those plants now operating in virgin timber will depend upon the steps taken to assure a continuing timber crop. The present drain of second-growth pine does not quite equal the board-foot increment, but as the excess of increment over drain was only 9 million feet in 1936, it is apparent that the second-growth forests have scant opportunity to produce the equivalent of the overcut in the old-growth timber. Actually, the sawlog-size conditions of the second-growth stands produced only 56 million board feet of increment, and since these are the stands from which most of the 68 million board feet of second-growth pine was taken, it is obvious that the merchantable second-growth pine stands also are overcut. In the under-sawlog-size pine stands, the increment amounted to 21 million board feet, but as there is little merchantable volume per acre in these stands, most of this increment must be allowed to accumulate for at least several years.

The drain on the hardwood species is about four times the increment. Sixty percent of this drain is from old-growth timber with most of the remainder from sawlog-size second-growth stands. Because of the high mortality, mainly in the old-growth stands, there is no surplus of increment to help satisfy drain requirements. In the stands now below sawlog-size, there was an annual increment of 11 million board feet, but this will generally remain unutilized until these younger stands attain a merchantable volume. Although increment and drain were badly out of balance in 1936, there is an opportunity to alleviate this situation by utilizing the trees that contribute to the excessive mortality. In 1936, the mortality of hardwoods was 46 million board feet, or 5 million more than the total volume of hardwood that was utilized. If the volume lost through mortality in 1936 could have been anticipated and utilized to satisfy a part of the drain requirements, the deficit shown in the table could have been reduced correspondingly. Old-growth stands and old trees in younger stands in the hardwood types are frequently in such poor growing condition that their early removal is indicated, even though it may result in an apparent reduction of the growing stock. Such trees do not contribute to the annual increment.

The effect of increment and drain upon the total sound-tree growing stock above 5.0 inches d.b.h. is presented in cubic feet inside bark in table 15. Although there is an additional large volume of cubic-foot increment in the trees below sawlog size, the drain exceeds increment by nearly 20 million cubic feet. This disparity could be reduced by 8 million feet if cull trees were used for all fuel wood, fence posts, and mine timbers.

Table 15. - Balance between increment and drain in cubic feet

Item	Pines	Hardwoods	Total
	- - M cubic feet (inside bark) - -		
Growing stock, Jan. 1, 1936	625,570	565,630	1,191,200
Growth, 1936	30,060	24,740	54,800
Mortality, 1936	6,260	23,640	29,900
Forest increment, 1936	23,800	1,100	24,900
Utilization drain, 1936	31,790	12,470	44,260
Net change in growing stock, 1936	-7,990	-11,370	-19,360
Net growing stock, Jan. 1, 1937	617,580	554,260	1,171,840

Summary and Future Outlook

Southeast Oklahoma is a mountainous, timbered region, with relatively poor transportation facilities and a declining population. In this area the further expansion of agriculture seems ill-advised because of the general low soil productivity, rugged topography, and severe erosion. The effect of these factors is seen in the high proportion of crop failure, small yields per acre, and high percentage of tax delinquency on farm land.

At present, 74 percent of the unit area is forested. Although only 3 million acres in extent, this timber land is highly important to Oklahoma, as it is the chief source, within the State, of lumber and other forest products. The optimum area to be retained in forest growth can be determined only through an intensive study of the land itself, but in general it appears that more of the upland soils should be used for timber production.

As agriculture has failed to utilize the land profitably, and since coal mining has declined in importance, future opportunities for employment may depend largely upon growing a forest crop for the wood-using industries. Such employment, however, cannot be increased and made permanent until the unfavorable balance between increment and drain is remedied. In 1936 the drain upon the forest was practically twice the forest increment. If it were not for the large quantity of small trees in the stand, upon which growth is constantly accumulating, such excessive use would mean the exhaustion of the forest, for commercial use, within a few decades. Even now, the large sawmills cutting in old-growth timber must close down within the next 10 or 15 years if their continued operation is predicated upon the use of virgin timber. Should they cease operating, about 75 percent of the wages now received for employment in the forest industries would be lost.

It is essential that the balance between growth and drain be restored if there is to be future security for the wood-using industries and the wage earners of this section of Oklahoma. One way to achieve a balance would be to reduce abruptly the annual commodity drain to about 60 percent of the present annual increment, and to hold the cut at this ratio for several decades until the growing stock of the region becomes built up sufficiently to justify a greater cut. But in the face of the present urgent need for industrial activity as a source of labor, such a course is impractical. The balance must be achieved by increasing the increment rather than by reducing the cut.

By adoption of appropriate forestry measures, it should be possible to double the increment. First should be the establishment of a unit-wide system of fire control that will greatly reduce the annual loss from fire. The State Division of Forestry already has an organization that could be expanded to the requisite size, and with (a) adequate financial support from the State and Federal Governments, and (b) the acceptance of fire-control principles by the local inhabitants, unit-wide fire prevention could become a reality. The elimination of frequent fires will do much to increase the growth of individual trees and will, in itself, greatly increase the density of the stands by preserving trees already established and by allowing new trees to become established. Additional measures, however, are needed, which comprise, in general, the management of the forest under a system of selective cutting. Briefly, this consists of making light cuts at frequent intervals, keeping the cut of growing-stock trees at somewhat less than the increment until full stocking is achieved. In this area an opportunity exists to remove a large volume of cull, dying, and hyper-mature trees, especially in the old-growth hardwoods, to satisfy some of the less exacting drain requirements, so that for the next few years the total cut could safely exceed the volume of increment occurring upon the sound-tree growing stock. Utilization of the volume in the "poor risk" trees will make it possible to reserve some of the increment of the better trees for later use, and at the same time put the forest in much better condition for growth. The ultimate object should be to build up a stand of vigorous, rapid-growing trees that fully utilize the growing space. In addition, where the soil is fertile enough for timber production, areas that will not restock naturally should be planted. Young second-growth stands should be thinned sufficiently to maintain the growth rate, whenever this is economically profitable. Successful application of a selective cutting system to the forest of southeast Oklahoma, coupled with protection from fire, eventually should double the increment as well as increase greatly the quality and value of the timber produced.

Since this area contains almost all the timber supply of the State, it is logical that the State should contribute to a program of increasing forest production on a sustained-yield basis. The maintenance of a State Division of Forestry and an Extension Service is essential if this region is to increase greatly its production of timber. The State appropriation for fire control should be commensurate with the contributions of the Federal Government and private owners; and the task requires that all three participants spend more for this purpose than they are now doing. Taxes on forest land should be levied on an equitable basis throughout the forest area and be held at a minimum. The State should establish demonstration forests and should also establish forests in localities where private enterprise cannot profitably own and manage the forest land. Furthermore, the State should strive to promote new industries that can use forest material now going to waste (e.g., small, low-quality hardwoods). State laws to govern cutting practices would insure that the forest stands were left in a productive condition, would equalize the problem of maintaining good practice among the forest owners, and would help protect the public's interest in its forest resource.

The Federal Government can assist by cooperating with the State in financing fire protection and forestry extension work. In this connection, the training of foresters to assume the duties of county agricultural agents, in heavily timbered counties, has been advocated; this seems very worthwhile. In communities where it is not possible for private capital or the State to manage the forest land, National Forests should be established to serve as demonstration areas and to contribute toward the stabilization of local forest industries. The Federal Government, through its forest experiment stations, should maintain and extend its program of research in silviculture, in management, in forest influences, and in wood utilization. Owing to the long-time character and wide application of much of this research, it is appropriate that it be financed and developed in this manner.

If the present overcutting of the timber resource continues, forest industrial activity must decline in this area. Under present practices, employment in the forest industries will be reduced greatly within the next 20 years. This reduction in employment either will greatly accelerate the movement of population out of the unit or will force more people to turn to agriculture on land that is even now generally incapable of supporting the farm population at a reasonable standard of living; either course will be detrimental to the economic welfare of the region. On the other hand, the above program, which is designed to assure a permanent and increasingly usable forest resource, will go far toward maintaining, or even improving, the economic status of the area through increasing employment and providing more raw material for industry.

It is obvious that the development of the forest stands of southeast Oklahoma to their maximum productivity is no small task, or one that can be accomplished in a decade. It will require a well-planned program of action, continued under strong leadership, over a long period of years. Private landowners alone cannot be expected to make or sustain such an effort; it will require the assistance of both the State and Federal Governments, coordinated with private forest industries and the general public.

FOREST SURVEY RELEASE NO. 38 NOVEMBER 3, 1938

FOREST RESOURCES OF CENTRAL AND SOUTH FLORIDA

A Progress Report

by

THE SOUTHERN FOREST SURVEY

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SOUTHERN FOREST EXPERIMENT STATION

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New Orleans, La.

FOREWORD

The nation-wide Forest Survey, being conducted by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products, (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products, and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies may be formulated for the effective use of land suitable for forest production.

This release, which should be regarded only as a progress report, is based on a field survey made Dec. 21, 1935, to Apr. 18, 1936. It contains Forest Survey data that will be included in complete reports to be published later and that, although considered reliable, are subject to correction or amplification as the work of computation proceeds; while item 4 above, which is being studied on a national basis, is not discussed in this report.

In the presentation of these survey data, it is to be noted that, owing to the sampling method used in collecting them, the greater the number of samples in any given classification the more accurate are the data for that classification. Hence classes that are of infrequent occurrence and relatively small in quantity generally cannot be determined with as high a degree of accuracy as classes that occur more frequently and in substantially greater quantities. Small tabular items are to be taken as showing, not the exact magnitude of the classes involved, but their relative magnitude in comparison with those of other classes.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

Staff Assignment

Preparation of Report - A. R. Spillers, Associate Forest Economist
In Charge of Field Work - W. E. Houser, Associate Timber Expert
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Note: The Southern Forest Experiment Station hereby wishes to acknowledge the clerical assistance received from the Works Progress Administration in the preparation of this Release.

FOREST RESOURCES OF CENTRAL AND SOUTH FLORIDA

General Description

The part of Florida treated in this report includes the more than two-thirds of the "peninsula" of the State extending south of the Withlacoochee River to the tip of the State. For greater ease in description and discussion, this area has been divided into two parts: central Florida, with 20 counties lying generally north of Lake Okeechobee; and south Florida, with 10 counties occupying the southern tip of the State (see map, fig. 1). This is Florida's tourist playground and the center of citrus and truck-crop production. The tourist trade, estimated to bring into the State between 200 and 300 million dollars annually, is probably its greatest industry, and is followed in importance by agriculture and forest industries. Miami, Tampa, and St. Petersburg are the largest cities and the principal seaports. Although the forests, which play an important role in making this entire area attractive to tourists, generally have been severely burned and cut, they still claim approximately 54 percent of the land area (table 1) and furnish raw materials for many forest industries. Longleaf pine predominates in central Florida, and slash pine and cypress in south Florida.

Lying entirely within the Coastal Plain, the area is generally low and flat with expanses of swamps and prairies, although in the ridge of sand hills that run southward through the middle of central Florida are found elevations that rise to about 300 feet above sea level. The area contains hundreds of lakes, of which the largest, Lake Okeechobee, is about 30 miles wide; and the numerous slow-moving streams provide only poor drainage for most of this section. The famous Everglades, a large expanse of saw-grass marsh dotted in many parts with "islands" of cypress and hardwood, is the dominant topographic feature of south Florida.

Soils in central Florida are generally sandy, with the soils of the Norfolk series on the hills and those of the Leon with its characteristic "hardpan" in the flatwoods. In south Florida, swamp and peat soils are commonly found around and south of Lake Okeechobee and in a strip along the Gulf Coast; while sandy soils (usually of the Leon series) occur upon the higher land west of the Lake and in a long narrow strip along the East Coast. Limestone rock underlies much of the area, outcropping in many places in south Florida.

Excellent transportation facilities are available except in the Everglades and in the Big Cypress Swamp in Collier County. The Florida East Coast Railway, the Seaboard Air Line, the Atlantic Coast Line, and several other lines serve the area. There is an excellent road system involving many hard-surfaced highways and country roads. There are several ports with deep-water harbors including Tampa, St. Petersburg, Miami, and Key West; and the Intracoastal Canal has been improved recently along the Atlantic Coast as far south as Miami. Water-transportation facilities for barges and small craft are also available on the St. Johns, the Withlacoochee, and the Caloosahatchee Rivers, on Lake Okeechobee, and on some of the drainage canals.

The rapidly growing population was 777,000 in 1930, and, unlike in the remainder of Florida, more than six-tenths of the people live in towns and cities of 2,500 or more. Either directly or indirectly, the majority of the people are dependent upon the tourist business, which is at its peak in the winter and is centered chiefly along the coasts and in the "lake and hill" region. Agriculture is important, although of the total area of 18 million acres, only $2\frac{1}{4}$ million is included in farms; less than one-third of this is cropland, according to the Agricultural Census of 1935. Both the total area in farms and that in cropland showed rapid increases from 1930 to 1935. Agriculture is chiefly concerned with citrus and truck crops and cattle grazing. Forest industries provide large quantities of products for expanding local markets as well as for northern and midwestern markets and for export. Industries of less importance include mining of limestone, phosphate, clay, and fuller's earth; the manufacture of cigars; and the taking of fish, sponges, oysters, shrimp, and turtles.

For the forest area alone, data from a recent study made by the Division of State and Private Forestry of Region 8 of the United States Forest Service and from the 1935 Census of Agriculture disclose the fact that about 6 percent is publicly owned, 10 percent is in farm woodlands, and 84 percent is in other private ownership. Most of the publicly owned land is in parks and reserves not managed for the sustained-yield production of timber. As for the non-farm privately-owned forest land, a study made of the forest management practices on 22 properties with an aggregate acreage of $1\frac{1}{2}$ million acres showed the following:

Lands left in good growing condition:	
Good cutting practices	9 percent
Poor practice but land left productive	15 percent
Lands not left in good growing condition	76 percent
Total	100 percent

Table 1. - Total land area classified according to land use

Land use	Central Florida		South Florida		Total area	
	Acres	Percent	Acres	Percent	Acres	Percent
Forest:						
Productive	6,170,000	60.8	2,167,800	27.4	8,337,800	46.2
Nonproductive	150,000	1.5	1,352,200	17.1	1,502,200	8.3
Total forest	6,320,000	62.3	3,520,000	44.5	9,840,000	54.5
Cropland and pasture	1,049,500	10.4	404,300	5.1	1,453,800	8.1
Other areas	2,764,900	27.3	3,986,700	50.4	6,751,600	37.4
Total area	10,134,400	100.0	7,911,000	100.0	18,045,400	100.0

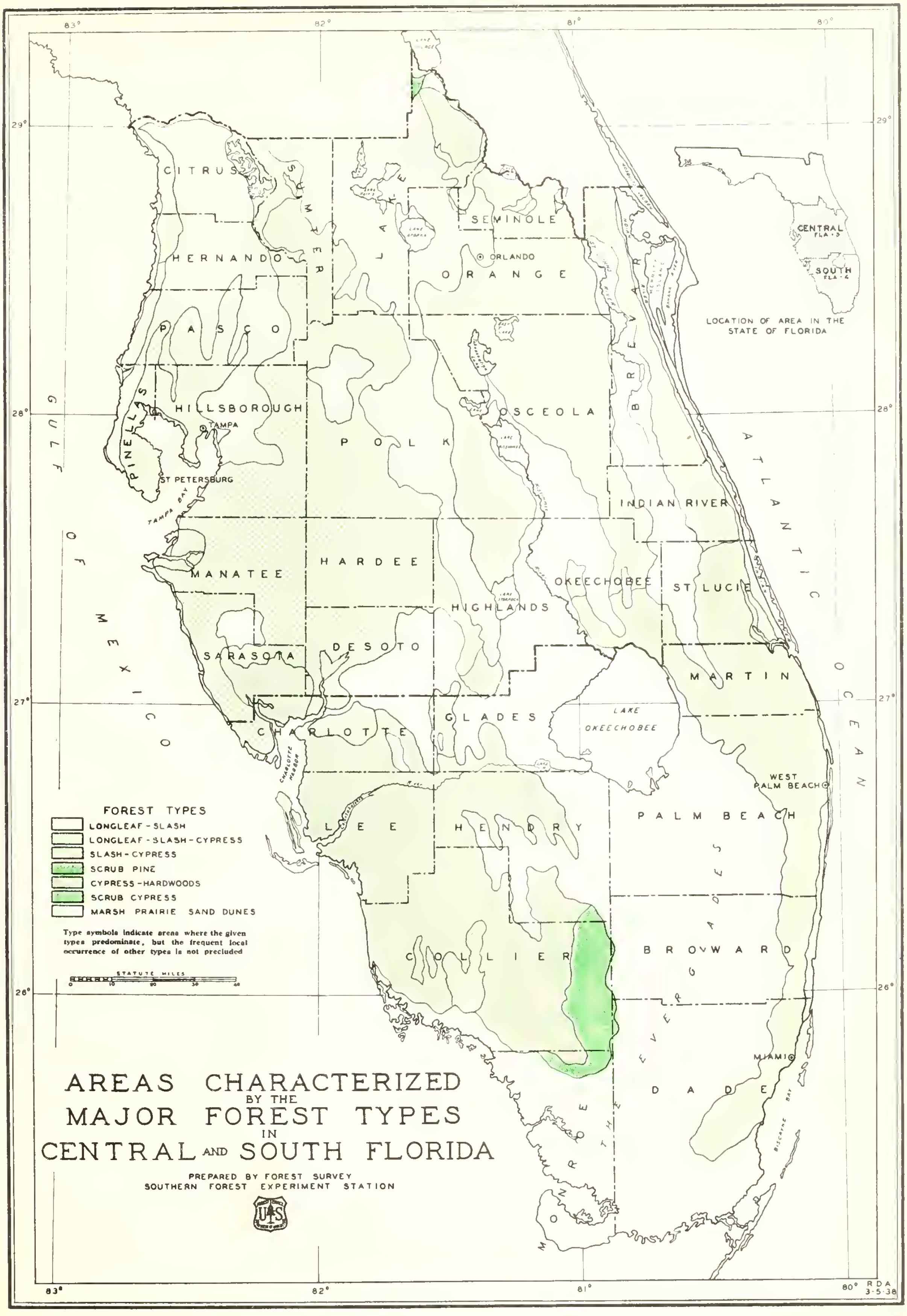

FIGURE 1 – FOREST TYPE MAP.

Only 13 percent of the land is owned by farmers, the remainder being held largely by land speculators, lumber companies, turpentine operators, and public agencies. In August 1934, approximately one-third of all the area was in tax default and theoretically owned by the State, although this may be a temporary condition, for the original landowners are seldom deprived of the use and occupancy of the property. In table 1 the land area of central and south Florida is classified by land use. Notwithstanding the huge areas in open prairies and marshes classified under "other areas", 46 percent of the land surface is productive forest land.

Description of the Forest

Inasmuch as the $1\frac{1}{2}$ million acres of nonproductive forest land, most of which is in south Florida, is of little or no value for timber growing, being suitable chiefly for grazing and for hunting and other types of recreation, the present discussion concerning the forest will deal only with the 8 million acres of productive forest land.

Table 2. - Forest area classified according to forest condition

Forest conditions	Central Florida		South Florida		Entire area	
	Area	Portion of forest area	Area	Portion of forest area	Area	Portion of total forest area
	Acres	Percent	Acres	Percent	Acres	Percent
Old growth						
Uncut	239,100	3.9	248,400	11.5	487,500	5.9
Partly cut	233,300	3.8	79,100	3.6	312,400	3.7
Total	472,400	7.7	327,500	15.1	799,900	9.6
Second growth:						
Sawlog size:						
Uncut	731,300	11.9	278,000	12.8	1,009,300	12.1
Partly cut	195,400	3.2	33,500	1.5	228,900	2.7
Under sawlog size	1,690,000	27.3	716,500	33.1	2,406,500	28.9
Reproduction	357,800	5.8	95,800	4.4	453,600	5.4
Total	2,974,500	48.2	1,123,800	51.8	4,098,300	49.1
Clear-cut	2,723,100	44.1	716,500	33.1	3,439,600	41.3
All conditions	6,170,000	100.0	2,167,800	100.0	8,337,800	100.0

Approximately two-thirds of this forest lies in the flatwoods, the remainder being almost equally divided between the rolling uplands and the swamps, bays, and ponds. Longleaf and slash pines, the species worked for naval stores (turpentine and rosin), predominate on 79 percent of the forest area; loblolly pine and other nonturpentine pines, on 2 percent; hardwoods, on 9 percent; and cypress, on 10 percent. Figure 1, which gives only the broad distribution of predominating species and species-groups, does not attempt to outline the nonforest land or the intermingled small areas of different types. The longleaf and slash pine types are found in all topographic situations; in central Florida, longleaf pine predominates, while in south Florida slash pine is the more common species. The former area, which includes most of the loblolly and other pines usually associated with the rolling uplands, also includes most of the hardwoods (such as red and black gums and red and white oaks), which are usually found in the swamps, bays, and ponds. Cypress also prefers these latter situations, but occupies a larger area in south than in central Florida.

Less than 10 percent of the forest area is classed as old growth, with the characteristics of large, old, high-quality trees (table 2 and fig. 2). Much of the old growth is partly cut, i.e., 10 percent or more of the saw-timber volume has been removed, but at least 1,000 board feet per acre of hardwood and cypress or 600 board feet of pine and mixed pine-hardwoods, have been left. "Sawlog-size" hardwoods are 13.0 inches and over d.b.h. (diameter at breast height, or $4\frac{1}{2}$ feet above the ground) and sawlog-size pine and cypress trees are 9.0 inches or larger d.b.h. A few of the tracts average more than 10,000 board feet per acre, as measured by the International $\frac{1}{4}$-inch rule, which in general is equivalent to green lumber tally, but the averages for the uncut old growth are about 4,200 board feet in central Florida and 3,200 board feet in south Florida, and for the partly cut old growth, 2,400 and 1,600 board feet, respectively. Cypress and hardwood stands are usually heavier than the average, while the pine stands are lighter.

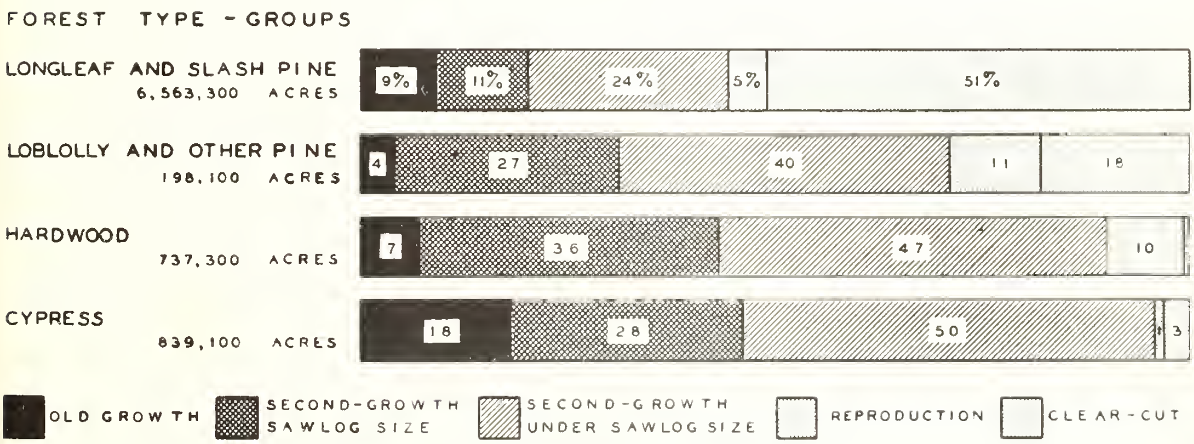

FIGURE 2 - CLASSIFICATION OF THE AREA IN EACH FOREST TYPE-GROUP ACCORDING TO FOREST CONDITION.

From an area standpoint, the most important forest condition is the second growth, which occupies almost half the forest area. Second-growth stands having a minimum of 600 board feet per acre if uncut, or 400 board feet if partly cut, in trees that have reached sawlog size, occupy only 15 percent of the total forest area. The average of the uncut, second-growth stands is about 2,000 board feet (green lumber tally) per acre in central Florida, and 1,600 in south Florida. Under-sawlog-size stands made up chiefly of pole or sapling-size trees are found on 29 percent of the forest area; and although average saw-timber volumes run between 100 and 200 board feet per acre, usually in remnant trees, they contain an average of about 2 cords per acre. Reproduction areas, where the most important cover is trees in the seedling stage less than 1 inch d.b.h, occupy 5 percent of the forest area and are found mostly in central Florida. All reproduction areas have been naturally reforested with at least 80 seedlings per acre, but owing principally to the frequency of fire, both the number and distribution of the seedlings are generally poor, as indicated by the following classification:

General stocking classification	Central Florida	South Florida
	- - - Percent - - -	
Satisfactory (more than 900 well-distributed seedlings per acre)	4	11
Fair (170 to 900 well-distributed seedlings, or 300 or more seedlings with fair distribution)	41	33
Poor (80 or more poorly distributed seedlings)	55	56
Total	100	100

Almost barren of both trees and seedlings, 41 percent of the forest land is "clear-cut," stripped of trees as the result of clear-cutting and fire. Central and south Florida have the unfortunate distinction of containing by far the highest proportion of clear-cut area found in any section of the South. For all pine types combined, approximately half the area is clear-cut. In about 27 percent of the pine clear-cut area, there are no seed trees; on 18 percent, one seed tree per acre; on 14 percent, two seed trees; and on 41 percent, three or more per acre. The development of reproduction from these seed trees, however, depends largely upon the escape of seed from birds and rodents and of the seedlings from the ravages of fire.

As shown graphically in the stand diagrams (fig. 3), the entire area has a growing stock of about 606 million sound living trees, chiefly in the 2-inch and 4-inch classes 1/. There are, in addition, large numbers of living cull trees, both sound and rotten, which contain some material useful only for pulpwood, fuel wood, etc. In number, these cull trees make up more than one-third of the forest stand.

The site quality, or productivity of the forest areas, based upon the average height (in feet) of dominant trees at the age of 50 years, is generally poorer than that found elsewhere in Florida or in the southern pine region as a whole. Of the sites dominated by pines, only 2 percent are good, with an index of 80 feet or better; 44 percent are medium, with an index of 60 to 70; while 54 percent are poor, with an index of 50 feet or less. The line separating the two units discussed herein represents in a general way the southern limit of profitable forestry possibilities. Nevertheless there may be a few areas in south Florida suitable for profitable management; while in central Florida there are undoubtedly large tracts of forest land where the sites are so poor that the cost of growing timber would be prohibitive.

1/ The 2-inch class includes all trees 1.0 to 2.9 inches (inclusive) d.b.h., the 4-inch class, those 3.0 to 4.9 inches d.b.h., and so on.

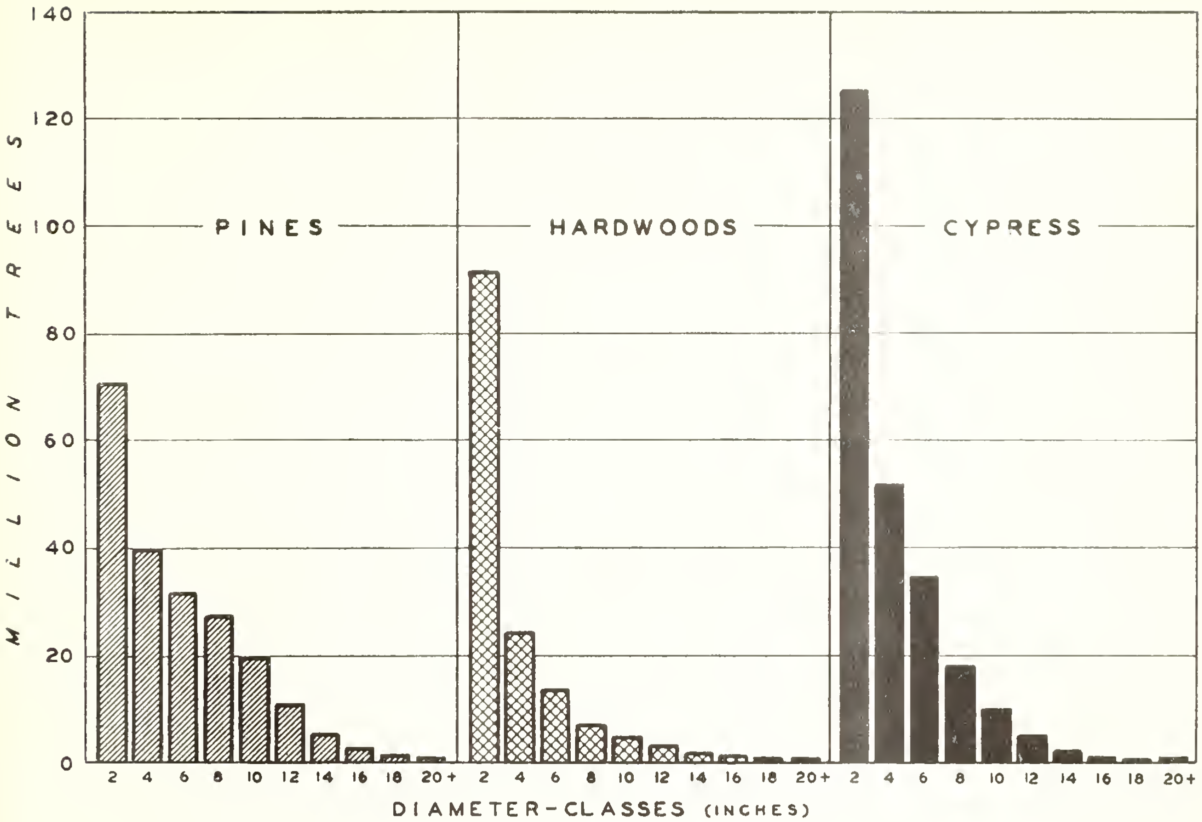

FIGURE 3—STAND DIAGRAMS.

A graphic picture of the condition of the longleaf and slash pine forests of central Florida is shown (fig. 4) by comparing the age-class and volume distribution of the present forest (shown by solid line) with those attainable under management (shown by dotted line). The managed forest is based on an assumed rotation of 70 years for the production of naval stores, lumber, poles, cross ties, and pulpwood as integrated crops. The yields are shown in gross volume, i.e., nothing has been deducted for woods or mill cull, but as a partial equalizing factor the volumes in butts of turpentined trees are excluded. That the estimated yields of the managed forest are attainable within a reasonable length of time, over large areas, through fire protection, planting, stand-improvement cutting, conservative turpentining, and selective logging is indicated by the yields actually found in the best 10 percent of the uncut field plots, adjusted to conform to the weighted-average site. In the managed forest, the area is divided into 7 equal parts — one for each 10-year age-class. The average gross volume per acre in cubic feet (i.b.) of the growing-stock trees increases with fair rapidity until the 31- to 40-year class is reached, after which the increase in volume per acre per decade is small, suggesting that a rotation of 40 years for naval stores and pulpwood may be more profitable than the longer 70-year rotation for saw timber and similar products.

Comparing the average volumes per acre, age-class for age-class, of the existing forest with those of the managed forest discloses the fact that they are far under the possibilities of the sites involved. It will take years of careful cutting practices and good protection from fire to build up the present, thin, open stands of pine with a high proportion of cull trees to thrifty stands with the number of trees and the volume that the soil and climate is capable of sustaining. It is also apparent that in the forest as it exists the area distribution of age-classes is badly out of proportion, in that approximately 59 percent of the area is now in the 0- to 10-year age-class, most of which is clear-cut. Only one age-class, viz., the 21- to 30-year, has an area distribution (10 percent of the total) even approximating the ideal 14.3 percent. Also, about 9 percent of the present area is occupied by stands that are over 70 years old and grow very slowly.

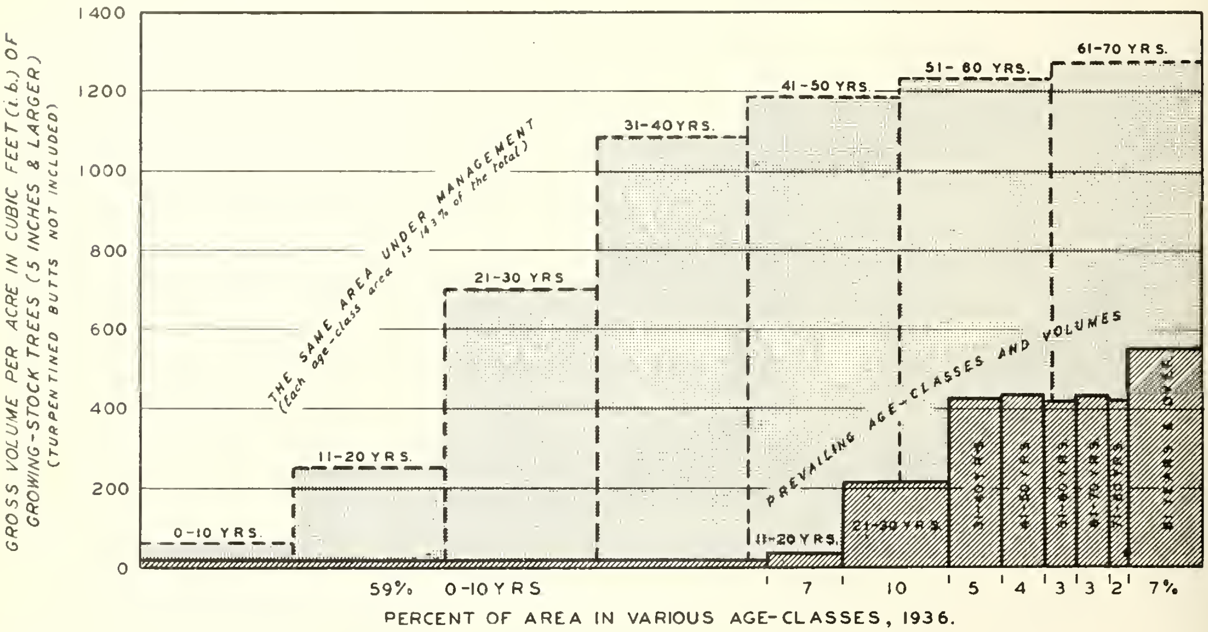

FIGURE 4 – PREVAILING AGE-CLASS AND VOLUME DISTRIBUTION COMPARED WITH THOSE ON THE SAME AREA UNDER MANAGEMENT (BASED ON LONGLEAF-SLASH PINE TYPE AREA OF 5,001,800 ACRES).

Gum Naval Stores Industry and Resources

This area furnishes only 3 percent of the annual production of gum naval stores in the United States. During the 1934-35 season (year beginning March 1), there were 23 gum naval stores distillation plants in central Florida and none in south Florida (map, fig. 5). The gum yields of trees in south Florida are considered too small to support commercial operations. At the beginning of the 1936-37 season there were 385 crops of cups (10,000 cups to a crop) in operation in central Florida, mostly in second-growth timber, and the season's production amounted to about 14,550 units 2/. The average yield for crops worked through the season was about 42 units, which was also about the average for the entire naval stores belt. According to prices received at the Savannah naval stores market, the production was worth about $900,000.

2/ A unit is one 50-gallon barrel of turpentine together with 3-1/3 500-pound (gross weight) barrels of rosin.

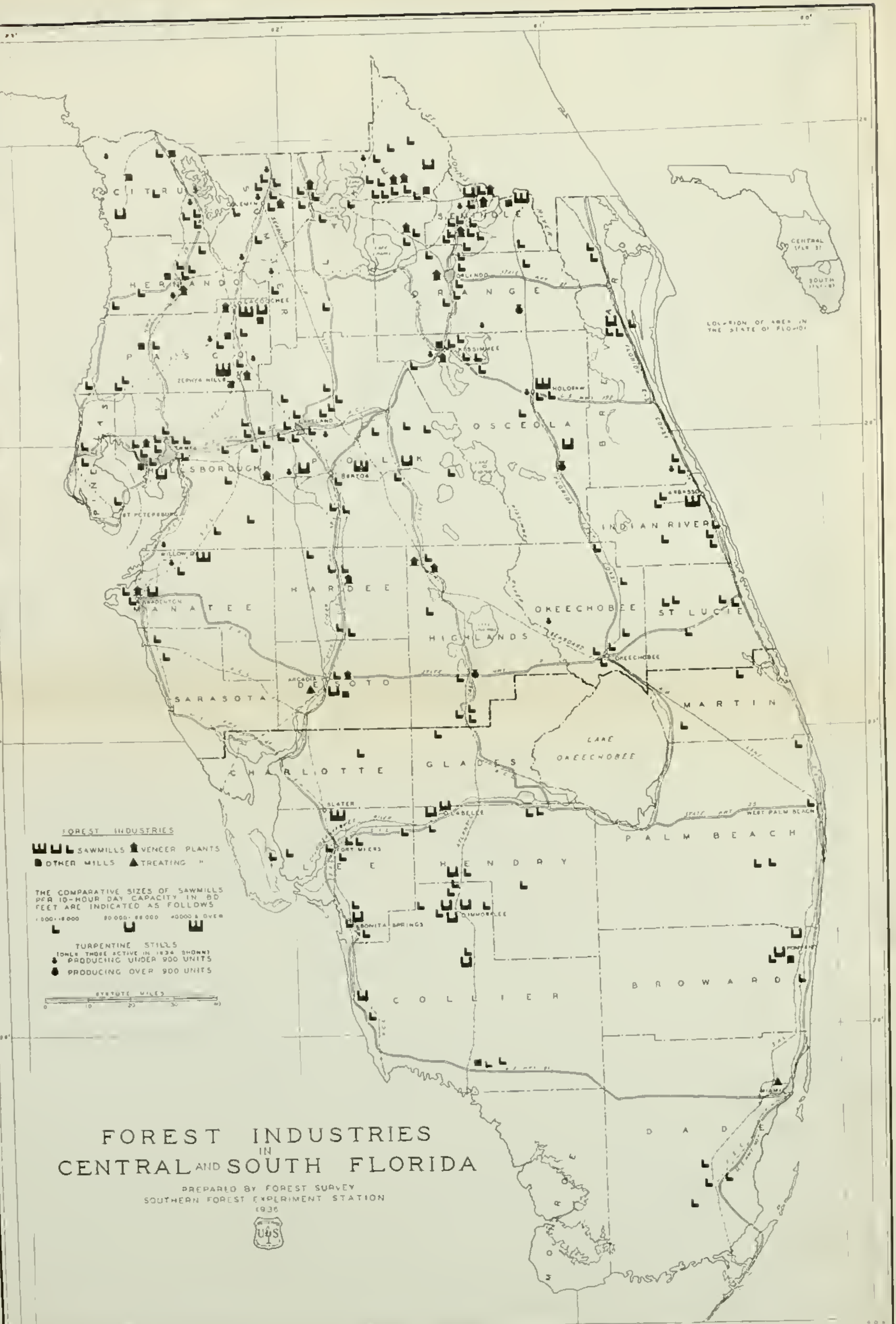

FIGURE 4.—FOREST INDUSTRIES MAP

Since very few areas in south Florida offer opportunities for commercial naval stores operations, the following discussion will be concerned entirely with central Florida. Here the tracts which make up the "turpentine area," an aggregate of about 5 million acres, are capable of supporting commercial naval stores operations, although many of them include intermingled nonturpentine forests and clear-cut areas. Tracts that are inaccessible or that are small and isolated (roughly estimated at about one-fifth of the turpentine area) may not be worked. Also, some of the poorer stands, generally found south of Tampa and Wabasso, have low productive capacity and may not be worked profitably except in times of high prices for naval stores.

The various tracts of the turpentine area are classified according to their history as follows: "round," "working," "resting," and "worked-out." Round areas, aggregating 4,085,000 acres, have not yet been worked and are characterized by unturpentined longleaf and slash pines ranging from reproduction to old growth. Working areas, with a total of 157,000 acres, have trees that were being cupped in the 1935-36 season; approximately half of these have at least 12 cups per acre. Resting areas have stands that are not being cupped at present but which have sufficient opportunities for another commercial operation by working a second set of faces on the worked trees and a first set of faces on round trees that have reached turpentine size since the earlier cupping. In worked-out areas the present working possibilities are exhausted, and operations must await the growth to workable size of an adequate number of round trees. The resting area includes 312,000 acres; the worked out, 631,000 acres.

The supply of trees for cupping for present naval stores operations and for those in prospect for several decades in the future must come from a total of about 139 million round, working, and resting longleaf and slash pines now standing in the turpentine area (table 3). Over 93 percent of these trees are round, and there are about 8 times as many round trees 9 inches and over as there are working trees.

Table 3. - Round, working, resting, and worked-out longleaf and slash pine trees on turpentine areas of varying history during the 1935-36 season

Turpentine area	Round trees: 1.0-8.9 in. d.b.h.	Round trees: 9.0 in. d.b.h. & over	Working trees	Resting trees	Worked-out trees	Total	Proportion of total
	M trees						Percent
Round-timber area	92,252	17,669	-	1,481	191	111,593	79.2
Working area	5,804	228	2,434	119	112	8,697	6.2
Resting and worked-out areas	12,703	1,240	-	5,391	1,247	20,581	14.6
Total turpentine area	110,759	19,137	2,434	6,991	1,550	140,871	100.0
Percent of total	78.6	13.6	1.7	5.0	1.1	100.0	

An analysis of the present naval stores stand condition of the gross turpentine area is given in figure 6, bar A, and for its component areas in the other bars. Of the total turpentine area, 24 percent, or 1,233,000 acres, has "well-developed" stands. These stands average 19 future faces per acre on round, resting, or working trees 9.0 inches or larger (no areas with less than 8 faces are included). Approximately 454,000 acres of the total turpentine area has "advanced-sapling" stands with a sufficient number of round trees now in the 8-inch diameter-class to become well developed within the next 8 to 15 years. An additional 585,000 acres is in "young sapling" stands, predominantly 2-, 4-, and 6-inch trees that will require 15 to 20 years to become well developed; while 2,778,000 acres is in reproduction and clear-cut areas requiring over 20 years to reach turpentine size. Much of this class of land is so bare of tree growth that artificial reforestation will be required to restore it to useful condition. About 135,000 acres is in intermingled non-turpentine areas.

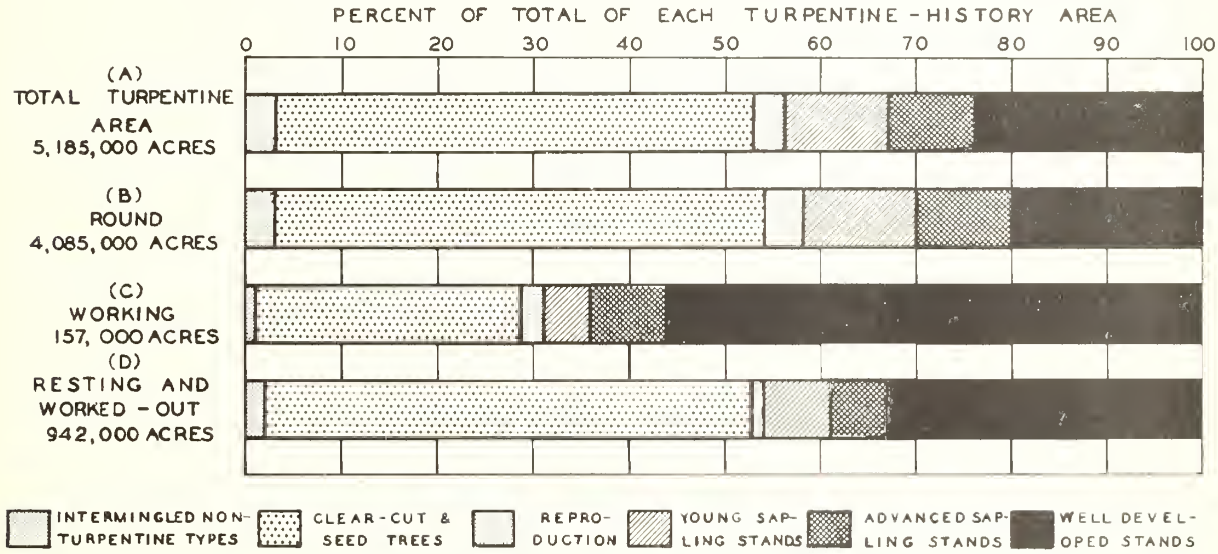

FIGURE 6 - CONDITION OF THE TURPENTINE AREA.

Future outlook for gum naval stores timber

To maintain their turpentine orchards during the period 1929-1935 the naval stores operators of central Florida drew upon the reserve supply of round and resting trees to the extent of about 500,000 new faces each season. It is interesting to analyze the inventory of potential faces in well-developed stands to see if this annual requirement can be met in the years to come. The basic assumptions are that all the potential faces on round, working, and resting trees in the well-developed stands will be utilized and that a 9-inch minimum diameter limit will be followed.

For the 8-year working cycle (6 years working, 2 resting) in the period 1936 to 1943, it appears that there are sufficient future faces to allow the placing of about 3 million new faces annually, or six times the requirements of the recent past. If the old practice of cupping at least one-third of the trees in the 8-inch class should prevail, the annual income would be increased to $3\frac{1}{2}$ million faces.

In the second 8-year cycle, 1944-1951, the inventory of potential faces on round, working, and resting timber would still be sufficient to allow the placing of about 3 million new faces on the 9-inch cupping limitation and $3\frac{1}{2}$ million on the old cupping basis. In the third cycle beginning 1952, the annual income may decrease to only $2\frac{1}{2}$ million new faces, 9 inches and up.

This consideration of the future supply is based upon assumptions that may not hold true. If the pulp industry should locate on, or draw heavily from, the pine forests of central Florida, the number of both round and resting trees might be materially reduced or at least removed from availability for naval stores use. Also, there is an insistent present demand for building material and wood for fruit and vegetable containers that may grow to such proportions as to reduce the supply for naval stores use. As shown in table 4, the number of round trees cut for wood products in 1936 was almost as great as the number used for turpentining.

In table 4, the inventory as of 1934 is brought forward through 1935 and 1936 by the application of subsequent growth, mortality, and drain estimate figures. This approximation discloses that the supply of round trees 9 inches and larger increased 6 percent between Jan. 1, 1934, and Dec. 31, 1936.

Table 4. - Net change in number of round trees 7 inches and up and 9 inches and up between Jan. 1, 1934, and Dec. 31, 1936, in the turpentine area

Item	1934		1935		1936	
	7 inches and up	9 inches and up	7 inches and up	9 inches and up	7 inches and up	9 inches and up
	Thousand trees					
Round trees as of Jan. 1	36,671	18,356	37,170	18,954	37,165	19,137
Increase due to recruits from small sizes	2,179	1,792	2,179	1,792	2,179	1,792
Decrease due to mortality	771	399	772	402	774	408
Net increase	1,408	1,393	1,407	1,390	1,405	1,384
Trees turpentined	293	243	741	615	651	540
Trees cut for products	616	552	671	592	571	509
Total industrial drain	909	795	1,412	1,207	1,222	1,049
Net change during year	499	598	-5	183	183	335
Round trees Dec. 31	37,170	18,954	37,165	19,137	37,348	19,472
Percent of number on Jan. 1, 1934	101.4	103.3	101.3	104.3	101.8	106.1

Wood Naval Stores Resources

Although there are no wood-distillation plants in this area — the closest is at Gainesville, Florida, about 45 miles north — the large resource of stumpwood is worthy of consideration. There are over 1 3/4 million acres with usable, matured longleaf and slash pine stumps, and in sufficient quantities (6 or more stumps per acre) to warrant commercial extraction. Practically all of this acreage is in central Florida, and slightly more than three-fourths of it is in the flatwoods, where the heaviest per-acre tonnage of stumps usually is found and extraction by mechanical stump pullers is most practicable (table 5). Approximately 70 percent of the present merchantable stumpland is in the clear-cut forest condition.

Table 5. - Stand of merchantable stumps (blasting basis)

Stumps per acre	Area	Topographic situation		Total	Proportion of total
		Flatwoods 1/	Rolling uplands		
	Acres	Thousand tons			Percent
6 to 13	709,100	1,097	321	1,418	19.1
14 to 25	589,000	1,944	412	2,356	31.7
26 or more	487,900	3,127	532	3,659	49.2
Total	2/ 1,786,000	6,168	1,265	2/ 7,433	100.0
Percent of total		83.0	17.0	100.0	

1/ Includes 2,500 acres and 7 thousand tons in swamps, ponds, etc.
2/ In addition, there are 674,600 acres and 270 thousand tons in areas having 5 stumps or less per acre.

If the common practice of blasting is used in extraction, there is an estimated supply of almost $7\frac{1}{2}$ million tons 3/ of stumps in areas having 6 or more stumps per acre. In addition, there is a potential supply of almost 4 million tons of stumps (6 or more stumps per acre) that are unseasoned or are in stands with trees so dense that present extraction would probably cause more damage to the small trees than the stumps are worth; in the future much of this may be usable.

With wood-distillation plants of the steam-solvent type elsewhere in the naval stores belt producing about 6 gallons of turpentine and 350 pounds of rosin per ton of stumps, it is evident, so far as the supply of wood is concerned, that central Florida could support a wood naval stores industry of considerable size. During the last decade the naval stores industry has suffered through chronic overproduction; thus large scale utilization of this wood supply may have to await more favorable times.

3/ If stump pullers are used, the estimated supply is increased about two-thirds.

Inventory Estimates of Volume

Saw timber

Only trees having the following requirements are included in the saw-timber inventory: living trees of commercial species at least 50 percent sound, or with a sound butt log at least 12 feet long; pines and cypress 9.0 inches and larger d.b.h., and hardwoods at least 13.0 inches. Although the top-diameter limit varies with the quality of the stem, no pine or cypress logs less than $5\frac{1}{2}$ inches in diameter inside bark at the small end and no hardwood logs less than $8\frac{1}{2}$ inches are included; the top-diameters actually used averaged larger than these minima. Usable portions of turpentine butts are included in the estimates. All figures are net, as necessary deductions have been made for woods cull because of rot, fire scar, crook, limbiness, etc., as well as for loss in manufacture due to sweep and hidden defects. Typical cull factors applied to the gross volume are:

	Percent
Longleaf and slash pines, old growth	10
Longleaf and slash pines, second growth	7
Loblolly and other pines, all conditions	10
Cypress, old growth	35
Cypress, second growth	25
White oak, all conditions	25
Red gum, all conditions	8

Table 6. - Net board-foot volume expressed in Doyle scale and in green lumber tally, based on International $\frac{1}{4}$-inch rule

Species	Central Florida		South Florida		Entire area	
	Doyle scale	Green lumber tally	Doyle scale	Green lumber tally	Doyle scale	Green lumber tally
	- - - - - -	- - - - - -	Thousand board feet	- - - - - -	- - - - - -	- - - - - -
Pines:						
Longleaf	767,800	1,442,300	34,900	58,700	802,700	1,501,000
Slash	514,100	951,300	499,700	882,700	1,013,800	1,834,000
Loblolly and other	103,200	173,200	-	-	103,200	173,200
Total pines	1,385,100	2,566,800	534,600	941,400	1,919,700	3,508,200
Hardwoods:						
Red gum	97,500	137,300	-	-	97,500	137,300
Black gum	119,900	170,300	2,000	3,200	121,900	173,500
Red oaks	51,400	69,400	500	700	51,900	70,100
White oaks	54,800	66,300	-	-	54,800	66,300
Other hardwoods	133,200	199,600	5,700	8,300	138,900	207,900
Total hardwoods	456,800	642,900	8,200	12,200	465,000	655,100
Cypress	322,200	613,200	368,100	618,800	690,300	1,232,000
Total all species	2,164,100	3,822,900	910,900	1,572,400	3,075,000	5,395,300

The total volume as of 1936 was 3 billion board feet measured by the Doyle rule, which is used locally but which results in an underestimate of the volume of small trees, or more than 5 billion board feet using the International $\frac{1}{4}$-inch rule, which closely approximates green lumber tally (table 6). The usual impression that this is primarily a pine area is verified by the fact that pine makes up almost two-thirds of the total saw-timber volume, using the figures of the green lumber tally as a basis. There is considerably more volume in cypress than in all the hardwoods combined, although black and red gums and red and white oaks are relatively important. Other hardwoods commonly found are bay, maple, ash, elm, and hickory. Central Florida includes 73 percent of all the pine saw-timber volume in the two units, 98 percent of the hardwood, and 50 percent of the cypress.

Old-growth stands include 46 percent of all the saw-timber volume (table 7). With an extension of roads and railroads and an increase in the price of old-growth stumpage in the future, many of the remaining old-growth uncut stands, such as the sizable block of old-growth cypress in the Big Cypress Swamp, probably will be logged. The second-growth stands, which are increasing in importance, already contain over half the saw-timber volume. Especially in south Florida, many stands running only 400 board feet per acre, which is the minimum used for the Survey's classification of saw-timber stands, are logged with tractors, trucks, and other mobile equipment.

It is noteworthy that trees generally considered small by lumber manufacturers (i.e., pine and cypress 9.0 to 12.9 inches d.b.h. and hardwoods 13.0 to 18.9 inches) include 51 percent of the pine saw-timber volume, 63 percent of the hardwood, and 45 percent of the cypress (table 7).

As a general rule, the saw-timber stands in this area have always been unusually "light" (i.e., they have low volumes per acre), as indicated by the proportional area and volume per acre of various stands in the longleaf and slash pine types (fig. 7). The proportions shown are based upon gross volumes; no deductions have been made for cull, but as a partially equalizing factor, the saw-timber volumes in turpentine butts have been excluded. While a slight error is possible in the first class (under 1,000 board feet) because the data were taken on quarter-acre plots, the combined data in the first two classes are significant. In central Florida, stands having less than 2,000 board feet per acre include 55 percent of the area in longleaf and slash pine sawlog-size conditions, but only 28 percent of the total volume (fig. 7, A). For south Florida, stands having less than 2,000 board feet make up 60 percent of the saw-timber area and less than 36 percent of the volume (fig. 7, B).

Table 7. - Diameter distribution of net board-foot volume (Int. ¼-inch rule) in the various forest conditions

Species-groups and diameter-groups in inches	Old growth		Second growth		Total	Percent of total
	Uncut	Partly cut	Sawlog size	Under sawlog size[1]		
	Thousand board feet					
Pines:						
10 - 12	239,600	126,400	948,600	480,500	1,795,100	33.3
14 - 16	440,300	146,000	397,700	96,100	1,080,100	20.0
18 - 20	263,700	88,000	82,700	13,900	448,300	8.3
22 & over	132,200	31,000	20,500	1,000	184,700	3.4
Total pines	1,075,800	391,400	1,449,500	591,500	3,508,200	65.0
Hardwoods:						
14 - 18	74,200	81,500	229,600	26,000	411,300	7.6
20 - 28	65,200	55,000	86,300	2,200	208,700	3.9
30 & over	20,400	7,100	7,600	-	35,100	0.7
Total hardwoods	159,800	143,600	323,500	28,200	655,100	12.2
Cypress:						
10 - 12	106,400	57,800	347,600	45,900	557,700	10.3
14 - 16	137,700	41,900	105,900	4,300	289,800	5.4
18 - 20	108,600	22,200	19,000	1,300	151,100	2.8
22 & over	200,200	30,400	2,800	-	233,400	4.3
Total cypress	552,900	152,300	475,300	51,500	1,232,000	22.8
Total all species	1,788,500	687,300	2,248,300	671,200	5,395,300	100.0
Total all species:						
Central Florida	993,400	563,300	1,761,600	504,600	3,822,900	
Percent of total	26.0	14.7	46.1	13.2	100.0	70.9
South Florida	795,100	124,000	486,700	166,600	1,572,400	
Percent of total	50.5	7.9	31.0	10.6	100.0	29.1

1/ Includes a small amount in the reproduction and clear-cut conditions.

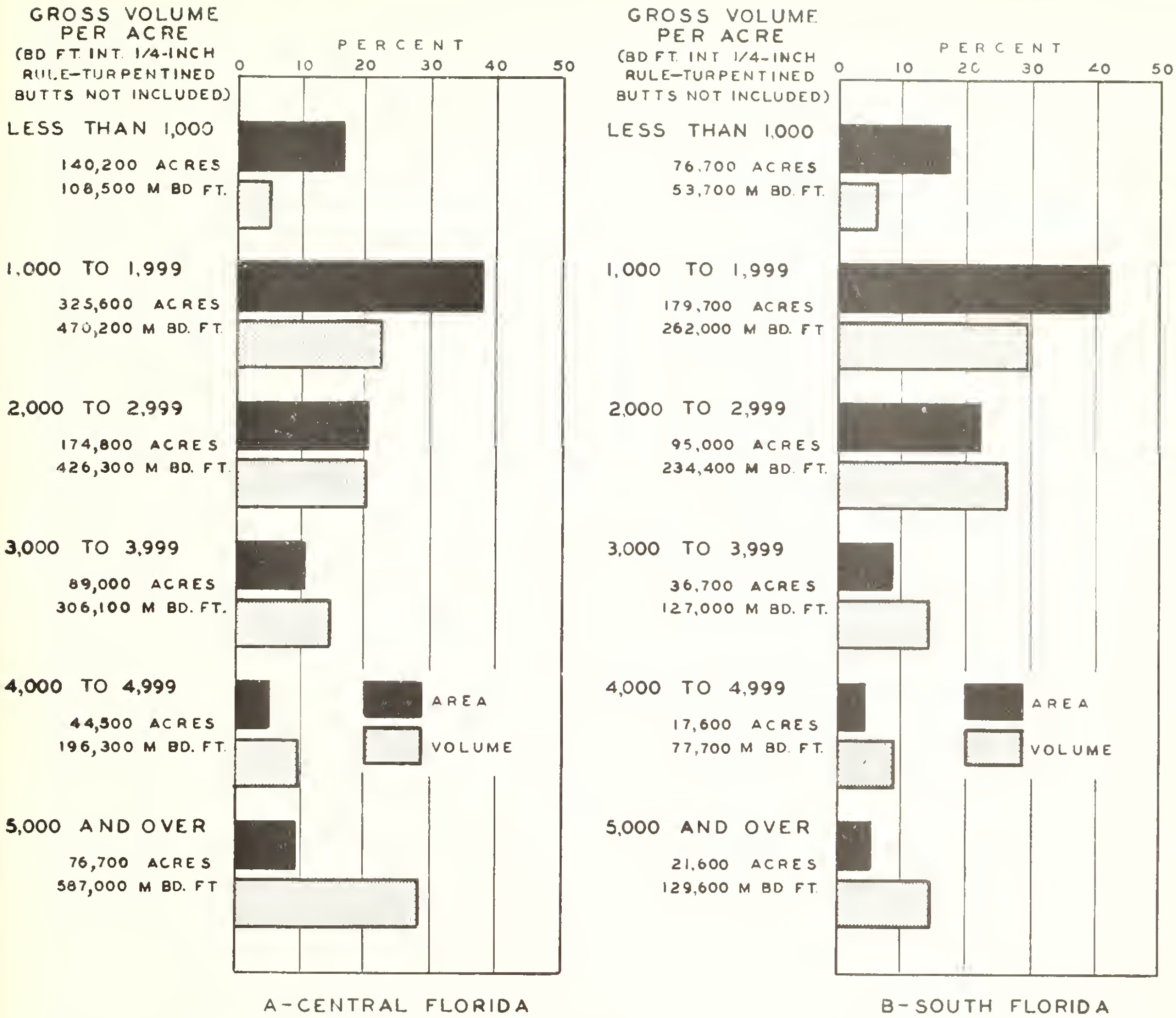

FIGURE 7 — PROPORTIONAL AREA AND VOLUME OF THE SAWLOG-SIZE CONDITIONS IN THE TURPENTINE PINE TYPES, CLASSIFIED ACCORDING TO VOLUME OF SAW TIMBER PER ACRE.

Cordwood

The entire usable volume of wood in all live trees 5.0 inches and larger, saw timber included, is over 33 million standard cords (4 x 4 x 8 feet), including bark. Approximately three-fourths of this volume is in central Florida and one-fourth is in south Florida. Of interest to the rapidly growing pulp and paper industry of the South is the fact that there are almost 29 million cords of wood suitable for pulping, of which 15 million are pine, 5 million are soft-textured hardwoods, such as red gum, black gum, magnolia, and bay, and 9 million are cypress, a possible future source of pulp. All the volumes mentioned herein are net, necessary deductions having been made for unusable volumes; these range from 20 to 80 percent for the cull trees, from 2 to 10 percent for the sound pines and hardwoods, and from 10 to 25 percent for the sound cypress. Much of this loss can be attributed either directly or indirectly to frequent burning of the woods.

In table 8, sound cordwood volume is shown by source of material and species-group. The first column includes the saw-timber volume (shown in the preceding section in board feet) as expressed in cords; it amounts to 40 percent of the total. The second column includes the material above the sawlogs to a usable top, the minimum allowable top-diameter never being less than 4 inches and generally greater; in the pines, the upper stems only are considered usable, while in the hardwoods and cypress both the upper stems and larger limbs are included. These sources of material have 11 percent of the total cordwood volume. Only the upper stems of pine are considered a part of the growing stock for calculating increment. The next column, "sound trees under sawlog size," includes all the usable volume in sound trees from 5.0 inches d.b.h. to sawlog size; this includes approximately 30 percent of all the cordwood volume. The last column, "cull trees," includes only the usable portion of these trees, and amounts to about 19 percent of all the usable cordwood. It is to be noted that this area has over 6 million cords of sound material in cull trees (which are not considered a part of the forest growing stock) and 500 thousand cords in worked-out turpentine trees. Approximately two-thirds of all the net cordwood volume, cull trees omitted, is in trees less than 13.0 inches d.b.h. (fig.8).

Table 8. - Net volume of all sound material, expressed in cords, bark included

Species-group	Source of material				Total
	Sawlog portion of saw-timber trees	Upper stems of saw-timber trees	Sound trees under saw-log size	Cull trees	
	Cords of rough wood				
Pulping species:					
Pines:					
Longleaf and slash:					
Round	6,194,300	1,069,800	3,635,700	298,600	11,198,400
Turpentined	1,710,800	436,700	388,000	79,200	2,614,700
Loblolly and other pines	405,600	57,500	160,700	76,100	699,900
Total pines	8,310,700	1,564,000	4,184,400	453,900	14,513,000
Hardwoods (pulping)1/	1,116,500	572,400	2,121,200	1,562,300	5,372,400
Cypress	3,406,000	1,130,300	2,982,400	1,284,900	8,803,600
Total pulping species	12,833,200	3,266,700	9,288,000	3,301,100	28,689,000
Nonpulping hardwoods2/	575,300	318,600	810,100	2,922,200	4,626,200
Total all species	13,408,500	3,585,300	10,098,100	6,223,300	33,315,200
Total all species:					
Central Florida	9,505,600	2,488,200	7,684,900	4,770,000	24,448,700
South Florida	3,902,900	1,097,100	2,413,200	1,453,300	8,866,500

1/ Pulping hardwoods include red, black, and tupelo gums; magnolia; bay; maple; etc
2/ Nonpulping hardwoods include scrub, white, and red oaks; ash; hickory; elm; sycamore; etc. All scrub oaks are classed as cull trees.

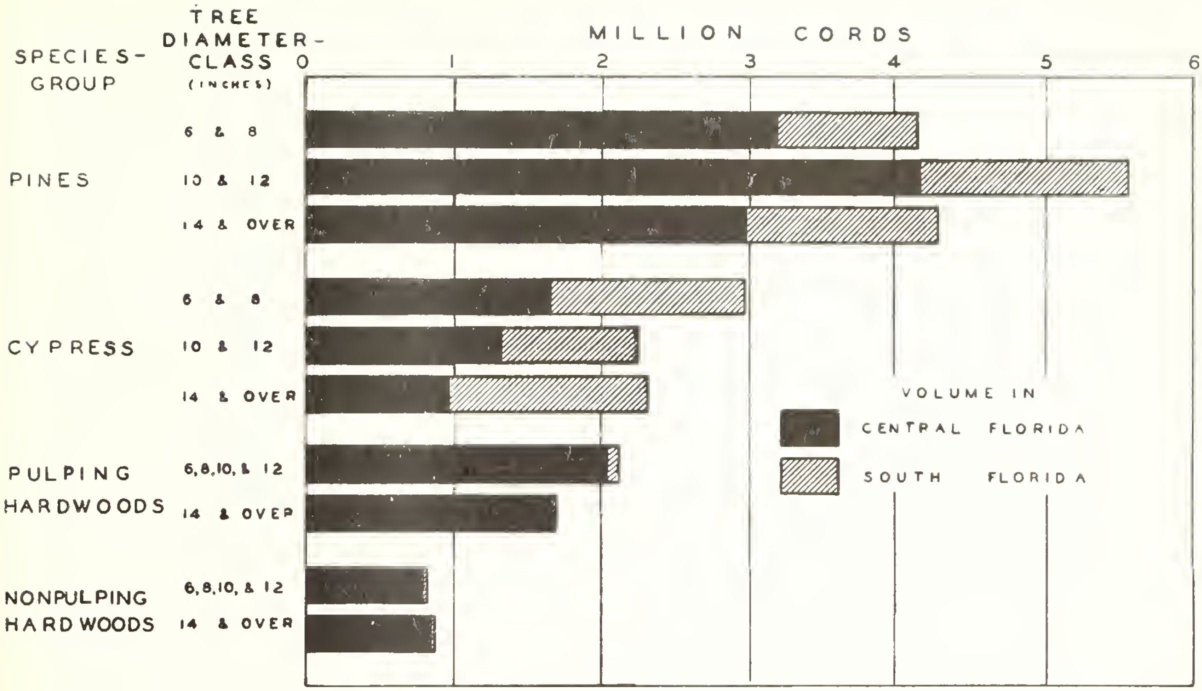

FIGURE 8 - CORDWOOD VOLUMES OF PULPING AND NONPULPING SPECIES BY SIZE-CLASSES, SOUND TREES ONLY (CULLS OMITTED).

Poles and piles

Although trees containing poles and piles are already included in the saw-timber and cordwood volumes, owing to their importance they are shown in a special inventory. At a conservative estimate there are in the area about $15\frac{1}{2}$ million trees that will make poles or piles (table 9); most of these are in central Florida. The great majority are round, but there are almost 2 million sticks in turpentined trees, where deduction in usable length was made for a part of the turpentined butts. That over three-fourths of the sticks are 20 and 25 feet long and that only a small number are 40 feet and over are important facts in considering the use of this resource. The table, however, does not show the significant item that 35 percent of the sticks are in trees 7 to 8.9 inches d.b.h. outside bark; 38 percent in trees 9 to 10.9 inches; and only 27 percent are in larger trees.

Table 9. - Pole and pile resources

Species-group	Length of poles and piles			Total	Percent of total
	20 and 25 feet	30 and 35 feet	40 feet and over		
	- - - - -	Thousand pieces	- - - - -		
Round longleaf and slash pines	10,579	2,490	390	13,459	86.4
Turpentined pines	1,399	451	20	1,870	12.0
Loblolly and other pines	217	40	-	257	1.6
Total	12,195	2,981	410	15,586	100.0
Percent of total	78.3	19.1	2.6	100.0	
Total all species:					
Central Florida	9,728	2,374	334	12,436	79.8
South Florida	2,467	607	76	3,150	20.2

Increment

Increment is defined as the difference between the growing-stock volume at the beginning and the end of any year, before the commodity drain for the same year is deducted. The saw-timber increment on the entire area, which during 1936 amounted to almost 183 million board feet (table 10) before deducting the commodity drain for the year, is calculated by subtracting mortality (83 million board feet) from total growth (266 million board feet). Total growth, which is the growth upon the growing stock that remains standing throughout the year plus the growth on trees cut during the year, is adjusted for degrading of butts due to turpentining. Neither the volume in cull trees nor that in the upper stems and limbs of hardwoods and cypress is considered part of the growing stock.

Approximately four-fifths of the total increment occurs in central Florida and one-fifth in south Florida. For the entire area under discussion, the net increment in board feet in 1936 by species-groups was as follows: longleaf and slash pines, 126 million; loblolly and other pines, 10 million; hardwoods, 22 million; and cypress, 25 million.

For all growing-stock material, including trees to a minimum of 5.0 inches d.b.h. as well as those of saw-timber size, the net increment, before making deductions for commodity drain, in 1936 amounted to 622,000 cords of rough wood with bark, or 44 million cubic feet of wood without bark (table 10).

It is roughly estimated that turpentining reduced the increment of the longleaf and slash pines in 1936 almost 40 million board feet. Sixty percent of this loss was made up of decreased growth; 20 percent was caused by increased mortality; and 20 percent was due to the degrading of wood in turpentined butts.

In 1936 the average net increment per acre, assuming that the stands had not been influenced by cutting, for all the productive forest area, including that classed as clear-cut, was only 23 board feet of saw-timber material, or 0.08 cord of rough wood for all growing-stock material; it was greater in central than in south Florida. For the area as a whole, the net increment per acre (table 10) generally compares very unfavorably with that of managed forests or with that of unmanaged forests in the remainder of the South.

Table 10. - Net increment, 1936

Forest condition	Net regional increment			Average increment per acre (uninfluenced by cutting)		
	M bd.ft.1/	Cords2/	M cu.ft.3/	Bd.ft.1/	Cords2/	Cu.ft.3/
Central Florida:						
Old growth	9,600	54,400	3,720	27	.13	8.9
Second growth:						
Sawlog size	67,600	169,600	12,060	74	.19	13.2
Under sawlog size	55,700	232,400	16,440	33	.14	9.7
Reproduction and clear-cut	11,400	25,300	1,880	4	.01	.6
Total northern part	144,300	481,700	34,100	24	.08	5.6
South Florida:						
Old growth	7,800	14,500	1,090	27	.05	3.9
Second growth:						
Sawlog size	13,500	36,100	2,600	44	.12	8.4
Under sawlog size	14,900	84,200	5,810	21	.12	8.1
Reproduction and clear-cut	2,300	5,100	370	3	.01	.5
Total southern part	38,500	139,900	9,870	18	.07	4.6
Total entire area	182,800	621,600	43,970	23	.08	5.4

1/ Green lumber tally.
2/ Rough wood, including bark.
3/ Inside bark (i.b.).

Wood-Products Industries

Sawmills

Shortly after the beginning of the present century, the lumber industry became active at several points within this area, and with the present excellent shipping facilities, sawmills are found in nearly all parts of these units except in the Everglades, large prairies, and the Big Cypress Swamp (map, fig. 5). Most of the 219 sawmills are small portable mills, which are efficient in utilizing the generally light stands of timber (table 11). Only 8 large mills (i.e., with a capacity of 40 thousand board feet or more per day) were in operation in 1936 and, as these were dependent upon large blocks of old-growth timber now rapidly disappearing, some of them will cut out in the near future. Over three-fourths of all the sawmills in the two units are in central Florida.

Table 11. - Number of sawmills, amount of lumber cut, and man-days of employment in mills of various sizes, 1936

Daily (10 hrs.) rated capacity	Sawmills	Lumber cut				Employment
		Pine	Hardwood	Cypress	Total	
Thousand board feet	Number	- - - - Thousand board feet - - - -				Thousand man-days
Under 20	189	92,500	3,800	10,700	107,000	369
20 - 39	22	58,900	5,900	14,200	79,000	259
40 - 79	6	34,100	700	32,100	66,900	241
80 and over	2	40,900	-	900	41,800	199
Total	219	226,400	10,400	57,900	294,700	1,068
Total all capacities:						
Central Florida	169	148,000	10,400	51,700	210,100	769
South Florida	50	78,400	-	6,200	84,600	299

Most of the lumber cut is of excellent quality, finding ready markets locally (especially in the Miami and Tampa districts), as well as in the North and in foreign countries. In 1936 the sawmills of this area, although operating at less than half their capacity (which had been greatly expanded during the building "boom"), furnished over a million 10-hour man-days of employment, equivalent to about 4,000 steady jobs (assuming 250 days of work per year). The total lumber cut by the mills of this area, regardless of the source of the stumpage, amounted in 1936 to 295 million board feet, green lumber tally, of which 77 percent was pine, 20 percent cypress, and 3 percent hardwood.

Other wood-products industries

In 1936 this area had 21 veneer mills, 2 treating plants, and 14 miscellaneous plants, most of which were small shingle mills; practically all of these are in central Florida. The veneer mills are unusually important locally, for there is a keen demand for crates, hampers, and other veneer packages for the large crops of citrus fruit and vegetables produced in the area. Approximately half the cut of the veneer mills is from pine and the other half from the hardwoods, principally red and black gums, magnolia, and bay. All wood-products industries together furnished in 1936 almost 2 million man-days of employment—equivalent to regular employment for about 8,000 men (table 12).

Table 12. - Wood-products production and employment, 1936

Kind of plant or commodity	Units produced[1]	Thousand man-days (10 hours) of employment		
		In woods	At plant	Total
Lumber	294,700 M board feet	442	626	1,068
Veneer	68,800 M board feet	118	161	279
Naval stores	14,550 units	244	14	258
Cross ties	928 M pieces	127	-	127
Poles and piles	10 M pieces	1	-	1
Fence posts	317 M pieces	5	-	5
Fuel wood	399,400 cords	205	-	205
Miscellaneous (shingle mills, treating plants[1], etc.)	5,900 cords	3	31	34
Total		1,145	832	1,977
Total man-days:				
Central Florida		891	666	1,557
South Florida		254	166	420

1/ Labor in treating plants is entirely at the plant. The units of material treated are included in the respective commodities.

Commodity Drain from the Growing Stock

As previously stated, the net increment, which is computed for the growing-stock material only, is the net increase of the forest before deduction is made for drain. The commodity drain consists of the volume removed from the growing stock for the production of lumber, poles, ties, veneer, fuel wood, etc., together with the usable volume left in the woods as waste from the trees cut. In order that it may later be compared with increment, commodity drain is expressed as (1) drain, measured in board feet, from the saw-timber trees of the growing stock, and (2) the over-all drain, measured in cubic feet, from the entire growing stock — from trees below saw-timber size as well as from the larger trees. From saw-timber material alone the commodity drain for 1936 amounted to 456 million board feet, green lumber tally, of which about three-fourths came from central Florida and one-fourth from south Florida (table 13). Considering the area as a whole, 70 percent of the saw-timber drain is for lumber, 15 percent for veneer, 12 percent for cross ties, and 3 percent for other products. More than half the saw-timber drain comes from pines; and the drain from cypress is more than twice that from hardwoods. In spite of the growing importance of the second-growth volume component of the stands, by far the greater part of the raw material is still taken from old-growth stands.

From all growing-stock material, i.e., the usable volume in all sound trees 5.0 inches d.b.h. and over, including trees of sawlog size, as well as the usable upper stems of pine, the over-all commodity drain amounted to 80 million cubic feet of wood (inside bark). The commodities derived as byproducts are charged to the primary use for which the trees are felled; thus fuel wood obtained from the upper stems of pine trees cut for lumber is included under the lumber-drain item shown in cubic feet.

Table 13. - Commodity drain from the growing stock, 1936

Reason for drain	From saw-timber material				From all growing-stock material
	Species-group			Total	
	Pines	Hardwoods	Cypress		
	- - Thousand bd.ft. (green lumber tally) - -				Thousand cubic feet (i.b.)
Lumber	228,500	11,200	79,700	319,400	55,330
Cross ties	19,100	100	34,300	53,500	8,980
Poles and piles	300	-	100	400	60
Veneer	36,600	33,300	-	69,900	10,880
Fuel wood	5,500	1,500	-	7,000	3,150
Miscellaneous 1/	3,300	1,000	1,400	5,700	1,850
Total	293,300	47,100	115,500	455,900	80,250
Total drain:					
Central Florida	185,800	46,900	100,500	333,200	56,120
South Florida	107,500	200	15,000	122,700	24,130

1/ Includes domestic farm use, fence posts, and land clearing.

Comparison of Net Increment and Commodity Drain

From Jan. 1, 1934, to Jan. 1, 1937, the commodity drain so greatly exceeded the net increment that there was a diminution in the growing stock of about 13 percent for saw timber alone, or over 5 percent for all growing-stock material (table 14). Considering only the saw-timber component of the growing stock, in 1936 the total commodity drain was 273 million board feet in excess of net increment——an over-cutting of 189 million board feet in central Florida and 84 million board feet in south Florida (table 15 and fig. 9). In each of the species-groups for the entire area, the commodity drain exceeded the corresponding net increment in saw timber.

As already pointed out, although the great majority of the trees are below sawlog size (fig. 3), the net increment of all growing-stock material in all sound trees 5.0 inches d.b.h. and larger, fails to meet the present demand for forest products. In 1936 the net increment (after the excessive mortality had taken an amount equivalent to 40 percent of the total growth in trees 5 inches d.b.h. and larger) was 36 million cubic feet (inside bark) less than the drain. It is recognized that the net annual increment is low—— the natural result of light stocking, high prevalence of poor sites, heavy mortality due to the widespread custom of burning the woods, and other causes.

Table 14. - Changes in the growing stock

Date	Saw-timber material				All growing-stock material
	Species-group			Total	
	Pines	Hardwoods	Cypress		
	- - Thousand board feet (green lumber tally) - -				Thousand cubic feet (i.b.)
Jan. 1, 1934	3,808,100	682,200	1,375,200	5,865,500	1,871,060
Jan. 1, 1935	3,663,000	668,200	1,304,600	5,635,800	1,841,240
Jan. 1, 1936	3,508,200	655,100	1,232,000	5,395,300	1,808,310
Jan. 1, 1937	3,350,700	629,900	1,141,600	5,122,200	1,772,030

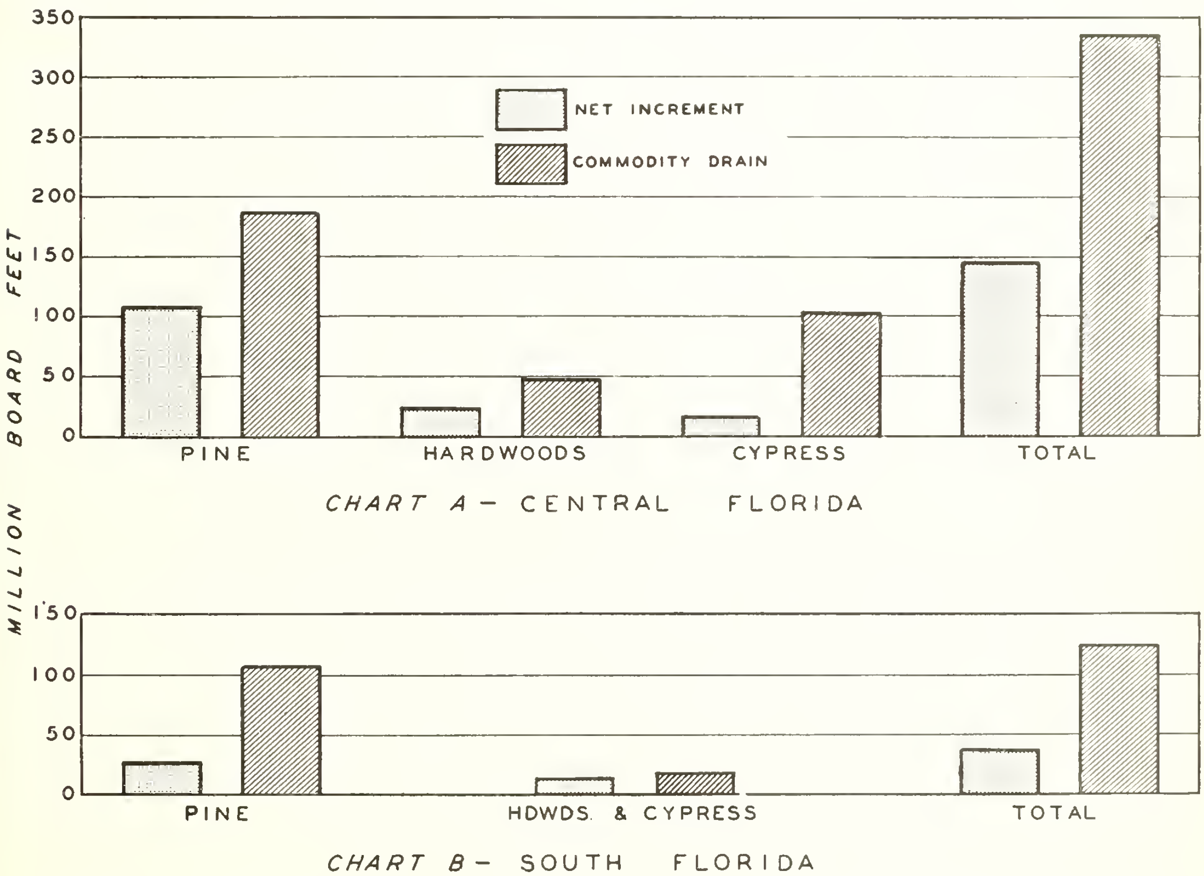

FIGURE 9 — COMPARISON OF NET INCREMENT OF SAWLOG-SIZE TREES WITH THE COMMODITY DRAIN, 1936.

Table 15. - Comparison of net increment with commodity drain in board feet and cubic feet, 1936

Item	Saw-timber material: Species-group: Pines	Saw-timber material: Species-group: Hardwoods	Saw-timber material: Species-group: Cypress	Saw-timber material: Total	All growing-stock material
	M board feet (green lumber tally)				M cu.ft. (i.b)
Central Florida:					
Growing stock, Jan. 1, 1936	2,566,800	642,900	613,200	3,822,900	1,311,200
Growth	161,400	30,200	19,700	211,300	57,470
Mortality	52,800	8,700	5,500	67,000	23,370
Net increment	108,600	21,500	14,200	144,300	34,100
Commodity drain	185,800	46,900	100,500	333,200	56,120
Net change in growing stock	-77,200	-25,400	-86,300	-188,900	-22,020
Growing stock, Jan. 1, 1937	2,489,600	617,500	526,900	3,634,000	1,289,180
South Florida:					
Growing stock, Jan. 1, 1936	941,400	12,200	618,800	1,572,400	497,110
Growth	38,000	500	15,900	54,400	15,890
Mortality	10,800	100	5,000	15,900	6,020
Net increment	27,200	400	10,900	38,500	9,870
Commodity drain	107,500	200	15,000	122,700	24,130
Net change in growing stock	-80,300	200	-4,100	-84,200	-14,260
Growing stock, Jan. 1, 1937	861,100	12,400	614,700	1,488,200	482,850
Entire area:					
Growing stock, Jan. 1, 1936	3,508,200	655,100	1,232,000	5,395,300	1,808,310
Growth	199,400	30,700	35,600	265,700	73,360
Mortality	63,600	8,800	10,500	82,900	29,390
Net increment	135,800	21,900	25,100	182,800	43,970
Commodity drain	293,300	47,100	115,500	455,900	80,250
Net change in growing stock	-157,500	-25,200	-90,400	-273,100	-36,280
Growing stock, Jan. 1, 1937	3,350,700	629,900	1,141,600	5,122,200	1,772,030

Practically all the saw-timber drain comes from old-growth trees, whereas these trees contribute only a small part of the net increment. With very rapid over-cutting in the old-growth conditions, many of the large sawmills (40 M and over per day capacity), which are efficiently operated only when large blocks of high-quality saw timber are available, are gradually cutting out. These mills account for about one-third of the lumber cut, and their closing down should reduce somewhat the existing unfavorable discrepancy between drain and increment in saw-timber material. On the other hand, the lively local demand for building material and veneers for packaging may encourage the establishment of small transient mills to replace the larger mills, and there may be no permanent decrease in the drain.

Summary of the Forest Situation

The area covered by this report comprises two sections of the lower peninsula of Florida that differ markedly from each other in topography, soil, and drainage, and consequently also in vegetative cover. An east and west line drawn along the northern boundary of Charlotte, Glades, and Martin Counties separates these two regions into "central Florida" and "south Florida," and in a general way marks the southern limit of optimum growing conditions for the commercial forest types characteristic of the lower South. The two sections combined comprise about 18 million acres, of which 46 percent is classified as productive forest land. Longleaf and slash pine types predominate, with cypress, hardwoods, and loblolly pine types occurring in decreasing frequency in the order named. The volume included in the sound-tree growing stock is over 5 billion board feet, green lumber tally. Although old-growth forest stands occupy less than one-tenth of the forest area, 46 percent of the saw-timber volume is found in such stands. Compared with other areas in the South, these two sections of Florida are characterized in general by poor forest sites. While the saw-timber stands are lightly stocked with a comparatively small volume per acre, they are, generally speaking, accessible and easily logged. Another outstanding feature is the high proportion (41 percent) of forest land that has been stripped of its forest growth and has failed to restock. The combination of poor sites, light stocking, and high proportion of clear-cut land results, therefore, in a very low annual net forest increment.

South Florida

South Florida has less than 30 percent of the total saw-timber volume of the entire area. Its few good stands of saw timber, largely in the old-growth condition, because of the brisk demand for building and packaging materials, are being liquidated rapidly and generally with inadequate provision for restocking. When the remaining supply of merchantable forest material has been removed, it appears unlikely that the forests of the section will be of interest from a commercial standpoint for many years to come. This does not mean, however, that these forests will not be important in the economy of south Florida. On the contrary, these picturesque forests may be of more value to this attractive winter playground as a part of its natural scenery and as cover for wild life than are the forest industries that are being displaced. The Big Cypress Swamp, on the west flank of the Everglades, contains probably the largest primitive area of old-growth cypress in the United States. Over 600,000 acres of unappropriated Federal and State land, part of which is forest land, is reported as reserved for inclusion in an "Everglades Natural Park."

Central Florida

Growing conditions are better in central Florida than in south Florida, although they are somewhat below the average for the lower South as a whole. Approximately six times as much land in this section is devoted to forests as to crop land and improved pasture. It is generally believed that, for some years at least, the need for more crop land will not reduce materially the present forest acreage. Recently there has been an increase in the use of land for cattle grazing, which if continued might retard or prevent the restocking to forests of the large acreage of clear-cut land now found. It might also result in a type of land management that would place timber growing second to grazing in some of the area now stocked to timber.

The population of central Florida, which was 515,000 in 1930, has been increasing rapidly in recent decades; since a considerable part of the increase is due to the attractions of its climate and scenery, this growth may be expected to continue. There is an excellent local market for lumber used in building and for veneer stock used in the manufacture of packages for the large citrus and vegetable industries. Within the section there are 169 sawmills and many other wood-using plants, whose products are used both locally and in more distant markets. The gum-turpentine industry, here appearing as the southernmost outpost of the widespread naval stores belt, is represented by 23 turpentine stills.

The outstanding preoccupation of this section of Florida is its tourist business, and the forests of the section constitute no small part of the many natural factors that make this part of the State so attractive to both winter and summer visitors. Although difficult to express tangibly in dollars and cents, this value is probably greater in the long run than that to be derived from the purely industrial use of the forests. This situation calls for forest management that, while yielding all of the industrial value possible, will at the same time preserve the attractiveness of the countryside and its recreational values.

Deficiencies in the present forests of central Florida

The outstanding deficiency in the present forests is that nearly half of the forest lands were harvested too clean, and have been burned over too frequently, since the timber was removed to allow the reestablishment of forest cover. Except for such usage as open-range grazing for cattle, these lands are virtually idle, produce no income to their owners, and are frequently tax delinquent. If these lands are to be returned to usefulness as producers of timber, much of the area will require the planting of trees, although undoubtedly a part of the cut-over area will restock naturally if effective protection from fire is afforded.

The forest stands of central Florida are deficient also in that they are sparsely stocked; many areas contain only a small fraction of the number of trees of valuable species that the soil and the climate can support. Good forest management and effective fire protection for a number of decades would increase greatly the stocking and improve its quality. Sparse, open stands are found not only in old-growth timber but also in many areas of second growth. The net annual increment for the forest averages only 24 board feet per acre—an annual growth far below the potentialities of the sites involved.

Measures for improving these forests

A high degree of fire control is absolutely essential in the management of Southern forests, and this is particularly true in central Florida. The prevalence of the old pioneer habit of burning the woods is directly responsible for the thin stands and the low increment found in these forests. No amount of good forest management can be expected to improve materially this situation unless the forest stands can be afforded a reasonable degree of protection from fire. Notwithstanding the fact that landowners here, as elsewhere, may receive cooperative assistance in fire protection from the State and Federal Governments under the provisions of the Clark-McNary Law, in 1936 it is reported that only one-tenth of the forest lands in central Florida were under organized fire protection.

Timber theft also is a widespread evil, with non-resident owners the chief sufferers, although resident owners are by no means immune. Better enforcement of the timber-theft laws and heavier penalties are needed.

About 700,000 acres of forest land has been so severely harvested that it contains an insufficient number of seed trees to restock the area naturally. In addition there are two million acres of clear-cut land with seed trees but which, even with fire protection, will require a long time for commercial forests to reestablish themselves. Artificial reforestation will be necessary if these lands, now idle and a drag on the economic prosperity of the section, are to be restored quickly to valuable forest uses. About 267 plantations, involving an aggregate area of more than 5,000 acres, have been established by landowners in central Florida, largely through the encouragement and assistance of the Florida Forest and Park Service. These small plantations have demonstrated that in the main excellent results may be obtained by planting.

Good management of existing stands of timber, both old and young, is necessary if the forests are to yield their greatest returns. In this section of the State, turpentining (now largely in second-growth stands) often involves such injurious practices as cupping small trees, hanging too many cups on the trees, and chipping too deeply. As a result, the mortality of the trees in the turpentine orchards is excessive. Conservative measures of turpentining now in general practice among progressive operators throughout the naval stores belt, if applied here, will not only reduce the unnecessarily high annual loss of faces and trees but will increase the rate of gum production.

Since its local timber supply means so much to this section of the State, the highest degree of thriftiness and economy in its use is justified. As a result of past turpentining and the high prevalence of fire, many stands contain large numbers of worked-out and abandoned turpentine trees and cull trees of all species. At the time of the survey, about 5 million cords of usable wood were estimated to be in these undesirable components of the stands. The removal of these trees not only would improve greatly the growing conditions of the remaining stands but also would meet a large part of the local wood requirement. Closer utilization of all the trees cut, by reducing the waste now left in the woods to rot, would tend to lengthen the present extensive drain upon the forest growing stock. To utilize the available material to the best advantage, a much greater effort should be made to devote each item of forest output to its highest use; every tree cut should go into those products that bring the greatest return.

The Need for a Land-Use Study

Both central and south Florida, the two sections covered in this report, should be the subject of an intensive land-use study. This part of the State is developing rapidly, and if its future is to be based upon the sound use and development of its natural resources, there should be a careful correlation of land use with the requirements of such activities as the tourist business, citrus and vegetable growing, cattle raising, and forestry. Such a study should include, among others, the answers to the questions: "What is going to become of the 3-1/2 million acres of cut-over land that has failed to restock and that is now lying as an unproductive eyesore?" "Is not the rehabilitation of this vast expanse of stump-land essential?" "And is its artificial reforestation a task for private ownership, or a responsibility of the general public?"

13.67

FOREST SURVEY RELEASE NO. 39 NOVEMBER 23, 1938

FOREST RESOURCES IN THE LONGLEAF PINE REGION OF MISSISSIPPI AND EAST LOUISIANA

by
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A Progress Report by

THE SOUTHERN FOREST SURVEY

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New Orleans, La.

FOREWORD

The nation-wide Forest Survey, being conducted by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products; (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probably future trend in the requirement for timber and other forest products; and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies may be formulated for the effective use of land suitable for forest production.

This release, is based on a field survey made Aug. 4, 1934, to March 30, 1935, and two field canvasses of forest industrial plants to determine forest drain, the last of which was made during May 1937. It should be regarded only as a progress report since it contains Forest Survey data that will be included in complete reports to be published later, and that, although considered reliable, are subject to correction or amplification as the work of computation proceeds. Item 4 above, which is being studied on a national basis, is not discussed in this report.

In the presentation of these survey data, it is to be noted that owing to the sampling method used in collecting them, the greater the number of samples in any given classification the more accurate are the data for that classification. Hence classes that are of infrequent occurrence and relatively small in quantity generally cannot be determined with as high a degree of accuracy as classes that occur more frequently and in substantially greater quantities. Small tabular items are to be taken as showing, not the exact magnitude of the classes involved, but their relative magnitude in comparison with those of other classes.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

Assisting Staff

P. R. Wheeler, Associate Forest Economist
In Charge of Computations

Note: The Southern Forest Experiment Station hereby wishes to acknowledge the clerical assistance received from the Works Progress Administration in the preparation of this Release.

FOREST RESOURCES IN THE LONGLEAF PINE REGION OF MISSISSIPPI AND EAST LOUISIANA

General Description

The area discussed in this report is formed by contiguous parts of Mississippi and Louisiana lying in the Gulf Coast and Lake Pontchartrain region; it includes 17 counties in southeast Mississippi and most of 5 Louisiana parishes between the Amite and Pearl Rivers (fig. 1). These areas, designated as Survey units Mississippi #4 and Louisiana #4, respectively, are characterized by longleaf and slash pine forests.

These units, which form the western extremity of the principal naval stores belt, have common economic interests and uniform geophysical features that warrant their consolidation in a study of their forest resources and industries. They form an area of 8,081,300 acres, about 79 percent of which is forested (table 1). The lumber production in 1936 was 628 million board feet. Hattiesburg, Laurel, Biloxi, and Gulfport in Mississippi, and Bogalusa in Louisiana are the largest cities and principal industrial centers, while the influence of New Orleans and Mobile as financial and market centers, and as terminals of land- and water-transport systems, is felt throughout the entire area.

Topography varies with the distance from the Coast, the higher, more hilly country lying in the northern portion. Elevations reach a maximum of 400 feet in Covington County, Miss., and decrease gradually toward the south, the rolling terrain finally levelling out into a narrow belt of flatwoods and marshes along the Coast. Most of the region is drained by the Pascagoula and Pearl Rivers, which flow south to the Gulf. Numerous smaller streams, independent of the two larger systems, drain limited watersheds along the Coast. The sandy and loamy clay soils are moderately well drained except in the belt of flatwoods, where an insufficient gradient causes surface water to accumulate during the winter and spring. Moderate sheet erosion is general, and occasional gullying occurs on farm land in the rolling uplands.

The development of transportation facilities has been commensurate with the needs of the area. Five major railroads, with terminals in New Orleans, Mobile, and Gulfport, touch all the principal cities, and feeder lines traverse every county. Several common carriers operated by lumber companies supplement this service in the less populated areas. Excellent paved highways are in service in all parishes of the Louisiana unit, and virtually all roads appearing on ordinary road maps are usable the year round. In Mississippi pavement is limited to the relatively few arterial highways that extend from New Orleans and Gulfport toward the east and north, but all the important towns are connected by all-weather gravel roads, and the present state road program provides for construction of modern highways in many counties. Considerable tonnage in wood products, construction materials, and garden truck is handled by barge lines and shallow draft vessels in coastwise trade.

Climatic conditions favor a long growing season. The average winter temperature is 53° F.; the summer average is 81°. The annual rainfall averages about 60 inches, the fall months being the driest.

Table 1. - Land area classified according to use

Land use	Area		Proportion of total area	
	- - - - Acres - - - -		- - - - Percent - - - -	
Forest		6,414,700		79.4
Agriculture:				
In cultivation	1,171,300		14.5	
Out of cultivation: Idle, abandoned, and improved pasture	249,700		3.1	
Total		1,421,000		17.6
Other nonforest		245,600		3.0
Total land area		8,081,300		100.0

The 1930 Census recorded a population of more than 418,000 people (31 percent negro), an increase of 17 percent over 1920. In six of the more rural Mississippi counties, however, decreases were recorded. The five largest cities were all under 20,000 population. The rural character of the region is further emphasized by the fact that 74 percent of all residents live on farms or in small communities under 2,500 population. According to the Census, agriculture employed 44 percent of the 152,700 gainful workers, 12 percent were engaged in various wood-using industries, and the remaining 44 percent were employed in other industries. It should be pointed out that in 1935 part-time work of some kind was engaged in by 32 percent of all farm operators, or more than 14,000, who worked 1 or more days in non-farm occupations.

The Federal Unemployment Census taken in November 1937, shows that 25,400 people were unemployed and wanted work. Approximately 10,200 were working on Government relief projects, and about 15,500 were working part time but desired more work[1/].

Agriculture is of prime importance to the region. In 1935, according to the Agricultural Census, nearly 45,000 farms occupied a gross area of about 2,870,000 acres, an increase over 1930 of about 6,000 farms and of 280,000 acres. About half the gross farm acreage (1,480,000 acres) is in woodland. Measured by its value in 1934, agriculture rated as the "big business" of the region, with land and buildings valued at more than 56 million dollars. General farming is practiced over most of the area, with corn, cotton, hay, potatoes, and sugarcane the most common crops. Pecans, tung nuts, strawberries, and citrus fruits are special crops. Unlike other parts of Mississippi and Louisiana, or indeed most of the agricultural South, only

1/ Federal Unemployment Census. John D. Biggers, Administrator, Washington, D. C., Nov. 1937.

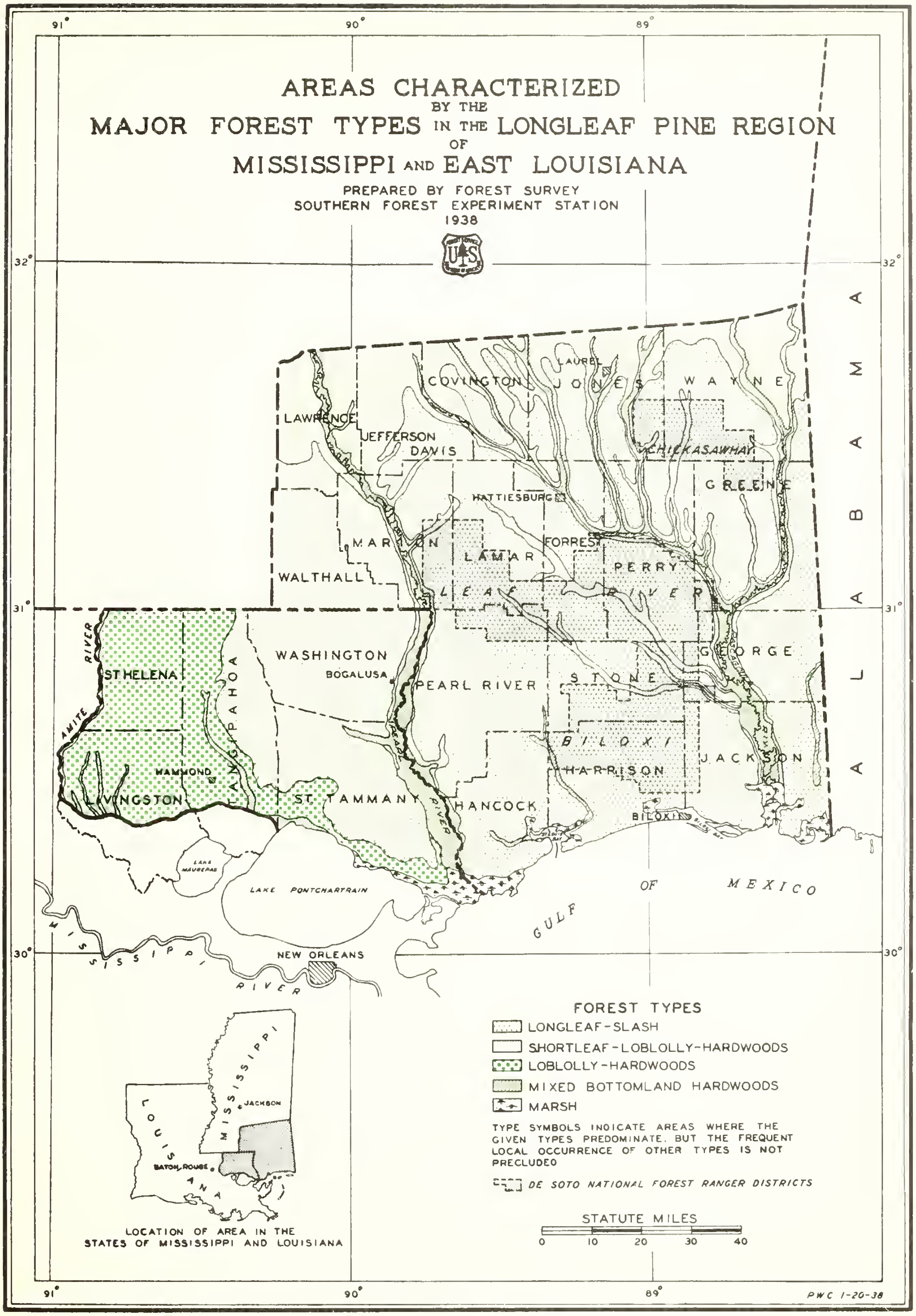

FIGURE 1 – FOREST TYPE MAP.

30 percent of the farm land was under lease to tenants or part owners in 1935. Sharecroppers, as distinguished from other types of tenants, operated slightly less than 10,000 farms2/.

Ownership of forest land has in the past rested largely with big lumber companies. Large individual holdings, many in excess of 100,000 acres, have been carried by these companies while the virgin timber was being cut. In more recent years, with the removal of the timber, large blocks have been subdivided and sold for farm development. Other areas in Mississippi have been sold to the Federal Government to form the nucleus of three ranger districts of the DeSoto National Forest (fig. 1); these have a gross area of 1,212,820 acres, almost 460,000 acres of which has been purchased or approved for purchase up to June 30, 1937. The University State Forest totals about 22,200 acres. A few owners have retained a large proportion of their original holdings for the express purpose of growing and harvesting additional crops of timber. Notwithstanding the fact that the virgin stands have been largely cut off, there are still many large ownerships of forest land in the 4 million acres or more of non-farm, privately-owned forest land. The lack of demand for agricultural land; the growing market for pulpwood, low-grade saw timber, and naval stores timber; and the hope of oil-field development are tending to hold many large forest land ownerships intact.

Reversion of forest land to state ownership for non-payment of taxes has been going on for many years as a result of the removal of the timber and the shutting down of the larger sawmills. Whether this trend continues or is checked will depend upon the replacement of the forests through reforestation and the reviving of forest industries, the possible development of sub-surface values, and the adjusting of tax charges to the productive capacity of the land. Local governments have suffered severely from the loss of their principal tax base——the forests. According to a report by C. O. Henderson and John T. Caldwell,3/ 10 to 21 percent of the total land area of Lawrence, Greene, Harrison, Marion, George, Perry, and Stone Counties was owned by the State through tax reversion on Jan. 1, 1936; most of this was formerly owned by lumber companies. In the other counties of the unit, the percentage of tax-forfeited lands was much smaller. The assessed value of timber in 1936 ranged from $2.25 per M board feet in Walthall County to $8.80 in Jefferson Davis County, with an average of $3.48 for the State of Mississippi. The assessed value of bare timberland in the same year ranged from $1.35 per acre in Jefferson Davis County to $4.00 per acre in Covington, Marion, and Walthall with an average of $3.42 for all counties in Mississippi4/. Combined countywide and State millage rates in 1934 ranged from 22 in Forrest County to 43 in Stone. In addition, all counties impose taxes for school districts and nearly all counties also impose road and other special-district taxes.

2/ A graphic summary of farm tenure. U.S.D.A. Misc. Publ. #261, pp. 5, 11. Dec. 1936.

3/ Lands owned by the State of Mississippi through tax reversion. Mimeograph #4, U.S.D.A. Farm Security Admin. and Bureau of Agric. Economics, Little Rock, Ark., Nov. 1937.

4/ Property assessments and ad valorem taxes. Miss. State Tax Comm. Service Bull. #18, Jackson, Miss., July 1937.

Description of the Forest

The Forest Survey classed as rolling uplands 67 percent (4,297,900 acres), uniformly distributed over the region except for a narrow belt bordering Lake Pontchartrain and the Gulf of Mexico. The low, level strip of land along the coast, aptly termed flatwoods, is limited to 730,400 acres, representing about 11 percent of the total forest area. The remaining 22 percent lies in the swamps and alluvial bottoms of the creeks and rivers distributed throughout the area.

Forest types

In general, there are three major associations of tree species in these units: The turpentine pines (longleaf and slash), the nonturpentine pines (loblolly, shortleaf, and spruce pines), and the hardwoods, including cypress (fig. 1). The turpentine pines dominate about 53 percent of the forest area. Here longleaf pine is the most abundant and widespread, occupying about 75 percent of the area in the type. Toward the northern and western boundaries of the region, this species mingles with increasing quantities of loblolly pine and hardwoods, which together finally form the dominant forest type. In the past 75 years, this transition zone has been creeping slowly toward the south and east, resulting in considerable shrinking of the commercial range of longleaf pine. Within the territory covered by this report, the loblolly-shortleaf-hardwood mixture occupies approximately 27 percent of the forest area. Slash pine occurs in greatest quantity in the southern part of the region, particularly in the flatwoods belt, where it mixes with tupelo gum and cypress in the shallow ponds and drains. Slash pine also forms a mixed type with longleaf, and under favorable conditions has completely replaced it. Loblolly pine and small quantities of shortleaf and spruce pine (*Pinus glabra* Walter) with gums, bay, and oak occasionally in mixture, occur in scattered locations in the southern part of the area.

The remaining 20 percent of the forest acreage is occupied by hardwood types.[5] Along the banks of streams and rivers, particularly the Pearl and Pascagoula, the oaks, gums, bays, magnolias, and other bottom-land hardwoods form a forest association which totals 773,600 acres and is the source of most of the volume of valuable hardwood cut in these Survey units. A poorer grade of oaks, gums, and hickories frequently is found mixed with pine in the 207,100 acres in the rolling uplands, while blackjack and other scrub oaks have completely excluded the commercially valuable species on 304,400 acres in the central and southern tiers of counties previously occupied by longleaf pine.

The 12 forest types recognized in the field have been grouped into 3 major associations which are dominant in large areas, as shown on the accompanying type map (fig. 1). Within these broad ranges, many areas of different but less prevalent forest types and of agricultural land are intermingled. The all-inclusive acreage characterized by major type-groups, as shown on the map, therefore, cannot be compared with type-area figures based on the actual

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5/ The cypress type, which occupies a relatively small area, is arbitrarily included in this report with the hardwood types.

determination in the field. It should be pointed out also that the shortleaf pine component of the loblolly-shortleaf-hardwood type is insignificant in this territory, the total cubic volume of this species accounting for only 7 percent of the aggregate pine volume inventoried. Its location is restricted principally to scattered patches in the northern tier of counties in the Mississippi unit.

In figure 2 is shown the distribution of the total stand of sound pine and hardwood trees by diameter-classes. This distribution, showing a large proportion of the trees in the lower diameter-classes, is typical of areas from which the mature timber has been largely removed and in which second growth is taking possession of the soil.

Forest conditions

Table 2 reveals a number of significant points characteristic of the forests of this region. The acreage of uncut old-growth turpentine pine, principally longleaf, is negligible in a region where the forest area is dominated by that forest type. The method of cutting used in the past has left clear-cut about 1 out of every 4 acres of the turpentine pine types—a total of 865,700 acres. A much brighter side of the picture is indicated by the extensive acreage of fast-growing second growth, which occupies more than 73 percent of the total forest area. Over 3 million acres—approximately 67 percent of the second-growth area, or 49 percent of the total forest area—bears only small saplings and reproduction. This statement is probably the most significant of any concerning the forest conditions, since it establishes the immature character of the general stands and dictates, to a large extent, the management—principally protection from fire—necessary to maintain an adequate future supply of timber. Also it foreshadows somewhat the acute shortage in high-quality pine saw timber which is likely to obtain in this territory for the next several decades.

The important timber areas of immediate interest to the wood-using industries are those in scattered old-growth stands and the large areas of sawlog-size second growth, with a combined area of 2,365,700 acres. Confined to no definite location or consolidated body, these stands are scattered mainly in the rolling uplands throughout the region, especially in the more rural counties of the Pearl and Pascagoula basins.

The area of forest in the under-sawlog-size second-growth condition (2,390,500 acres) bears but little timber of immediate use to the lumber industry, although a number of small mills are currently "scrapping up" residual trees and the larger second-growth trees in this area. If properly cared for, however, it will be of prime importance as a future source of supply for pulpwood, saw timber, and naval stores.

The total area classified as reproduction includes 756,900 acres mainly in the pure turpentine pine types, where the reproduction on 17 percent of the area was classified as satisfactory, having 900 or more well-distributed seedlings per acre; on 35 percent, as fair; and on 48 percent as poor, with less than 300 poorly distributed seedlings per acre. In the nonturpentine pine type, stocking was satisfactory on 23 percent of the reproduction area, fair on 36 percent, and poor on 41 percent.

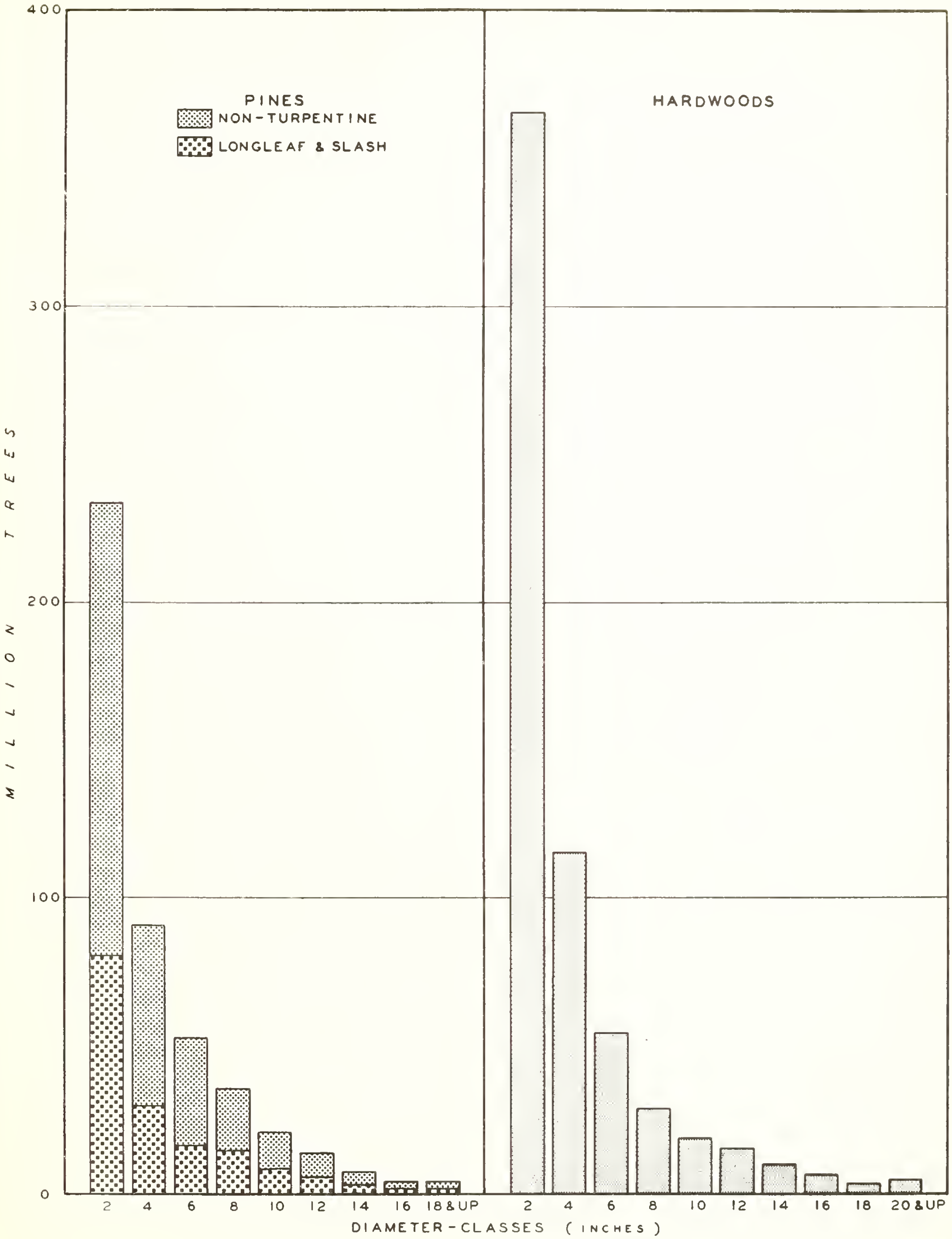

FIGURE 2 — STAND DIAGRAMS

Table 2. - Forest area classified according to forest condition and type-group

Forest condition	Forest type-group			Total	Percent of total forest area
	Turpentine pine	Nontur-pentine pine	Hardwood 1/		
	Acres				
Old growth:					
Uncut	43,300	28,400	157,000	228,700	3.6
Partly cut	228,900	77,300	286,900	593,100	9.2
Total	272,200	105,700	443,900	821,800	12.8
Second growth:					
Sawlog size:					
Uncut	322,200	746,900	196,200	1,265,300	19.7
Partly cut	106,100	130,400	42,100	278,600	4.3
Under sawlog size	1,210,500	654,000	526,000	2,390,500	37.3
Reproduction	632,400	60,100	64,400	756,900	11.8
Total	2,271,200	1,591,400	828,700	4,691,300	73.1
Clear-cut 2/	865,700	23,400	12,500	901,600	14.1
Total all conditions	3,409,100	1,720,500	1,285,100	6,414,700	100.0
Percent of total forest area	53.2	26.8	20.0	100.0	

1/ Includes 40,600 acres in the cypress type.
2/ Includes a negligible acreage in the fire-killed condition.

There are 901,600 acres of cut-over land which has practically no timber and no immediate prospects of any, since adequate restocking has not yet taken place; but 25 percent of this area has 3 or more seed trees 6 inches or larger per acre and, if properly managed, probably will restock ultimately to merchantable timber species. In the 3 years that have passed since the field inventory was made (1935), many acres in this class have probably entered the reproduction condition. Thirty-four percent has 1 or 2 seed trees per acre and will eventually restock under favorable conditions, but the remaining 41 percent (370,000 acres) must be artificially restocked if desirable species are to be established within any reasonable time. Much of this bare land is located in the southern portion of the region, particularly in the Florida parishes in Louisiana, where the original pure longleaf pine stands were removed completely and fires have been of regular occurrence. In Pearl River County about 10,000 acres of such land recently has been placed under cultivation for the production of tung trees.

Although only a very small acreage was classed as fire-killed, much of the area is burned each year in spite of the protective efforts of private, State, and Federal agencies. The Mississippi Forest Service has established protection areas totaling 1,213,600 acres in 5 of the 17 counties. In the Louisiana parishes more than 1,600,000 acres are under protection. The United States Forest Service maintains an intensive fire-control system, including a short-wave radio network covering all land within the national forest boundaries. Of the total forest acreage in these two Mississippi-Louisiana survey units, about 60 percent is under fire protection.

To point out the deficiencies in the present forest as compared with the forest attainable through sustained-yield management, the existing age-class and volume distribution has been compared in figure 3 with the distribution in a well-managed forest on a 70-year rotation. The green area, representing the present forest stand, is based upon a rough determination of the age-classes and volumes per acre in turpentine pine types. The upper dotted lines, which represent the attainable forest, show an equal distribution of the same area among seven 10-year age-classes and the volume which might be expected if the area were placed under good forest management, based upon the heaviest stocked 10 percent in each age-class on weighted-average sites in the present uncut stand.

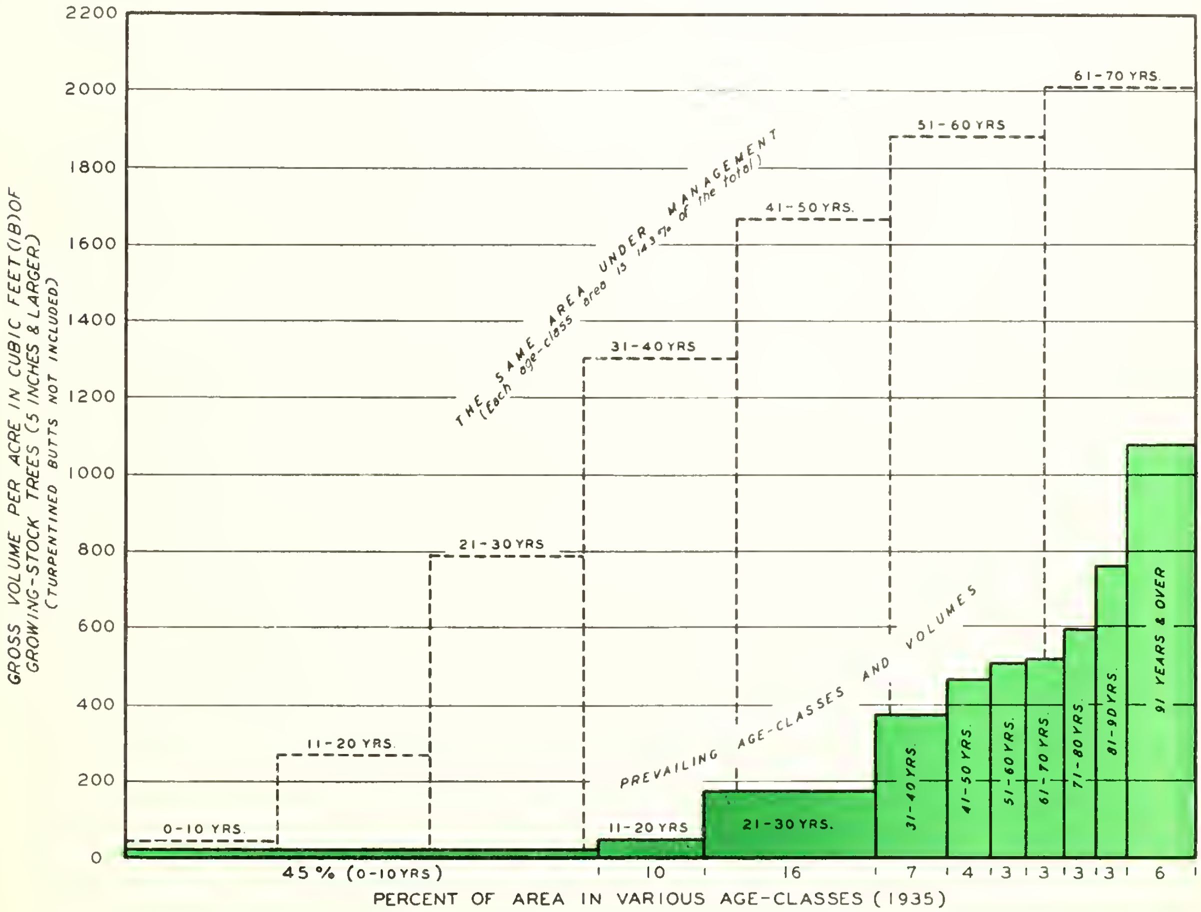

FIGURE 3 — PREVAILING AGE-CLASS AND VOLUME DISTRIBUTION COMPARED WITH THAT ON THE SAME AREA UNDER MANAGEMENT (BASED ON TURPENTINE-PINE TYPE AREA OF 3,409,100 ACRES)

The present forest differs from the theoretical one in at least two major respects. First, the distribution of age-classes by area is irregular and faulty; there is an area deficiency in each of the age-classes older than 30 years, and the prevailing 0- to 10-year age-class occupies 45 percent of the area, whereas in the managed forest this age-class is limited to 14 percent. The second outstanding difference is the obvious under-stocking in all age-classes of the present forest; on the average, the total volume per age-class appears to be considerably less than a third of what it might be.

Approximately 31 percent of the pine forest sites in these Survey units are classed as good, growing trees 75 feet or higher in 50 years; 68 percent of the sites are medium, as indicated by 60- and 70-foot trees: and only 1 percent of the sites are poor, growing trees which attain a height of less than 55 feet in 50 years.

Naval Stores Aspects

The turpentine, rosin, and other naval stores manufactured in this area are produced by three distinct industries: wood-distillation plants, pulp mills, and gum-turpentine stills. In 1936 their combined output amounted to 290,000 barrels of rosin and 56,000 barrels of turpentine, of which the gum stills produced 13 and 21 percent, respectively.

Gum naval stores industry

The production of naval stores through distillation of crude gum is one of the leading forest industries in lower Mississippi and the adjoining pine lands of Louisiana. Because of the scattered nature of the turpentine pine stands in the northern and western parts of the region, the gradual encroachment of the nonturpentine species, and the industrial development in the northern and central counties, the area of active turpentine farming is limited principally to the southern and eastern sections. Consequently the industry has not reached the commanding position it enjoys in other parts of the naval stores belt.

Thomas Gamble 6/ states that as early as 1850 there were five stills operating in Mississippi. This number had increased to 145 by 1900, when production amounted to 9 percent of the total United States output. Since 1900, as the supply of old-growth timber was cut for lumber, the number of stills has decreased. Production, after reaching a peak in 1920, fell into a steady decline, and for the 1933-34 season 7/ in the territory covered by this report was estimated at 13,700 units 8/, only 3 percent of the total United States output; in the 1936-37 season it had decreased still further to 11,600 units. During the latter season it is estimated that in this territory the gum naval stores industry, which gave employment to 1,100 men in the woods and at the stills, provided a total of approximately 220,000 man-days of labor.

6/ Naval stores history production, distribution, and consumption, compiled by Thomas Gamble, 1921.
7/ Statistics on gum naval stores production, Forest Survey Release #17, Southern Forest Exp. Sta. Dec. 31, 1935.
8/ A naval stores unit is equivalent to one 50-gallon barrel of turpentine and three and one-third 500-lb. (gross) barrels of rosin.

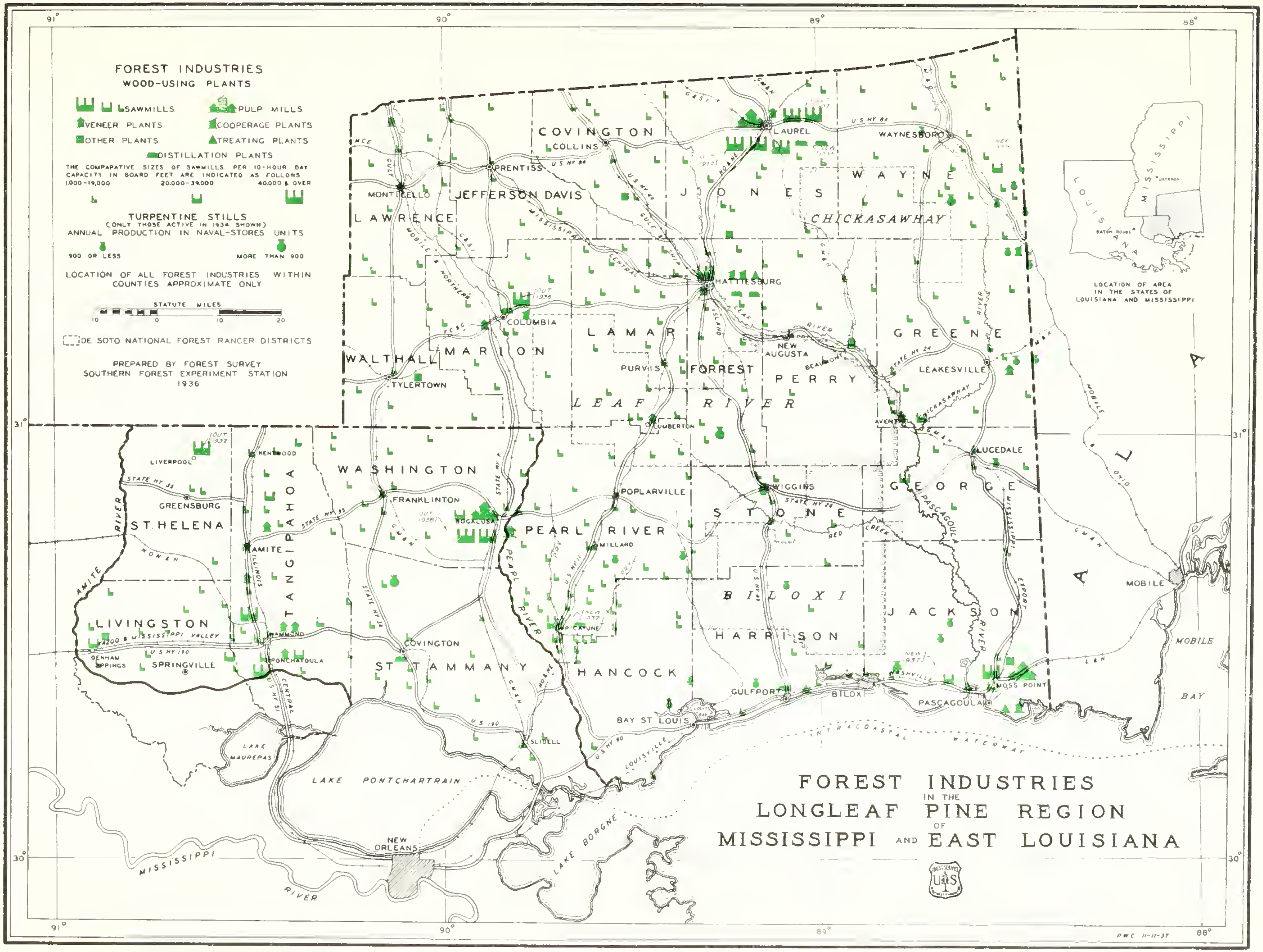

FIGURE 4 - FOREST INDUSTRIES MAP

There were 22 stills operating in this area during the 1934-35 season, when the last complete count was made. Two of these had no woods operation but depended solely upon local gum producers for their supply. Gum producers without stilling facilities numbered approximately 510. Altogether 388 crops (of 10,000 faces each) were worked. Since 80 percent of the timber was leased, the amount of leased timber is higher here than the average for the whole naval stores belt (73 percent); and this lack of owner-control may have been a contributing factor in the local decline of the industry. Turpentine-still operators worked an average of 13 crops each (in 1933-34), from which 563 naval stores units were produced—an average yield per crop of 43 units. Five of the largest stills manufactured 53 percent of the output for that season. Most of the stills are located in the eastern and southern counties of Mississippi (fig. 4).

The naval stores forest area

The naval stores area is characterized by the prevalence of forest types in which longleaf and slash pines are the dominant species. The gross forest area is 3,711,600 acres, of which 11 percent is located in the flatwoods, 80 percent in the rolling uplands, and 9 percent in swamps, bays, ponds, etc. Parts of the area are occupied by stands that have not been cupped; these are designated as round-timber areas. In other areas, the trees of turpentine size have been cupped and, at the time of the survey, were being chipped and dipped for gum production; these are designated as working areas. In still other areas, the trees of turpentining size have been cupped and worked and are either being rested before a new series of faces are placed on them, or they have been entirely worked-out and abandoned for further naval stores use; these are known as resting and worked-out areas. The round-timber area constitutes 85 percent of the naval stores territory; the working area, 6 percent; and the resting and worked-out areas, 9 percent. The proportion of round-timber area here is considerably higher than in other Survey units of the naval stores belt, where it ranges from 19 percent in south Georgia to 79 percent in central Florida.

The forest areas in the three broad turpentine condition-classes described above contain timber stands in all degrees of development, ranging from seedling areas, with only a scattering of future faces on residual large trees, to well-developed stands of turpentine size with many potential faces per acre. The stands generally are made up of trees of various ages and sizes. Except for clear-cut and reproduction areas, almost every acre has trees of turpentine size (either round, working, or resting) as well as smaller, round trees that in time will reach cupping size. To assist in visualizing a rather complex situation, the proportions in the various stand-conditions are graphically shown in figure 5. "Well-developed" stands have a minimum of 8 and an average of 19 future faces per acre, of which 5 are back faces and 14 are faces that can be placed on round trees now 9 inches or more in diameter. In addition, these stands have an average of 54 round trees per acre, of which 10 are in the 8-inch diameter-class and 44 are in the 2-, 4-, and 6-inch classes. Well-developed stands, which occupy about 22 percent of the naval stores territory, represent the area on which naval stores operations must depend in large measure for new crops in the immediate future.

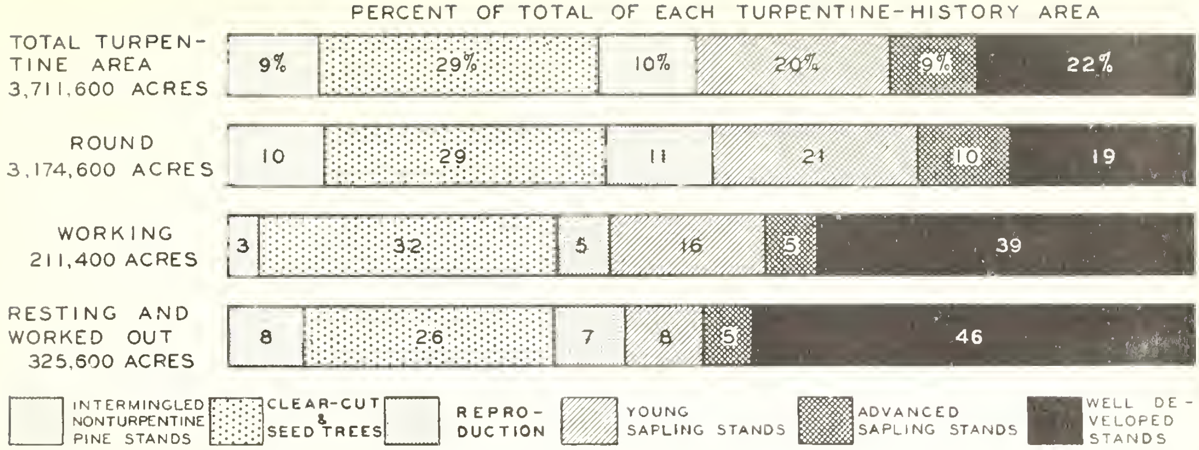

FIGURE 5 — CONDITION OF THE TURPENTINE AREA

"Advanced sapling" stands are in a younger age-class than the well-developed stands. The stand averages 76 round trees per acre, of which 2 are in the 10-inch diameter-class, 12 in the 8-inch class, and 62 are in the 2-, 4-, and 6-inch classes. Such stands occupy 9 percent of the turpentine area and constitute, in the main, areas that will be ready for intensive turpentining in 8 to 15 years.

"Young sapling" stands average 87 round longleaf and slash pine trees, all in the 2-, 4-, and 6-inch diameter-classes. These young stands occupy 20 percent of the forest area in the naval stores territory. With reasonable protection from fire, and if not first cut for pulpwood, many of these trees should attain workable size for naval stores operations in 15 to 20 years.

"Reproduction" areas have established seedling stands of longleaf and slash pine. The "clear-cut and seed-tree" area had at the time of the survey no established stands of seedlings and occupied 29 percent of the naval stores forest area. With effective and continuous protection from fire, within 30 years a large part of the area in these two classes should develop stands of turpentine pines to carry the load in the cycle of naval stores operations. A part of the clear-cut area may have to be planted if it is to reach operable size within the time limit indicated. Intermingled in the turpentine forest, in patches and "stringers," are areas occupied by loblolly pine, hardwoods, or other nonturpentine forest types, which at present occupy about 9 percent of the turpentine-forest area. These areas, which cannot be considered as an asset in naval stores operations, probably will increase in extent.

At the time of the field inventory an estimate was made of the total number of slash and longleaf pine trees 2 inches in diameter and larger in the naval stores forest area. Table 3 is a statement of this inventory, in which the <u>trees</u> are shown as round, working, resting, or worked out. The inventory is further broken down by <u>areas</u> classified as round, working, and resting and worked out. The outstanding fact disclosed by this inventory is that for every tree being worked for turpentine in 1934 there were 50 round trees 2 inches d.b.h. and larger serving as a possible resource for future turpentine operations. Even with a heavy discount for losses due to fire, wind, and insects, and for trees prematurely cut for pulpwood, there would seem to be ample justification for the belief that these two Survey units might easily support a much larger naval stores industry on a continuous-supply basis.

Table 3. - Round, working, resting, and worked-out longleaf and slash pine trees, classified according to turpentine-history area

Turpentine-history area	Round trees 1.0 to 8.9 inches d.b.h.	Round trees at least 9.0 inches d.b.h.	Working trees	Resting trees	Worked-out trees	Total
	- - - - - - - - - - - - -		Thousand trees	- - - - - - - - - - - - -		
Round-timber area	115,671	12,545	-	319	47	128,582
Working area:						
Front faced	6,013	237	2,048	22	52	8,372
Back faced	3,650	27	925	40	28	4,670
Resting and worked-out areas	9,635	987	-	2,312	1,242	14,176
Total	134,969	13,796	2,973	2,693	1,369	155,800

The future naval stores timber supply

In the effort to approach the matter of a future supply from a more realistic angle than that involved in considering only the number of round trees regardless of their location or stand density, an analysis has been made that involves consideration of (1) the number of potential or future faces now in well-developed stands, (2) the future faces that may be reasonably expected from the areas now in the advanced sapling stage, and (3) the faces to come in at a still later period from stands now in the young sapling areas. In this approach, it is assumed that the well-developed stands will be exploited in the working period 1935-1942. At the end of this period, the advanced sapling stands, which will begin to reach operable size and density, together with the back-faces on previously worked timber, will produce the supply of working faces for the period 1943-1950. The third cycle of naval stores operations, beginning in 1951, would depend upon trees now in the young sapling stage of development, supplemented by back-faces on previously worked timber. A basic assumption is that all of the trees will be worked for naval stores when they reach 9 inches d.b.h., and that after being worked on the front side they will be back-faced. Natural mortality and prevailing growth behavior have been taken into account.

On these assumptions, the analysis shows that during the first 8-year working period (1935-1942) the stands on the well-developed areas should produce sufficient round trees to allow the hanging of 1.8 million new cups each year and, in addition, to permit the hanging of cups each year on approximately a half million new back-faces. An annual replacement possibility of this size would maintain a working body of turpentine crops over $2\frac{1}{2}$ times the average working body maintained between 1932 and 1936.

In the second 8-year working period (1943-1950), the analysis indicates that the annual supply of both round trees and back-faces on previously worked trees would allow the hanging of approximately $2\frac{1}{2}$ million new cups annually. In the third 8-year period, the annual income of new trees and new back-faces would be still greater, allowing a further increase in the size of the naval stores industry in the two Survey units.

As stated before, these calculations are based upon the use of a minimum 9-inch diameter limit for cupping; if the practice of past years of cupping approximately one-third of the trees in the 8-inch class should prevail, the indicated income of new faces would be about 20 percent greater.

In all of the above considerations, it is assumed that the trees will not be cut before they have been completely worked out for naval stores, and that all of the potential faces will be used when the trees reach turpentining size. Table 4 indicates that although during 1934, 1935, and 1936 the number of round trees cut for wood products exceeded that of the newly turpentined trees, there was a slight increase in the number of round trees 7.0 inches d.b.h. and larger and an appreciable increase in the number 9.0 inches and larger. The growing demand for pulpwood to feed the mills in and near this territory may reduce materially the supply of round longleaf and slash pine trees for turpentining through the simple process of removing them before they are large enough to be turpentined. Also, a considerable part of the naval stores area in these two units is included in the DeSoto National Forest, where the management policy may be to grow large, high-quality, sawlog trees, and to withhold or limit turpentining on a considerable proportion of the stands.

Another factor that may have a bearing on the future timber supply is the growing tendency on the part of many private timber owners to manage their forests for integrated wood products with naval stores either left out of the picture entirely or included only as byproducts. This may sharply reduce the amount of timber that would otherwise be available for maintaining turpentine operations. The outcome of the growing competition between lumbermen, pole and pile producers, pulpwood consumers, and naval stores men——all for the same timber——cannot be forecast, but there certainly is a sufficient number of growing trees in sight to maintain a much larger naval stores industry than at present, if that industry can get the use of the timber before it is felled for other purposes.

Table 4. - Net change in number of round trees 7 inches d.b.h. and larger and 9 inches d.b.h. and larger between Jan. 1, 1934, and Dec. 31, 1936

Item	1934		1935		1936	
	7 inches and larger	9 inches and larger	7 inches and larger	9 inches and larger	7 inches and larger	9 inches and larger
	Thousand trees					
Round trees as of Jan. 1	26,734	13,494	26,733	13,796	27,264	14,601
Increase due to growth of smaller trees	2,265	1,802	2,265	1,802	2,265	1,802
Decrease due to mortality	565	296	572	307	583	324
Net increase	1,700	1,506	1,693	1,495	1,682	1,478
Trees turpentined	725	502	398	227	380	217
Trees cut for products	976	702	764	463	1,283	882
Total industrial drain	1,701	1,204	1,162	690	1,663	1,099
Net change during year	-1	302	531	805	19	379
Round trees as of Dec. 31	26,733	13,796	27,264	14,601	27,283	14,980
Percent of number on Jan. 1, 1934	100.0	102.2	102.0	108.2	102.1	111.0

Wood naval stores industry and resources

The chief producers of turpentine and rosin in this region are the wood distillation plants rather than those of the gum naval stores. Using the steam and solvent process, the eight plants now in operation (1938) are reported to have a combined maximum daily utilization capacity of about 1,270 tons of stumps and topwood. These plants, which are well scattered throughout the best stumpland areas in this territory, represent the greatest concentration of these plants in the South (fig. 4). It is estimated that they provide about 600,000 man-days of labor in the woods and at the plants. Their potential annual production volume, assuming a 300-day year and operation at full capacity, is estimated to be 320,000 barrels of rosin, 50,000 barrels of turpentine, and 48,000 barrels of pine oil. Three new establishments and one rebuilt in 1936 have come into production in the last 2 years.

The five plants operating during 1934 consumed 217,000 tons of distillate wood in the ratio of 80 percent stumpwood to 20 percent topwood. Most of the stumpwood was blasted from the "stump fields" that resulted from clear-cutting virgin longleaf pine stands. Since second-growth stumps are not now acceptable and existing virgin stands are disappearing rapidly with no replacement in sight, this is probably the sole wood-using industry that is based upon "mining" of the resources.

Blasting is the common method of extraction employed in this section. Although yielding only 60 percent as much volume per acre as mechanical stump-pullers, blasting remains the more economical method here, owing to the low operating efficiency of the expensive pullers in hilly country and to the tenacious, clay subsoils, which make up the bulk of the merchantable stump land.

The area bearing accessible seasoned stumps in 1935 totaled about 1,500,000 acres, 88 percent of which was in the rolling uplands. Since profitable extraction depends largely upon the number of stumps per acre, the merchantable acreage is broken down into four density classes (table 5). Over 50 percent of this area averages 14 or more stumps per acre.

Table 5. - Present merchantable area of stump land, classified according to topographic situation and stumps per acre

Stumps per acre	Flatwoods	Rolling uplands	Swamps, bays, ponds, etc.	Total stump land	Percent of total stump land
	- - - - - - - - - - Acres	- - - - - - - - - -			
5 or less	27,800	233,200	7,800	268,800	17.5
6 to 13	38,500	389,100	5,500	433,100	28.3
14 to 25	35,600	375,000	5,400	416,000	27.2
26 and over	51,300	357,400	4,600	413,300	27.0
Total stump land	153,200	1,354,700	23,300	1,531,200	100.0
Percent of total stump land	10.0	88.5	1.5	100.0	

The volume of seasoned stumpwood occurring on the merchantable area in 1935 is estimated to have been more than 5,700,000 tons (blasting basis). This aggregate tonnage is classified in table 6 according to its topographic location and average number of stumps per acre. Of interest to the industry is the fact that 83 percent of the tonnage occurs on areas where stumps average 14 or more per acre.

In addition to the present merchantable acreage, there are extensive areas of seasoned stumps that are considered inoperable under present standards because of surrounding dense stands of second-growth timber or reproduction. These areas may eventually be "stumped" and should be considered as potential sources of future supply. Another such source is made up of freshly cut stumps from old-growth trees, which must season 10 to 15 years before they are suitable for distillation. Areas on which these two types of stumps occur total 1,880,000 acres. On the basis of extraction by blasting there are in this area over 5,700,000 tons (i.e., approximately the same as on the merchantable area), 79 percent of which occurs at an average rate of 14 or more stumps per acre. Finally, there is the unestimated supply to be obtained when old-growth timber now standing is felled and its stumps are seasoned and utilized.

In addition to the stumpwood supply, there is a considerable (but unestimated) tonnage of "topwood" derived from the seasoned heartwood of dead longleaf pine trees both standing and down. Assuming that a full use is made of the stumpwood and topwood on areas classified as "accessible" and that the potential supply in less favorable situations will be used as this supply is exhausted, it would seem possible for the present distillation plants to operate for at least 30 years at three-fourths of their maximum capacity. The slow but certain attrition of fire and rot, however, and the use of stumps for fuel wood will tend to shorten the life of the operations.

Table 6. - Present merchantable stump volume classified by topographic situation and stumps per acre (blasting basis)

Stumps per acre	Flat-woods	Rolling uplands	Swamps, bays, ponds, etc.	Total stump volume	Percent of total stump volume
	----- Thousand tons ------				
5 or less	11	94	3	108	1.9
6 to 13	77	778	11	866	15.1
14 to 25	143	1,499	22	1,664	29.0
26 and over	385	2,681	34	3,100	54.0
Total stump volume	616	5,052	70	5,738	100.0
Percent of total stump volume	10.7	88.1	1.2	100.0	

Volume Estimates

Board-foot volume

In the estimates given in table 7, the volume of sound sawlog-size trees is expressed in terms of board feet, as measured by the Doyle log rule. The volumes are net log scale, that is, allowance has been made for material that would be left in the woods because of rot, fire scar, crook, limbiness, and similar defects, as well as for loss in sawing at the mill due to sweep and hidden defects. Volume was included to the upper limit of usable material in the tops rather than to a fixed top-diameter, but neither pine logs less than 5.5 inches in diameter inside bark at the small end nor hardwood logs less than 8.5 inches, were included. The trees in the volume estimate must contain at least one sound butt log, or 50 percent of the gross volume of the tree must be sound material. In addition, hardwoods must be at least 13.0 inches d.b.h. outside bark, and pines and cypress 9.0 inches. Only the usable portion of turpentine butts is included in inventory figures.

Table 7. - Net board-foot volume (Doyle) by major species-groups and forest conditions [1], 1935

Species-group	Old growth: Uncut	Old growth: Partly cut	Second growth: Sawlog size	Second growth: Under sawlog size [2]	Total	Percent of total volume
	- - - - - - - -	Thousand board feet	- - - - - - - -			
Pines:						
Longleaf	23,700	299,400	222,000	113,100	658,200	9.9
Slash	402,900	95,600	201,100	29,300	728,900	11.0
Loblolly	89,600	117,100	1,461,200	82,000	1,749,900	26.4
Others	70,400	70,200	321,900	24,200	486,700	7.3
Total	586,600	582,300	2,206,200	248,600	3,623,700	54.6
Hardwoods:						
Red gum	213,600	159,100	214,000	28,800	615,500	9.3
Black gum	353,900	263,900	215,200	26,900	859,900	12.9
Other pulping [3]	110,300	148,900	173,400	13,800	446,400	6.7
Red oaks	91,900	191,300	143,200	41,900	468,300	7.0
White oaks	39,800	66,700	56,000	13,900	176,400	2.7
Other nonpulping [4]	65,600	121,400	77,200	20,300	284,500	4.3
Total	875,100	951,300	879,000	145,600	2,851,000	42.9
Cypress	102,100	38,600	20,700	5,700	167,100	2.5
Total all species	1,563,800	1,572,200	3,105,900	399,900	6,641,800	100.0
Percent of total	23.5	23.7	46.8	6.0	100.0	

1/ Includes usable butt sections of turpentined trees.
2/ Includes volume in reproduction and clear-cut conditions.
3/ Bay, yellow poplar, etc.
4/ Hickory, ash, beech, etc.

All board-foot volume shown in tables 7 and 8 is accessible. Favorable logging conditions, light logging equipment, trucks, adequate road systems, and the portability of the present sawmills generally bring even the most isolated stands within reach of the mill operator. The availability of this volume, however, depends upon a number of variable factors, chief of which are ownership, quality, stand per acre, and the working status of the turpentine timber.

In figure 6 is given an analysis of the saw-timber stands of the turpentine pine types to illustrate the relative prevalence of areas with certain board-foot volumes per acre. The outstanding features brought out by the chart are (1) that a relatively large proportion (54 percent) of the area in sawlog-size turpentine pine types bears less than 2,000 board feet per acre, and (2) that nearly 50 percent of the saw-timber volume in these types occurs in stands of 5,000 or more board feet per acre. If it is assumed that an area must bear 2,000 feet per acre or more to be available for utilization, principally lumber, then 46 percent of the forest area in the turpentine pine types falls in this class. Moreover, 79 percent of the total volume in these types was in areas bearing 2,000 feet per acre or more.

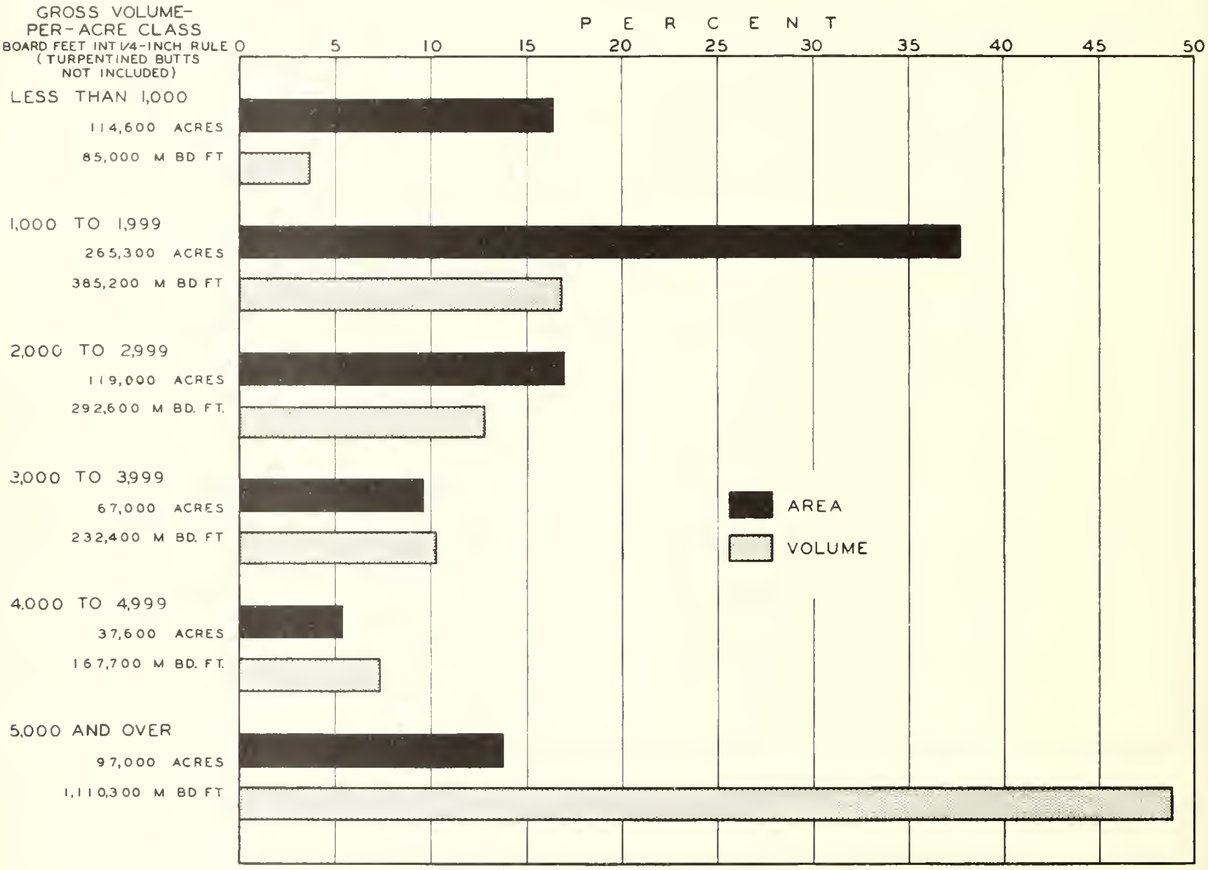

FIGURE 6 — PROPORTIONAL AREA AND VOLUME OF THE SAWLOG-SIZE CONDITIONS IN THE TURPENTINE PINE TYPES, CLASSIFIED ACCORDING TO VOLUME OF SAWTIMBER PER ACRE.

Since the naval stores industry ordinarily makes much use of longleaf and slash pines, especially in the southern portion of the territory, a delay of 6 to 14 years for the turpentining cycle should be anticipated after stands of these trees reach sawlog size before complete utilization may be realized.

Timber estimating and purchase of logs in the South has been based until recently almost entirely upon the Doyle log rule. Although it is the legal rule for Mississippi and Louisiana, in stands composed predominantly of small trees, which are typical of this forest area, the use of the Doyle rule results in greatly underestimating the actual recoverable volume. An estimate that closely approximates green lumber tally has been derived by the use of the International $\frac{1}{4}$-inch rule; it appears in table 8.

Table 8. - Net board-foot volume, classified according to species-group and forest condition (International $\frac{1}{4}$-inch rule), 1935

Species-group	Old growth		Second growth		Total
	Uncut	Partly cut	Sawlog size	Under sawlog size 1/	
	- - - - - - - - - Thousand board feet - - - - - - - - -				
Pines	833,000	913,900	3,850,700	534,500	6,132,100
Red and black gum, bay, cypress, etc.	1,026,100	873,600	934,300	121,100	2,955,100
Red and white oak, hickory, etc.	249,500	487,500	393,000	114,000	1,244,000
Total	2,108,600	2,275,000	5,178,000	769,600	10,331,200

1/ Includes volume in reproduction and clear-cut conditions.

Cordwood volumes

A large portion of the wood volume taken from the forest each year is used in the form of cordwood. Table 9 shows the sound volume of the entire stand of trees 5.0 inches or more d.b.h., outside bark, expressed in standard (4 x 4 x 8 ft.) cords, woods cull deducted. Briefly, this is supplied from the following sources:

1. From the merchantable stems of sawlog-size trees.
2. From that portion of saw-timber trees not used as sawlogs but usable as cordwood. This includes the upper stems of all species to a variable top-diameter limit (but not less than 4 inches), the limbs of hardwoods and cypress to a 4-inch minimum, and unusable portions of turpentined butts.
3. From sound trees under sawlog size at least 5.0 inches d.b.h., in which the entire stem of all species is included to a variable top-diameter (but not less than 4 inches).
4. From the estimated sound material in sound and rotten cull trees.

Deductions for cull include only defects which cause the material to be unsuited for use as cordwood. Sweep and slight crook, therefore, are not deducted.

Table 9. - Net volume of all sound material, including bark, expressed in standard cords

Species-group	Source of material: Sound trees sawlog size	Source of material: Tops of sawlog-size trees	Source of material: Sound trees under sawlog size	Source of material: Cull trees	Total all sources	Percent of total
	- - - - - - - - - - - - - -	- - - - - - - -	Cords	- - - - - - - -	- - - - - - - -	
Turpentine pines:						
Worked	1,909,700	386,500	204,200	7,700	2,508,100	4.3
Unworked	3,331,900	651,100	1,820,700	39,300	5,843,000	9.9
Nonturpentine pines	8,518,300	1,494,100	3,398,700	537,100	13,948,200	23.8
Total pines	13,759,900	2,531,700	5,423,600	584,100	22,299,300	38.0
Hardwoods:						
Pulping 1/	7,401,900	3,770,000	8,039,700	4,827,100	24,038,700	40.9
Nonpulping	3,037,300	1,714,900	4,003,300	3,656,300	12,411,800	21.1
Total hardwoods	10,439,200	5,484,900	12,043,000	8,483,400	36,450,500	62.0
Total all species	24,199,100	8,016,600	17,466,600	9,067,500	58,749,800	100.0
Percent of total	41.2	13.6	29.8	15.4	100.0	

1/ Includes cypress.

There is no question concerning the physical accessibility of the area upon which this volume occurs. Economic availability, however, is another question, which depends upon much the same factors as the profitable logging of saw timber. In general, the smaller the average size of trees and the lower the quality acceptable, the greater is the quantity of material available. The chart (fig. 7) shows at a glance the relative volumes (exclusive of that in cull trees) distributed among the broad species-groups and diameter-classes. The relatively large volume in pulping hardwoods reflects the opportunities for more intensive use of these species, especially the under-sawlog-size material.

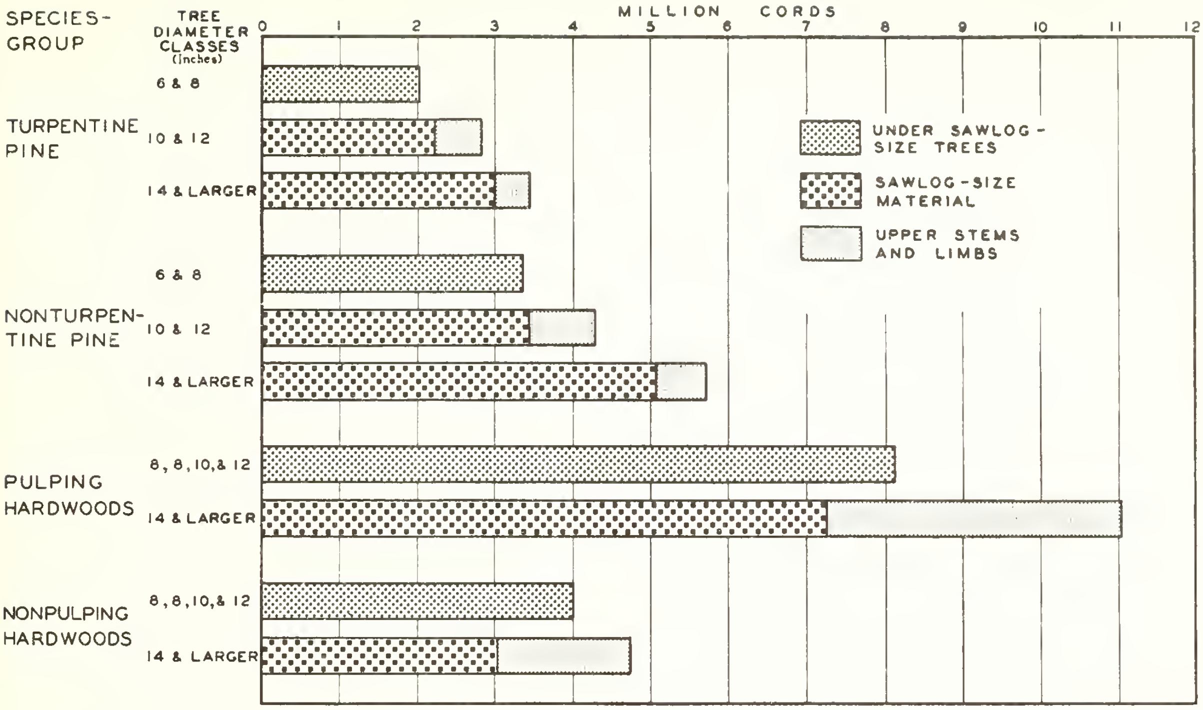

FIGURE 7 — TOTAL CORDWOOD VOLUME IN SOUND TREES BY SPECIES- AND DIAMETER-GROUPS AND BY SOURCE OF MATERIAL

Two important factors limiting the immediate use of some of the pulpwood timber are (1) prior use for naval stores, and (2) low average stand (in cords) per acre. Turpentine pines make up 14 percent of the total cordwood volume. Some of this occurs in the northern part of the area, where there are no naval stores operations, and it will not be affected; but on approximately 6 million cords in the southern part, the claim of the naval stores industry currently operates to delay the harvest, retard growth, and lower slightly the quality and volumes per acre recoverable.

The average number of cords per acre[9] in the several forest conditions and species-groups is a further index to the availability of these volumes. This is shown in table 10 and indicates what may be expected over large areas in similar types and conditions.

9/ Volumes on average acres in the principal units of the naval stores region, Forest Survey Release No. 29, Oct. 30, 1937, Southern Forest Exp. Sta., New Orleans, La.

Table 10. - Average net cordwood volume per acre, classified according to species-group and forest condition

Species-group	Old growth		Second growth sawlog size		Second-growth under sawlog size	Weighted average, all conditions 1/
	Uncut	Partly cut	Uncut	Partly cut		
	Cords per acre 2/					
Turpentine pines:						
Round	2.8	1.6	1.5	1.8	0.7	1.2
Worked	3.2	1.1	0.5	0.7	0.1	0.5
Nonturpentine pines	2.5	1.5	6.9	4.8	0.7	2.8
Pulping hardwoods 3/	15.9	6.5	4.2	3.5	0.7	3.2
Total pulping species	24.4	10.7	13.1	10.8	2.2	7.7
Nonpulping hardwoods	4.0	3.1	1.7	1.7	0.7	1.5
Total all species	28.4	13.8	14.8	12.5	2.9	4/9.2

1/ Does not include areas in reproduction or clear-cut condition.
2/ Excludes upper stems and limbs of hardwoods, and cull trees.
3/ Includes cypress.
4/ The weighted average for all species and all conditions, including reproduction and clear-cut areas, is 6.9 cords per acre.

Pine poles and piles

Included in the tables and charts of cordwood and saw-timber volume are many pine trees suitable for poles and piles. These especially qualified trees may be found as scattered individuals throughout the area, but are most common in the old-growth and sawlog-size second-growth pine stands in the northern and central counties of Mississippi. The Survey made a conservative estimate of their number, placing them in length- and diameter-classes (table 11). With approximately 320 wood-using plants in this area, other than treating plants, it is evident that pole buyers must meet a strong competition for their material, but the premium price they are able to offer encourages sellers to seek the better market.

Table 11. - Total number of poles and piles, classified according to length and diameter, 1935

Diameter-class (outside bark)	Pole or pile length (feet)						Total	Percent of total sticks
	20	25	30	35	40 and 45	50+		
Inches	Thousand sticks							
8	3,638	693	188	-	-	-	4,519	30.6
10	2,326	1,055	731	255	120	-	4,487	30.3
12	1,113	784	681	353	235	37	3,203	21.7
14	361	413	362	241	203	59	1,639	11.1
16	83	176	163	106	137	54	719	4.9
18	6	52	43	38	49	26	214	1.4
Total	7,527	3,173	2,168	993	744	176	14,781	100.0
Percent of total	50.9	21.5	14.7	6.7	5.0	1.2	100.0	

Forest Increment

Forest increment as used in this release means the difference between the net volume of good trees standing on the area at the beginning of the year and that at the end, before deducting the total commodity drain for the year. If the loss in volume during the year due to mortality, rot, or injury is equivalent to the increase due to growth, there will be no increment; and if these losses are greater than the increase due to growth, there will be a reduction in the growing stock, in addition to that caused by commodity drain.

Board-foot increment is made up of the growth on sawlog-size trees and the total board-foot volume of trees becoming sawlog size during the year. Cordwood increment represents growth on the sound stemwood of pines 5.0 inches d.b.h. and over, on under-sawlog-size hardwoods, and on the sawlog portion of hardwoods 13.0 inches d.b.h. and larger. Included also is the total volume in pine and hardwoods that become 5.0 inches or larger during the year. In calculating both the board-foot and cordwood increment, cull material and cull trees are excluded.

In order to arrive at an estimate of average increments for various conditions uninfluenced by cutting, the data in table 12 were assembled. These figures are intended only as a basis for comparison with other forest regions and cannot be applied accurately to individual tracts of timber; they represent the <u>average</u> increment that occurred on live trees standing on the area at the beginning of the year, deduction having been made only for mortality. In 1935, the increment in the second-growth sawlog-size condition throughout the area averaged 263 board feet per acre, while that in the reproduction and clear-cut conditions averaged only 6. For the entire forest area, the average increment per acre was 105 board feet. Cordwood increment averaged 0.4 cord per acre for all types and conditions.

Table 12. - Average increment per acre on the forest area, classified according to forest condition, 1935

Forest condition	Saw-timber material			All material		
	Pine	Hard-wood 1/	Total	Pine	Hard-wood 1/	Total
	- - - Board feet 2/ - - - -			- - - - Cords 3/ - - - -		
Old growth	28	104	132	.09	.39	.48
Second growth:						
Sawlog size	211	52	263	.56	.30	.86
Under sawlog size	54	10	64	.25	.13	.38
Reproduction and clear-cut	6	negl.	6	.02	.02	.04
Weighted average	75	30	105	.24	.18	.42

1/ Includes cypress.
2/ International $\frac{1}{4}$-inch scale.
3/ Outside bark.

In table 13, the total increments (in board feet and cords) which occurred during 1935 in the three major species-groups are listed by forest conditions. In these calculations allowance has been made for the effect of cutting. It may be estimated roughly that in 1935 turpentining was responsible for a loss of over 40 million board feet. Most of this was due to the increased mortality and the difference between the growth of the turpentined trees and the growth they would have made had they been left round. A small part was caused by the degrading of material in turpentined butts.

Table 13. - Total net increment classified according to forest condition and species-group, expressed in board feet 1/ and standard cords, 1935

Forest condition	Longleaf and slash pine		Loblolly, shortleaf, and other pine		Hardwood and cypress		Total all species-groups	
	M board feet	Cords	M board feet	Cords	M board feet	Cords	M board feet	Cords
Old growth	-400	-5,300	18,600	65,100	83,900	317,800	102,100	377,600
Second growth:								
Sawlog size	60,700	157,900	260,300	692,700	77,700	466,800	398,700	1,317,400
Under sawlog size	58,100	264,700	69,700	335,800	23,300	309,400	151,100	909,900
Reproduction and clear-cut	6,800	21,200	2,500	5,800	500	31,400	9,800	58,400
Total	125,200	438,500	351,100	1,099,400	185,400	1,125,400	661,700	2,663,300

1/ International $\frac{1}{4}$-inch scale.

Wood-Products Industries and Employment

The manufacture of lumber, veneer, cooperage, pulp, and miscellaneous forest products constitutes the major industry in this region. Almost every community has a mill or a concentration yard for lumber, cross ties, or poles (see industry map, fig. 4), and the larger inland cities have grown up around the sawmill industry. But conditions are changing. During the last few years several of the largest sawmills have ceased operation and more will cut out shortly, owing to the lack of adequate supplies of virgin timber. In contrast, the smaller mills are increasing in number.

The major production item, of course, is lumber, about 628 million board feet of which was produced by sawmills in 1936; 500 million of this was pine, 110 million hardwood, and 18 million cypress. Table 14 lists the number of sawmills operating in 1936 by capacity and species cut, together with the number of man-days of employment provided by them within the area.

Table 14. - Number of sawmills and man-days of employment, classified according to capacity of mill, 1936

Rated capacity (10-hour day) 1/	Mills 2/			Employment provided		
	Pine	Hardwood 3/	Total	Woods	Mill	Total
Thousand board feet		Number			Thousand man-days	
Under 20	268	-	268	148	249	397
20 to 39	10	1	11	62	88	150
40 to 79	2	3	5	61	88	149
80 and over	6	3	9	357	907	1,264
Total	286	7	293	628	1,332	1,960

1/ Rated capacity indicates size of mill rather than actual average production.
2/ Based on field survey in May 1937.
3/ Includes cypress.

Non-lumber industries

Scattered throughout the area and competing for the same timber are pulp mills, veneer mills, cooperage plants, and a number of other plants turning out such miscellaneous products as shuttle blocks, furniture squares, and paper-roll plugs. These accounted for approximately 20 percent of the wood products manufactured from material cut within the area in 1936. Moreover, these mills provided 31 percent of the man-days of labor required to cut and manufacture all woods products.

Although no manufacturing plants are required to produce cross ties, poles, piles, fuel wood, fence posts, etc., these are important activities, particularly in the rural sections, where they supply much of the part-time employment to farmers and other residents. Their wood consumption amounted to about 20 percent of the total of all wood-using industries. In this non-plant classification, the production of fuel wood ranks highest, both in volume production and in man-days of labor involved.

Treating plants, which are fixed consumers of premium-quality timber and cross ties, provided 47,000 man-days of plant labor in 1936.

Table 15 summarizes the employment data for the commercial forest industries and for other wood-producing activities. Under "units produced" is given the total volume (mill scale) that was manufactured in the area from forests both inside and outside the area. "Woods employment" includes all labor required to produce all the volume cut in the area. "Plant employment" includes all labor required in the forest-industrial plants to produce the given volumes.

Table 15. - Production and employment in the wood-products industries, 1936

Industry or commodity	Number of plants	Units produced	Thousand man-days (10 hours) of employment		
			Woods	Plant	Total
		M bd. ft.			
Lumber	293	627,900	628	1,332	1,960
Veneer	14	48,900	99	157	256
		Pieces			
Cross ties	-	645,000	90	-	90
Fence posts	-	1,551,000	25	-	25
Poles and piles	-	300,000	49	-	49
		Cords			
Pulpwood	3	448,800	244	759	1,003
Cooperage	5	19,800	21	24	45
Fuel wood	-	767,200	833	-	833
Miscellaneous	7	7,800	7	12	19
		M cu. ft.			
Treating plants	6	3,320	-	47	47
Total	328		1,996	2,331	4,327

Commodity Drain

The total volume cut annually from the forests of this area, regardless of its destination or point of manufacture, together with the incidental woods waste in logging, constitutes the commodity drain. Table 16 lists the board-foot and cubic-foot drain by commodity and general species-groups. In the sawlog material, all commodity drain is expressed in terms of board feet for purposes of comparison.

Table 16. - Commodity drain from good trees expressed in board feet (International $\frac{1}{4}$-inch scale) and cubic feet, 1936

Commodity	Sawlog material				All material			
	Pine	Hard-wood 1/	Total	Per-cent	Pine	Hard-wood 1/	Total	Per-cent
	- - - - M bd. ft. - -				- - M cu. ft. (i.b.)- - -			
Lumber	420,400	99,300	519,700	66	74,640	14,250	88,890	60
Veneer	6,000	51,500	57,500	7	1,020	7,360	8,380	6
Cooperage	1,100	11,900	13,000	2	210	1,710	1,920	1
Pulpwood	50,300	1,600	51,900	7	17,100	430	17,530	12
Fuel wood	44,200	34,500	78,700	10	10,570	5,650	16,220	11
Poles and piles	21,100	200	21,300	3	4,300	40	4,340	3
Cross ties	19,200	11,400	30,600	4	3,880	2,070	5,950	4
Miscellaneous 2/	5,600	5,900	11,500	1	2,350	1,570	3,920	3
All commodities	567,900	216,300	784,200	100	114,070	33,080	147,150	100

1/ Includes cypress.
2/ Includes material in fence posts, volume from land clearing, and wood for domestic farm use.

Comparison of Volume Increment and Commodity Drain

During the past 50 years the forests of the longleaf pine region in Mississippi and adjacent Louisiana have suffered severe over-cutting, and for many years each succeeding year saw the total standing volume progressively reduced. In recent years, however, this trend has reversed until in 1934 the increment, principally on the fast-growing second growth exceeded by 74 million board feet the volume cut during that year. In 1935 the cut increased, but the total increment was still sufficient to cause an increase in growing stock of approximately 12 million board feet. Again in 1936 the commodity drain increased, and that year the growing stock was reduced more than 102 million board feet, as shown in table 17, which gives the board-foot volume estimated to have been standing on Jan. 1 of each year from 1934 to 1937.

Table 17. - Changes in growing stock

Date	Saw-timber material: Pine	Saw-timber material: Hardwood	Saw-timber material: Total	All growing stock 5.0 inches d.b.h. and larger
	- Thousand bd.ft. (green lumber tally) -			Thousand cu.ft. (i.b.)
Jan. 1, 1934	6,101,200	4,156,100	10,257,300	3,032,780
Jan. 1, 1935	6,132,100	4,199,100	10,331,200	3,109,950
Jan. 1, 1936	6,145,700	4,197,500	10,343,200	3,175,790
Jan. 1, 1937	6,074,300	4,166,800	10,241,100	3,224,420

The comparison of increment and commodity drain for 1936 (table 18) shows the net change in growing stock that took place during that year and the factors responsible for it. The nonturpentine pine group alone shows an increase in the saw-timber growing stock. The decrease among the other species, however, is sufficient to cause a general decrease of more than 102 million board feet of saw timber (fig. 8). If the saw-timber material is combined with that unsuited for sawlogs, and expressed in cubic feet, there results an increase in the total growing stock of almost 49 million cubic feet.

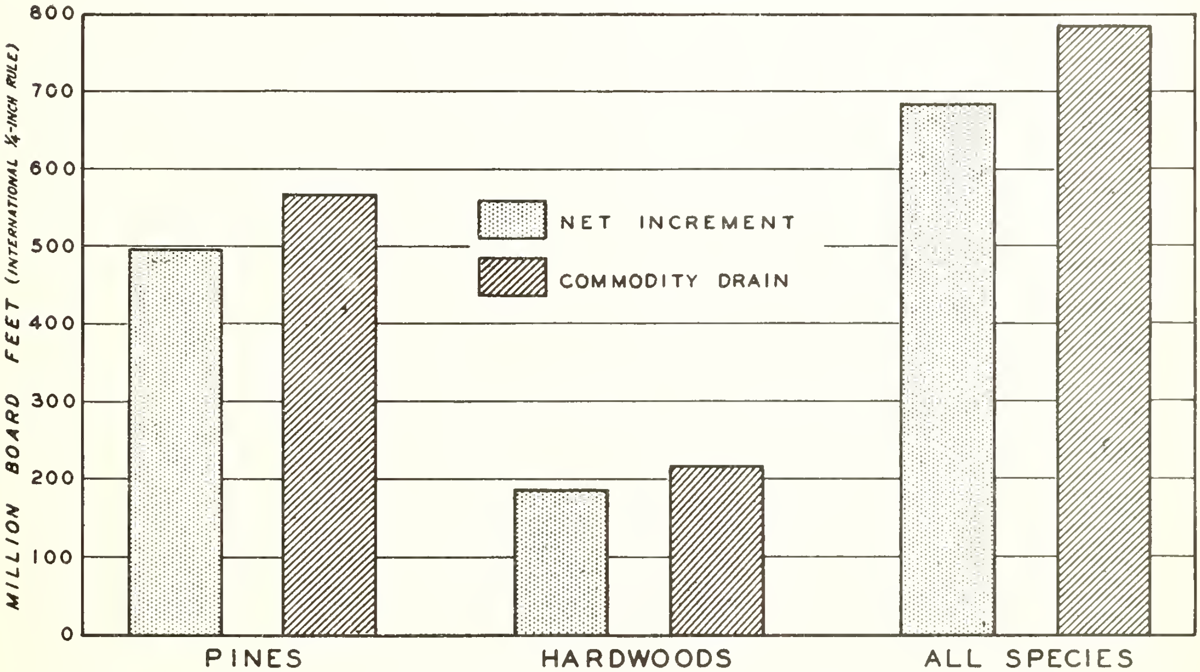

FIGURE 8 - COMPARISON OF NET INCREMENT WITH COMMODITY DRAIN, 1936.

Table 18. - Comparison of increment with commodity drain, 1936

Item	Saw-timber material					All growing stock 5 inches d.b.h. and over
	Longleaf and slash pines	Nontur-pentine pines	Total pines	Hardwood and cypress	All species-groups	
	---Thousand board feet (International $\frac{1}{4}$-inch rule)---					M cu. ft. (i.b.)
Growing stock, Jan. 1, 1936	2,228,200	3,917,500	6,145,700	4,197,500	10,343,200	3,175,790
Growth	170,300	407,400	577,700	212,200	789,900	226,370
Mortality	39,600	41,600	81,200	26,600	107,800	30,590
Net increment	130,700	365,800	496,500	185,600	682,100	195,780
Commodity drain	327,700	240,200	567,900	216,300	784,200	147,150
Net change in growing stock	-197,000	125,600	-71,400	-30,700	-102,100	48,630
Growing stock, Jan. 1, 1937	2,031,200	4,043,100	6,074,300	4,166,800	10,241,100	3,224,420

Summary and Outlook for the Future

This section of Mississippi and Louisiana, in which about 79 percent of the land area is forested, is adapted primarily to industrial-timber production. Well-developed forest industries established throughout the area take a leading role in its industrial activities and as a source of income and employment are second only to agriculture.

The forests of this area are passing through the closing years of a transition period. The acreage of old-growth timber is being replaced rapidly by second growth, but 73 percent of the forest area was classed in 1935 as second growth, 13 percent as old growth, and 14 percent as clear-cut.

Notwithstanding good forest soils and favorable growing conditions, understocking characterizes most of the forest area. In the turpentine pine types, which occupy 53 percent of the forest area, the prevailing average volumes per acre are less than a third of those attained on the areas bearing the best-stocked stands. Uncontrolled fire, disease, and the weakening effect of careless turpentining have added to the natural mortality, and in 1936 the total loss from these causes amounted to almost 108 million board feet in the sawlog material. Although natural conditions encourage rapid tree growth on practically all the forest area, the average increment per acre for the entire forest is only 105 board feet of saw timber.

The varied and well-developed forest industries present offer an excellent market for many types of wood products; 293 sawmills (25 of which have a capacity of 20 M board feet or more per day) produced almost 630 million board feet in 1936 and provided nearly 2 million man-days of employment. During 1936 and 1937, four of the largest sawmills cut their last logs, and one more large mill is scheduled to cut out in 1938. The 268 small portable mills, with capacities of less than 20 M board feet per day, cut only 19 percent of the lumber produced in 1936 and accounted for 20 percent of the total man-days of employment provided by the lumber industry. The 35 non-lumber plants, including pulp mills, veneer, cooperage, and treating plants, together with the producers of fuel wood, cross ties, and poles, used 40 percent of the volume cut from the forests of the area and accounted for 55 percent of the labor provided by all wood-using industries.

Turpentine and rosin is produced principally by the 8 wood distillation plants operating in this territory. These plants now operate on the principle of mining (i.e., the removal of an irreplaceable resource), although they may extend their life indefinitely by purchasing crude gum from producers without stills, a practice already started. Gum turpentine stills, which numbered 22 in 1934, produced about 21 percent of the turpentine and 13 percent of the rosin manufactured in this territory during the 1936-37 season. They provided about 220,000 man-days of employment.

The forest situation as it was at the close of 1936 is epitomised in the comparison of growth and drain: The saw-timber growing stock was reduced more than 102 million board feet, while the total growing stock on trees 5 inches d.b.h. and over increased approximately 49 million cubic feet.

The facts outlined above point toward the obvious conclusion that the wood-using industries are consuming the high-quality timber much faster than it is being replaced through growth. To continue in this direction can lead only to serious curtailments among the larger wood-using industries, increased unemployment, and a progressive depreciation of timber values.

Of prime importance, therefore, is the immediate inauguration of an intensive, organized effort to develop more fully the forest resources. Natural soil and climatic conditions favor excellent tree growth, and if the full potentialities of the forest are developed, it is probable that annual increment and volume per acre could be double or triple that which now obtains. To bring this about will require widespread and effective fire protection, with particular attention directed to the reduction of incendiarism, at present the principal cause of forest fires. The poorly stocked forests that now characterize large areas must be built up, and areas where restocking is doubtful or will be long delayed should be planted to trees.

The present timber stand must be carefully utilized and improved through selective cutting, commercial thinnings (particularly in sapling and pole stands), and closer utilization, especially among the lower-grade hardwoods. Integrated use of wood, with each industry consuming as far as possible the class of material best adapted to its needs, should be fostered among all users of forest products. Conservative turpentine practices will contribute substantially toward a lower death rate and a higher growth rate in longleaf and slash pines. Public agencies should assist liberally through budgetary appropriations and tax relief, as well as by the extension of education in the principles of sound woodland management, directed especially toward farmers and owners of small acreages.

In this area the forest industries eventually will use almost exclusively small and medium-sized second-growth timber. Short rotations of 30 to 60 years will probably characterize forest management on private land. Because of the change in conditions now taking place in both the industries and their resources, the next few years should be a very opportune time to promote the principles of good forest management. The private owner of forest land, and particularly the small owner, must be reached directly with a systematic and sustained program of forest education involving fire protection and skillful management. Ultimately the effects of such efforts should increase greatly the volume and the quality of the forest asset of this section, whose future prosperity largely depends upon what it does with its timber resources.

FOREST SURVEY RELEASE NO. 40 DECEMBER 22, 1938

FOREST RESOURCES OF NORTHEAST TEXAS

by
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A Progress Report by

THE SOUTHERN FOREST SURVEY

I. F. Eldredge, Regional Survey Director

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

FOREWORD

The nation-wide Forest Survey, being conducted by the United States Forest Service, was authorized by the McSweeney-McNary Forest Research Act of 1928. Its five-fold object is: (1) to make an inventory of the present supply of timber and other forest products; (2) to ascertain the rate at which this supply is being increased through growth, (3) to determine the rate at which this supply is being diminished through industrial and local use, windfall, fire, and disease, (4) to determine the present requirement and the probable future trend in the requirement for timber and other forest products; and (5) to correlate these findings with existing and anticipated economic conditions, in order that policies may be formulated for the effective use of land suitable for forest production.

This release is based on a field survey made April 13, 1935, to August 24, 1935, and three field canvasses of forest industrial plants to determine forest drain, the last of which was made during January 1938. It should be regarded only as a progress report since it contains Forest Survey data that will be included in complete reports to be published later, and that, although considered reliable, are subject to correction or amplification as the work of computation proceeds. Item 4 above, which is being studied on a national basis, is not discussed in this report.

In the presentation of these survey data, it is to be noted that owing to the sampling method used in collecting them, the greater the number of samples in any given classification the more accurate are the data for that classification. Hence classes that are of infrequent occurrence and relatively small in quantity generally cannot be determined with as high a degree of accuracy as classes that occur more frequently and in substantially greater quantities. Small tabular items are to be taken as showing, not the exact magnitude of the classes involved, but their relative magnitude in comparison with those of other classes.

In the South, the Forest Survey functions as an activity of the Southern Forest Experiment Station with headquarters at New Orleans, La.

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Note: The Southern Forest Experiment Station hereby wishes to acknowledge the clerical assistance received from the Works Progress Administration in the preparation of this Release.

FOREST RESOURCES OF NORTHEAST TEXAS

General Description of the Unit

Notwithstanding its importance, the timber resource of northeast Texas has been overshadowed in recent years by the petroleum industry. Until 1930 agriculture and the forest industries were the chief sources of livelihood for the people of the area, but with the drilling of the Joiner well in 1930, and the oil boom of 1931 and 1932, the area quickly became the largest oil field in the world and produced about 176 million barrels of petroleum in 1935. The petroleum industry, however, actually utilizes only a small proportion of the land surface. Exclusive of lands under lease, the area occupied by oil wells is probably less than 300,000 acres, forming a belt not more than 8 miles wide and 50 miles long, extending from northeast to southwest through Cherokee, Rusk, Smith, Gregg, and Upshur Counties. These counties are included in the forested counties of northeast Texas, the timber resource of which is discussed in this report.

The area of the survey unit under consideration consists of 19 counties located in the northeastern corner of the State (fig. 3). The gross land area is 8,622,100 acres, nearly 46 percent of which is forest land. Agriculture, petroleum, and forest industries employ a large proportion of the population. There are no large cities in the area, but Tyler, Longview, and Marshall, in or near the oil field, are very active and growing centers. Texarkana, on the Texas-Arkansas State line in the northeast corner of the unit, has long been a center of forest industries. Convenient access can be had to the larger cities of Dallas and Fort Worth on the west, and to Shreveport, La., on the east, as main highways and railroads cross the unit and connect these urban centers.

The surface topography is gently undulating to moderately hilly, with a general southeast slope. Elevations range from 200 to 600 feet above sea level, some of the highest land occurring in Anderson, Cherokee, Smith, and Rusk Counties. The northern part of the unit is drained by the Red River and its tributaries, while the remainder is largely in the drainage basin of the Sabine. All the main streams flow southward or southeastward. Moderate sheet erosion and occasional or frequent gullies occur throughout the unit except in the stream bottoms and on two areas in Panola and Red River Counties that have only slight sheet erosion (Reconnaissance Erosion Survey, Soil Conservation Service, 1934).

Seven main railroad systems, with several secondary roads, provide adequate rail transportation throughout the unit and to outside points. Paved highways are numerous and well distributed. Five Federal highways cross the unit from east to west and two from north to south. Practically all the State highways are paved and most of the county roads are passable for motor vehicles even in wet weather. Forested areas hitherto unavailable to motor transport have been tapped by Civilian Conservation Corps truck trails, so that not many areas now exist that are more than a few miles from a road.

The discovery of oil has caused rapid changes in the population since the census of 1930. At that time the total population was 522,000, but it is probably nearer 650,000 at present. In 1930 nearly 80 percent of the people lived outside of urban centers, and even though these urban centers have grown rapidly, it is possible that this proportion has increased, since many of the oil-field workers live in rural homes and scattered communities. Agriculture furnished employment to 64 percent of the working population in 1930, while forest industries furnished year-long employment to only 3 percent. According to the last Census of Agriculture, farmers secured 1,912,000 man-days of employment away from their farms in 1934; this is equivalent to 24 days for each farm operator. Much of this labor was expended in the oil fields and the forest industries. The great need for employment by all classes of people in the unit is evident from the Unemployment Census of November 1937, according to which 31,800 were totally unemployed, 6,500 were engaged in emergency relief work, and 18,200 were partly employed but wanted more work.

Land held in small farms is the leading type of land use. According to the 1935 Census, there were 79,000 farms in the unit containing 6,165,000 acres, or 72 percent of the land area. These farms averaged 78 acres each, 26 of which were wooded. The total acreage in these farm woodlands amounts to 2,068,000 acres, or 52 percent of all the forest lands. The number of farms decreased slightly between 1930 and 1935, but the total acreage in farm ownership increased by about 770,000 acres. Practically all of this increase is wooded or pasture land, as the area available for crops remained about as in 1930. The amount of idle cropland increased from 242,000 acres in 1924 to 512,000 acres in 1934, owing in part to the tendency of farmers in, or adjacent to, the oil field to depend upon oil leases and royalties for income rather than tillage of the soil, and in part to the Federal crop-control programs of recent years.

Cotton is the principal crop. Between 1924 and 1937 the cotton acreage was reduced by 36 percent, or 576,000 acres. This shrinkage in cotton acreage must seriously affect the economic life both of the rural people and of the region as a whole, since it has resulted in a labor loss equivalent to nearly 5 million man-days of employment. This shrinkage in employment, which has probably affected between 40,000 and 50,000 people, is undoubtedly reflected in the unemployment data given above.

Although cotton growing has decreased the corn acreage increased nearly 100,000 acres between 1929 and 1934. The growing of tomatoes, sweet and Irish potatoes, and watermelons for market has increased materially; about 65,000 acres of these crops were grown in 1934. Specialized crops, such as the commercial production of rose bushes around Tyler, are important in a few localities. The tomato industry, centering in Cherokee and Smith Counties, is a source of cash income to part of the farm population, and also utilizes a part of the production of the 17 veneer and basket plants in the unit.

The results of a classification by the Survey of the land area of the unit according to actual land use are given in table 1. A large part of the 700,000 acres of idle or abandoned land should be used for timber production. Since most of this acreage is in small tracts, often contiguous to forest stands, natural seeding will restock a part of the land. Artificial planting will be necessary on the rest. Fire protection is essential in either case.

Table 1. - Land area classified according to land use, 1935

Land use	Area		Percent of total area	
	- - - - - Acres - - - - -			
Forest:				
Productive	3,943,100		45.7	
Nonproductive	3,100		.1	
Total forest		3,946,200		45.8
Nonforest:				
Agricultural:				
In cultivation:				
Old cropland	2,885,000		33.4	
New cropland	102,300		1.2	
Out of cultivation:				
Idle	532,500		6.2	
Abandoned	171,000		2.0	
Pasture	770,700		8.9	
Total agricultural	4,461,500		51.7	
Other nonforest	214,400		2.5	
Total nonforest areas		4,675,900		54.2
Total forest and nonforest		8,622,100		100.0

Description of the Forest

The forests of northeast Texas are largely second growth, typically found in small tracts intermingled with cultivated land. Of the forest area 78 percent is in the rolling uplands, 10 percent in swamps and small stream bottoms, and 12 percent in the main river bottoms. Shortleaf and loblolly pines mixed with hardwoods form the characteristic forest of the uplands, while red gum, red and white oaks, and various other hardwoods occur in the river bottoms. The two pine species are well distributed throughout the upland pine area, although shortleaf is much more abundant, particularly upon the higher hills and ridges. Along the western and northern edges of the unit, the pine-hardwood stands are replaced by nearly pure hardwoods, chiefly scrubby post oak (fig. 3). The river-bottom hardwoods are found mainly in the bottoms of the Red, Sulphur, Sabine, Angelina, Neches, and Trinity Rivers.

Ninety percent of the total forest area is stocked with second-growth timber (table 2), two-thirds of which is of sawlog size. The clear-cut area is negligible. The old-growth stands, which occupy only 10 percent of the forest area, are largely confined to the hardwood types. Less than 100,000 acres of old-growth pine remains, and most of this is in small, widely scattered tracts, often only a few acres in extent. Some of the larger blocks are located in Panola County along the east bank of the Sabine River, in Shelby County, and in Anderson County along the Neches River.

Table 2. - Forest area classified according to forest condition and forest type-group, 1935

Forest condition	Pine	Pine-hardwoods	Upland hardwoods	Bottom-land hardwoods	Total all types	Proportion of total
	Acres					Percent
Old growth:						
Uncut	33,600	21,900	44,500	85,900	185,900	4.7
Partly cut	26,500	17,200	68,700	93,700	206,100	5.2
Total	60,100	39,100	113,200	179,600	392,000	9.9
Second growth:						
Sawlog size:						
Uncut	762,100	273,300	118,700	170,200	1,324,300	33.6
Partly cut	418,500	243,600	107,000	117,900	887,000	22.5
Under sawlog size	224,100	282,700	509,800	178,000	1,194,600	30.3
Reproduction	17,200	22,600	87,500	11,700	139,000	3.5
Total	1,421,900	822,200	823,000	477,800	3,544,900	89.9
Clear-cut	2,300	1,500	1,600	800	6,200	.2
Total all conditions	1,484,300	862,800	937,800	658,200	3,943,100	100.0
Percent of total forest area	37.6	21.9	23.8	16.7	100.0	

Figure 1 shows the species composition of the four type-groups into which the forest stands were classified. In this figure the net cubic-foot volumes in each of the four species-groups—(1) pines, (2) gums and other pulping hardwoods, (3) oaks including scrub oak, (4) hickories, elms, etc.—are expressed as a percentage of the total net cubic-foot volume in the type-group. Conspicuous is the high proportion of pine, three-fourths of which is shortleaf, in the "pure" pine type-group. In the upland hardwoods type-group, nearly two-thirds of the oaks are post and scrub species of rather inferior quality, while hickory is more abundant here than in any other type-group. The bottom-land hardwoods have more than half their volume in red gum and in red and white oaks. Ash, although making up only 3 percent of the bottom-land hardwoods is most prevalent in this type-group.

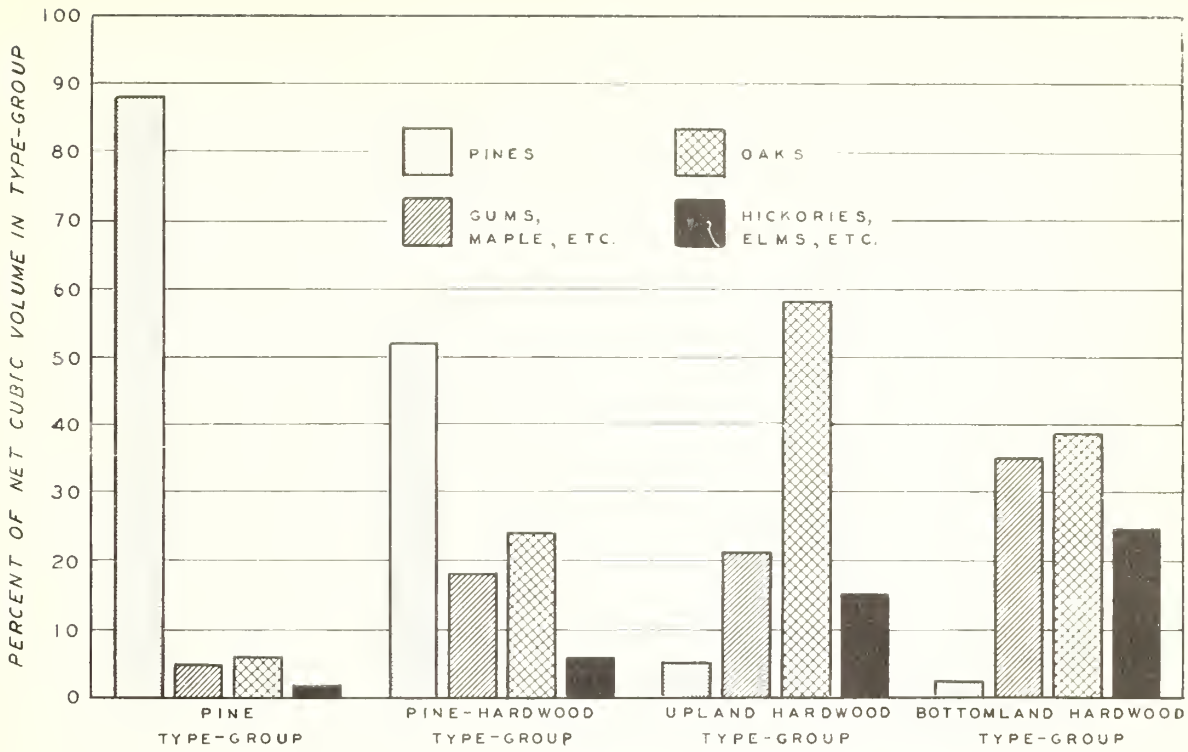


FIGURE 1 - SPECIES COMPOSITION OF FOREST TYPE-GROUPS

The approximate age-class and volume distribution of the present pine and pine-hardwood forest is compared in figure 2 with that of a theoretical ideal forest managed on a rotation of 70 years. The area represented is the 2,347,100 acres at present stocked to the type of forest that occupies 60 percent of the total forest area. The forest under management is divided into 7 equal areas, each containing 335,300 acres and supporting one 10-year age-class. The occurrence of age-classes in the present forest is also plotted; and reference to figure 2 shows that the areas occupied by the respective age-classes are far from regular, varying from 2 percent of the total area in the 0- to 10-year age-class to 22 percent in the 41- to 50-year age-class. The per-acre volumes of the managed forest are based upon the best stocked 10 percent of the uncut stands of weighted-average sites in the pine and pine-hardwood types, while the volumes of the present forest are averages of all the stands in a specific age-class.

The figure reveals several characteristics of the present pine and pine-hardwood forest among which are that (1) stocking is much less than the land is capable of supporting, as the present forest contains only 52 percent of the volume of the managed stands; and that (2) while the distribution of age-classes by area does not agree with that of the managed forest, it is not unfavorable for sustained yield provided the age-classes are utilized in the order of their maturity during the period of the rotation.

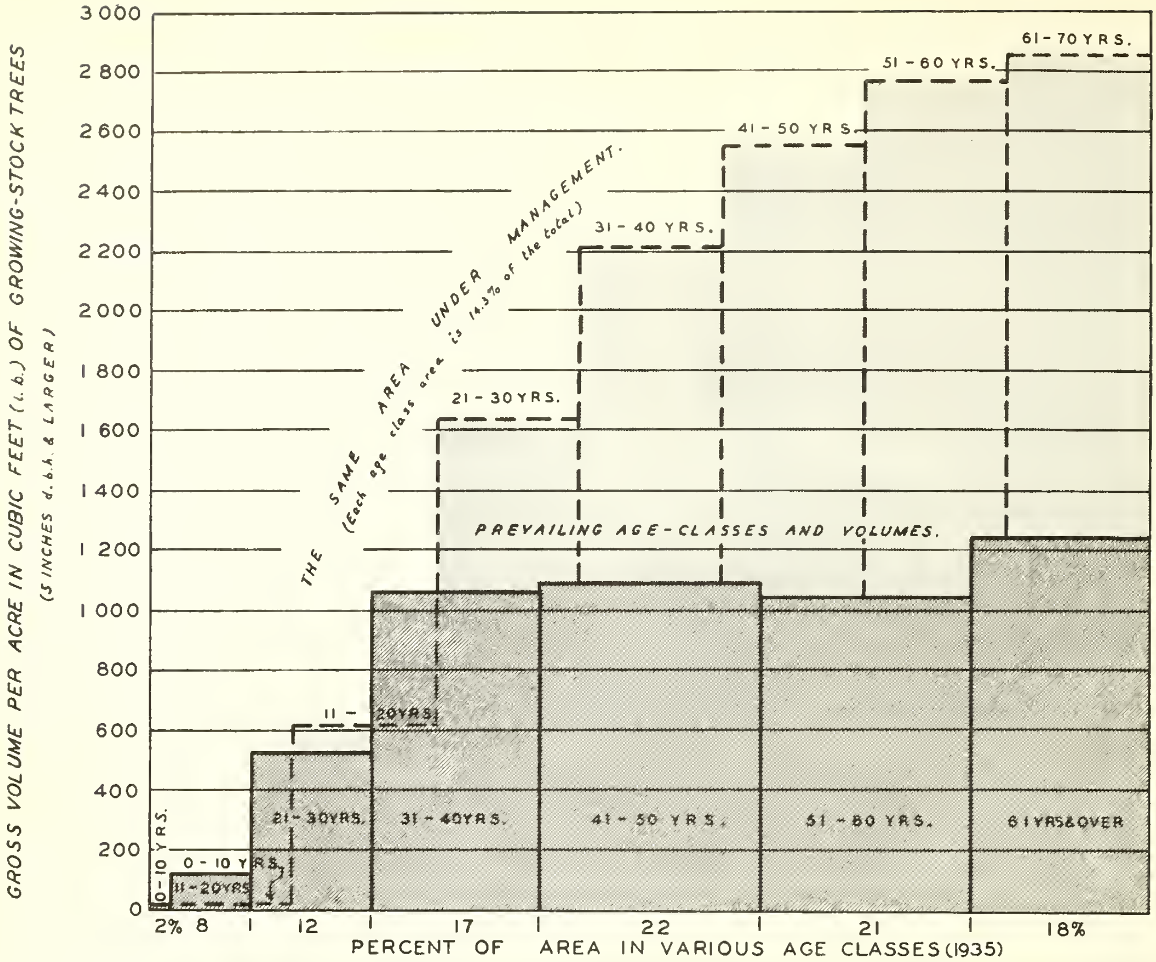


FIGURE 2 - PREVAILING AGE-CLASS AND VOLUME DISTRIBUTION COMPARED WITH THAT ON THE SAME AREA UNDER MANAGEMENT (BASED ON PINE AND PINE-HARDWOOD TYPE AREAS OF 2,347,100 ACRES).

While no comparable calculation for the upland hardwood and bottom-land hardwood type-groups has been attempted, it may be said with confidence that the stocking in these type-groups is far below the attainable density and the proportionate volume in large trees is less than it should be to obtain the full benefit of forest management.

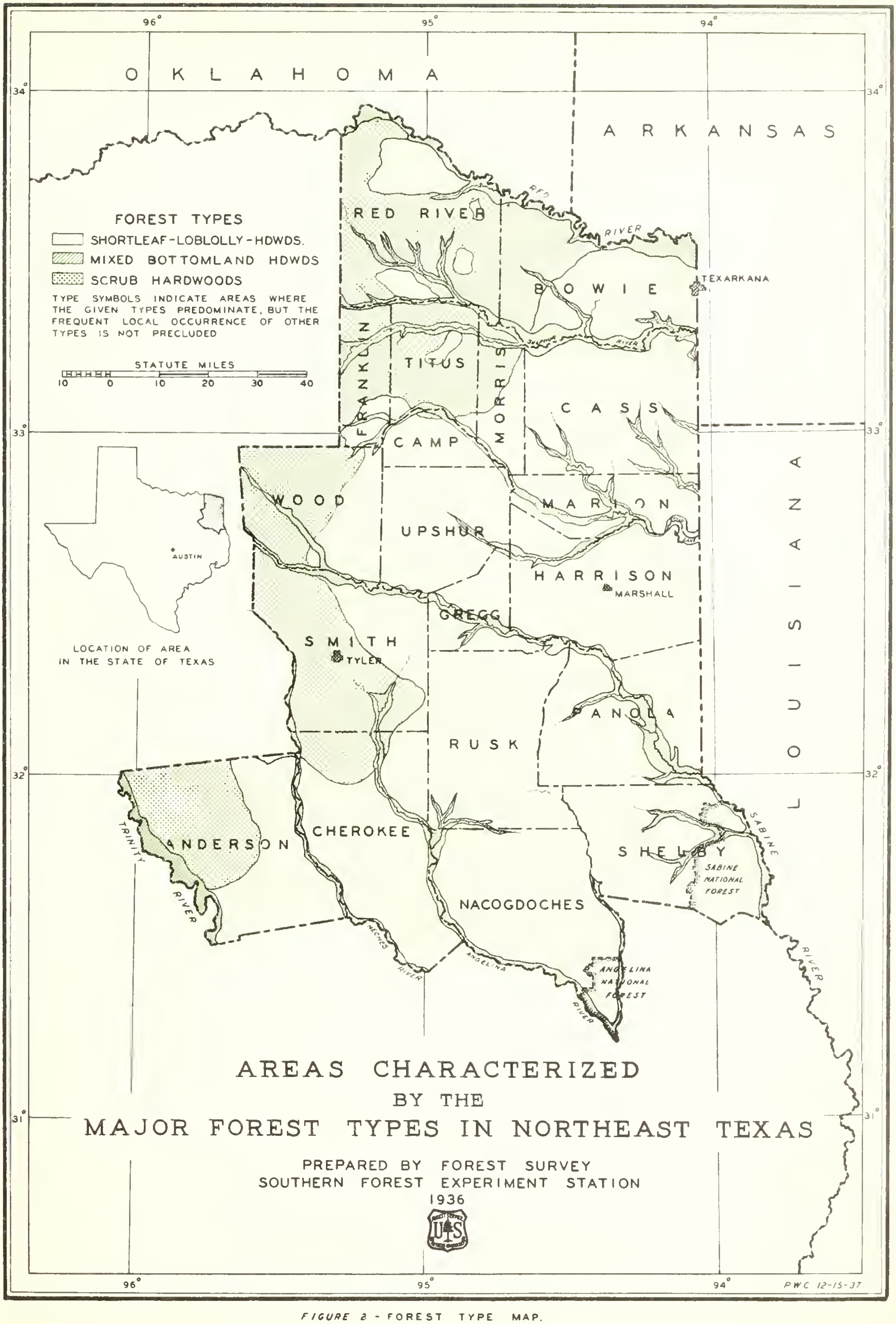


FIGURE 2 - FOREST TYPE MAP.

Volume Estimates

Board-foot volume

The estimate of the volume in sound saw-timber trees is given in table 3, expressed in terms of board feet, as measured by the Doyle log rule. To be included in this estimate, hardwoods must be at least 13.0 inches in diameter at breast height (d.b.h.) outside bark, and pines and cypress 9.0 inches. Also all trees must contain at least one 12-foot butt log, or have 50 percent of their gross volume in sound material. Top diameters vary with the limits of usable material, but no hardwood logs less than 8.5 inches in diameter at the small end nor any pine logs less than 5.5 inches were included. Deductions were made for woods cull, such as rot, fire-scar, crook, limbiness, and similar defects, as well as for loss in sawing at the mill due to sweep and hidden defects; consequently the volumes given here can be considered net log scale.

Table 3. - Net volume (Doyle) classified according to species-group and forest condition, 1935

Species-group	Old growth		Second growth		Total	Percent of total
	Uncut	Partly cut	Sawlog size	Under sawlog size 1/		
	Thousand board feet					
Pines:						
Shortleaf 2/	167,500	113,000	1,744,500	34,300	2,059,300	37.5
Loblolly	174,200	41,200	910,500	13,700	1,139,600	20.8
Total pines	341,700	154,200	2,655,000	48,000	3,198,900	58.3
Pulping hardwoods:						
Red gum	83,500	46,400	357,400	12,200	499,500	9.1
Black gum	24,900	17,900	51,600	2,700	97,100	1.8
Others 3/	8,500	18,700	38,100	1,600	66,900	1.2
Nonpulping hardwoods:						
Red oaks	154,800	111,100	365,800	12,000	643,700	11.7
White oaks	77,200	80,900	140,100	2,700	300,900	5.5
Post oak	68,800	80,000	180,300	18,800	347,900	6.3
Hickory	7,200	11,000	49,800	6,200	74,200	1.4
Ash	8,000	9,300	23,500	2,300	43,100	.8
Others	68,100	49,100	88,700	6,000	211,900	3.9
Total hardwoods	501,000	424,400	1,295,300	64,500	2,285,200	41.7
Total all species	842,700	578,600	3,950,300	112,500	5,484,100	100.0
Percent of total	15.4	10.5	72.0	2.1	100.0	

1/ Includes areas classified as reproduction; clear-cut areas are negligible.
2/ Includes 65 million board feet of longleaf pine.
3/ Includes 22 million board feet of cypress.

The total board-foot volume by the Doyle rule is nearly $5\frac{1}{2}$ billion feet. This volume is shown by species-groups and forest conditions in table 3. Accessibility is not a limiting factor in the utilization of this volume, as shown by the fact that 95 percent (table 2) of the forest area has been logged over at least once, and the increasing use of truck transportation makes it even possible in many areas to log for individual selected trees.

Fifty-eight percent of the total volume occurs in the pine species, with the volume of shortleaf almost twice that of loblolly. In the hardwoods, which account for nearly 42 percent of the total volume, red oaks and red gum are most common. The nearly 600 million board feet of red and black gum form the chief support of the active crate and basket industry in the unit—an industry which utilizes nearly 20 million board feet of these species each year.

The volume has been shown in table 3 by the Doyle log rule, because this rule is in general use throughout the South; but since this rule materially underestimates the volume of small trees, which make up a large proportion of the stand in this unit, a more accurate expression of the recoverable volume is obtained by using the International $\frac{1}{4}$-inch rule. The latter rule therefore, is used in table 4, where the volumes given very closely approximate green lumber tally. A comparison of volumes in tables 3 and 4 shows that the Doyle rule underestimates lumber tally by 25 percent in the old-growth conditions, while in the second-growth conditions, made up chiefly of smaller trees, the under-estimate is 41 percent.

Table 4. - Net volume, lumber tally, classified according to species-group and forest condition, 1935

Forest condition	Pines	Red and black gums, etc.	Red and white oaks, etc.	Total
	Thousand board feet (green lumber tally)			
Old growth:				
Uncut	483,300	152,200	481,300	1,116,800
Partly cut	233,700	111,800	436,500	782,000
Second growth:				
Sawlog size	4,895,000	652,100	1,169,500	6,716,600
Under sawlog size 1/	107,800	26,800	71,000	205,600
Total all conditions	5,719,800	942,900	2,158,300	8,821,000

1/ Includes reproduction; clear-cut acreage is negligible.

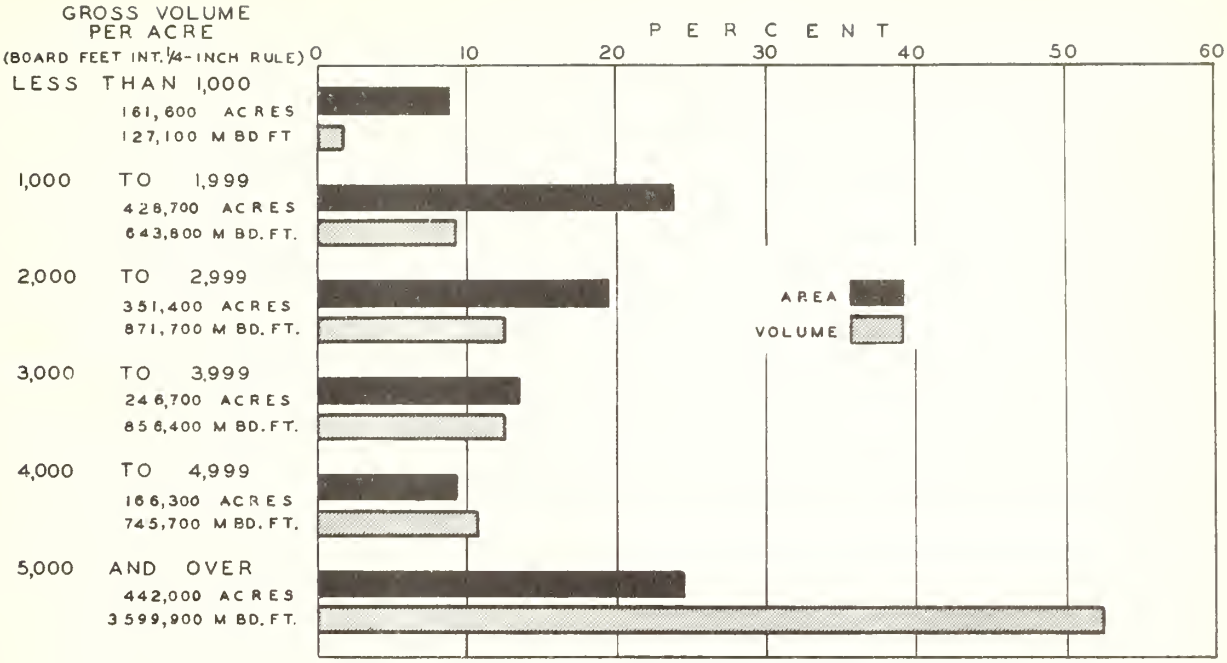
Although old-growth stands occupy only 10 percent of the forest area, they contain 22 percent of the total saw-timber volume (lumber tally), or nearly 2 billion board feet. Only 13 percent of the total pine volume is in old-growth stands, as compared with 38 percent of the hardwood volume. The average volume per acre[1] in the old-growth uncut condition of the pure pine types is 10,900 board feet, of which 10,600 is pine. The similar condition in the upland hardwood types averages 3,000 board feet per acre, while in the bottom-land hardwood types this condition averages 5,200 feet, each of these types having less than 200 feet of pine per acre.

The second-growth pine and pine-hardwood stands which occupy 57 percent of the forest area, contain 65 percent of the saw-timber volume. Uncut stands of the pure pine types average 4,000 feet per acre, and of the pine-hardwood types 3,300 board feet. The second-growth hardwood stands occupy 33 percent of the forest area but contain only 13 percent of the total saw-timber volume. In the upland hardwoods, the uncut stands average 1,700 feet per acre, while similar stands in the bottom-land hardwoods average 2,700 feet.

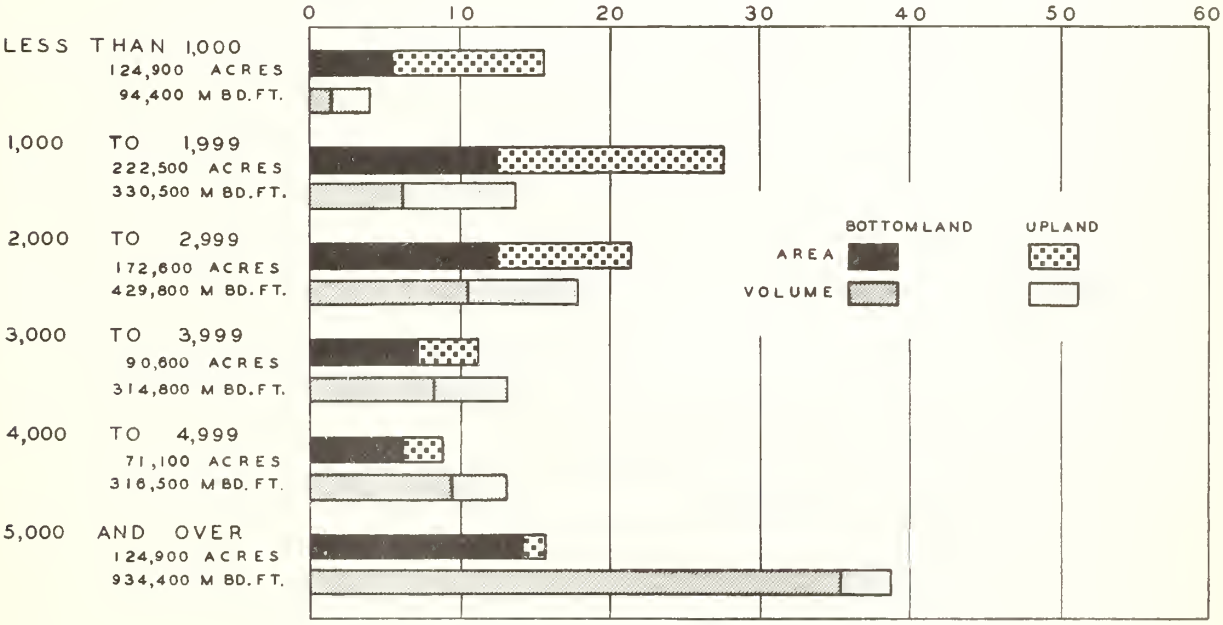
In figure 4 is shown the area and volume of the sawlog-size conditions grouped according to gross volume-per-acre classes. The portion of the figure designated as 4-A is based upon the pine and pine-hardwood types, which occur on 1,796,700 acres, or 46 percent of the forest land, and contain 73 percent of the total board-foot volume. Stands having at least 2,000 board feet per acre are found on two-thirds of the area and contain 89 percent of the volume. More than half the volume is in stands of at least 5,000 feet per acre, occupying only 25 percent of the area in these types.

The sawlog-size stands in the bottom-land and upland hardwood types represented in figure 4-B have a combined area of 806,600 acres, or 20 percent of the forest land; their volume is 25 percent of the total board-foot stand. Fifty-seven percent of the area is stocked with at least 2,000 board feet per acre, containing 82 percent of the volume in these types. In the bottom-land hardwood types, however, 69 percent of the area is stocked with stands of at least 2,000 board feet per acre, while in the upland hardwood types only 40 percent of the area is stocked this heavily.

1/ "Volumes on an average acre in the various units of the Pine-Hardwood Region west of the Mississippi," Forest Survey Release #26, July 12, 1937, Southern Forest Exp. Sta., New Orleans, La.



A - PINE AND PINE-HARDWOOD TYPES



B - BOTTOMLAND AND UPLAND HARDWOOD TYPES

FIGURE 4 - PROPORTIONAL AREA AND VOLUME OF THE SAWLOG-SIZE CONDITIONS, CLASSIFIED ACCORDING TO VOLUME OF SAW TIMBER PER ACRE.

Cordwood volume

The estimate of cordwood volume, as of 1935, shown in table 5, includes the entire stand of sound trees at least 5.0 inches d.b.h. outside bark, and in addition the net sound volume in cull trees 5 inches d.b.h. or larger. These volumes are expressed in terms of standard cords (4 x 4 x 8 feet), estimated to contain 90 cubic feet of pine or cypress, or 80 cubic feet of hardwood, all including bark. The volume shown in table 5 in the column "sound trees sawlog size" includes only the merchantable sawlog portion of saw-timber trees, while the remaining portion of the stem (i.e., the upper stem) taken to a variable diameter (but not less than 4 inches) is given under "upper stems of sawlog-size trees." "Upper stems" in pines include only the stem, but in hardwoods and cypress the usable limbs to a 4-inch minimum diameter are also included. Volume of "sound trees under sawlog size" includes only the full stems of both pines and hardwoods taken to a variable (minimum 4-inch) usable top. The volume shown under "cull trees" is the estimated sound, usable portion of these low-quality trees. Deduction from the volume of all trees is made for woods cull, such as rot, fire-scar, crook, bad knots, or other defects. Volume data on "upper stems" and cull trees are presented, in order to make the cordwood volume estimate complete; how much of this material will actually be used will depend upon the future demand for pulpwood, chemical wood, and fuel.

Table 5. - Net volume of all sound material, expressed in cords of wood with bark, 1935

Species-group	Source of material				Total all classes	Proportion of total
	Sound trees sawlog size	Upper stems of sawlog-size trees	Sound trees under sawlog size	Cull trees		
	Cords					Percent
Pines	13,188,600	2,631,700	6,766,200	405,000	22,991,500	42.3
Hardwoods:						
Pulping	2,422,000	1,228,100	3,903,000	1,967,800	9,520,900	17.5
Nonpulping	5,201,600	2,951,000	6,710,700	6,935,500 1/	21,798,800	40.2
Total hardwoods	7,623,600	4,179,100	10,613,700	8,903,300	31,319,700	57.7
Total all species	20,812,200	6,810,800	17,379,900	9,308,300	54,311,200	100.0
Percent of total	38.4	12.5	32.0	17.1	100.0	

1/ Includes scrub oak.

Of the pine cordwood volume 72 percent is shortleaf, and practically all of the remainder is loblolly, with pines under 9.0 inches d.b.h. containing 29 percent of the total pine volume. The pulping hardwood volume is chiefly red gum, although such species as black gum, maple, willow, and cypress are included. In these pulping hardwoods, 41 percent of the cordwood volume is in trees below sawlog size. In the nonpulping hardwoods, chiefly various species of oaks, nearly half the cordwood volume shown is in scrub oaks, cull trees, and in the upper stems of saw-timber trees, leaving about 12 million cords in the merchantable boles of sound trees.

In figure 5 the cordwood volume of sound trees is classified according to species-group and diameter-class. Sound-tree volume as used here includes the full stem of under-sawlog-size pines and hardwoods as described previously, the full stem of merchantable pines to a variable (minimum 4-inch) top, and the saw-timber portion of sawlog-size hardwoods. The volume in cull trees, scrub oaks, and tops and limbs of merchantable hardwoods is not included.

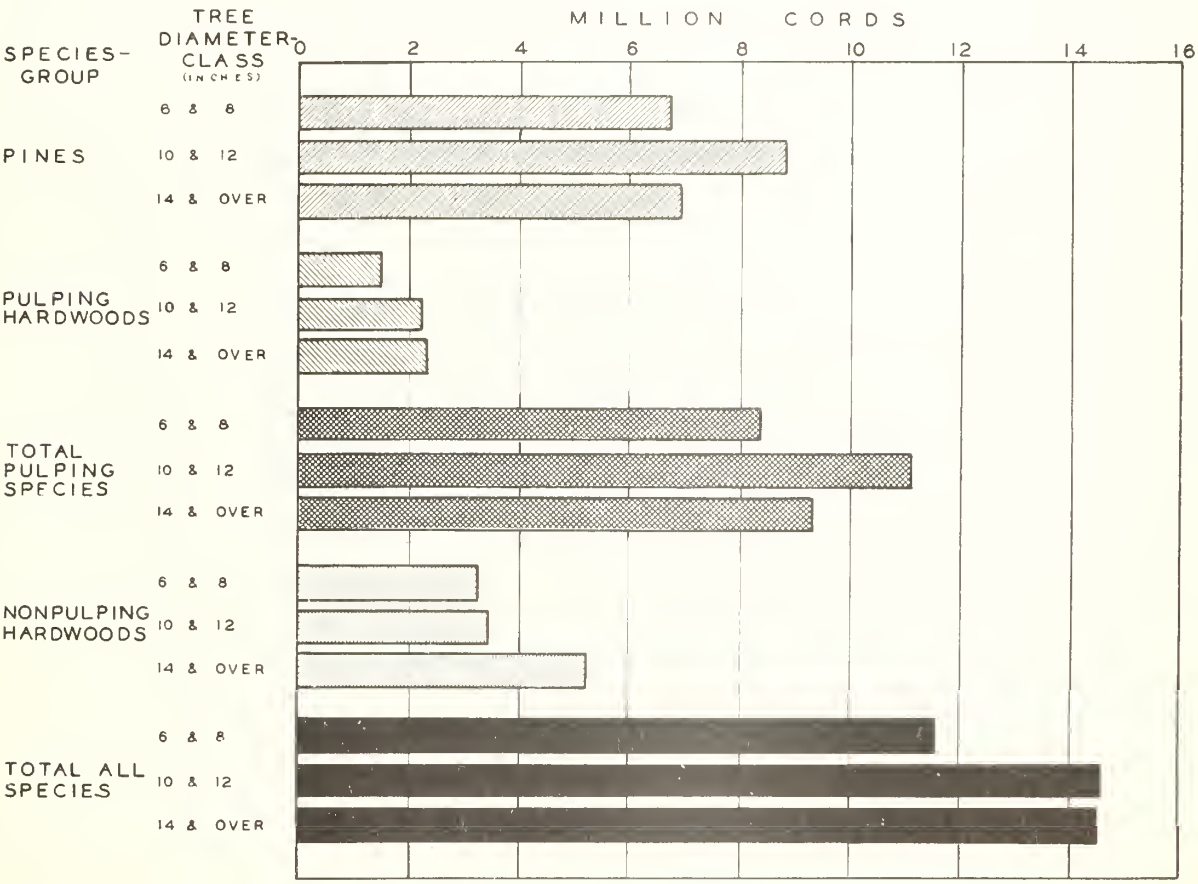


FIGURE 5 - CORDWOOD VOLUMES OF PULPING AND NONPULPING SPECIES.

Pine poles and piles

The pine trees suitable for poles or piles occur singly or in scattered groups throughout the forest. Table 6 gives the timber cruisers' estimate of the number of pole or pile trees in the unit, classified according to length and diameter (outside bark). As it is difficult to classify trees while they are standing, it is probable that the actual number of poles or piles recoverable from the forest will vary somewhat from the total shown in the table. Although these totals are probably low, owing to the conservatism of the field crews, the proportions of trees of the various length and diameter are believed to be fairly accurate.

Table 6. - Total number of pine poles or piles, classified according to length and diameter, 1935

D.B.H. of trees (outside bark)	Pole or pile length (feet)							Total	Proportion of total
	20	25	30	35	40	45	50 or over		
Inches	Thousand pieces								Percent
7.0 - 8.9	2,758	1,083	606	81	-	-	-	4,528	35.4
9.0 - 10.9	1,571	1,265	871	334	306	38	-	4,385	34.2
11.0 - 12.9	518	725	662	331	219	106	44	2,605	20.3
13.0 - 14.9	91	222	315	153	128	46	38	993	7.8
15.0 - 16.9	3	37	94	47	44	16	12	253	2.0
17.0 - 18.9	-	-	22	10	9	3	-	44	.3
Total	4,941	3,332	2,570	956	706	209	94	12,808	100.0
Percent of total	38.6	26.0	20.1	7.5	5.5	1.6	0.7	100.0	

Forest Increment

Forest increment of the unit

Table 7 presents the increment of the total forest stand during 1935. As this was the year in which the growing stock was inventoried, it is possible to determine with some accuracy the increment by forest conditions. The changes in the volume and area of the individual forest conditions due to cutting cannot be accurately determined for subsequent years, for which increment can be expressed only in totals for all conditions combined. The increment shown in table 7 includes the volume increase of all trees that remained in the stand during the year, as well as the increment accruing for a portion of the year on the trees that were cut. Volume lost through mortality and other natural losses is deducted.

Table 7. - Forest increment in board feet and cubic feet in the various forest conditions, 1935

Forest condition	Saw-timber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	-- Thousand board feet---			Thousand cubic feet (i.b.)		
Old growth	17,100	40,500	57,600	3,470	5,660	9,130
Second growth:						
Sawlog size	345,600	87,200	432,800	76,220	22,810	99,030
Under sawlog size	46,400	16,400	62,800	16,960	13,270	30,230
Reproduction and clear-cut	100	200	300	40	70	110
Total all conditions	409,200	144,300	553,500	96,690	41,810	138,500

The increment rate of the pine board-foot growing stock was 7.2 percent in 1935. This is a noteworthy increase for a stand that extends over 4 million acres and that has been subject to repeated burning. Four percent of the pine saw-timber increment occurred in old-growth stands, 85 percent in sawlog-size second growth, and 11 percent in young stands not yet of sawlog size. The hardwood growing stock increased by only 4.7 percent. Old-growth stands produced 28 percent of the saw-timber increment in this species-group, sawlog-size second growth 60 percent, and under-sawlog-size stands 12 percent. Although the growing stock was increased through increment by more than a half billion board feet during 1935, nearly as great an amount was removed for utilization with the result that there was little change in the stand volume in that year.

The increment for 1935 is expressed in standard cords (4 x 4 x 8 ft.) in table 8. This material is not in addition to that given in table 7 but is identical with the cubic-foot volume there given, except that the volume in table 8 includes bark. The values in this table, therefore, express the volume in the form of measurement commonly used in the pulpwood industry throughout the South.

Table 8.- Forest increment in 1935 in the various forest conditions, expressed in cords of wood with bark

Forest condition	Pine	Hardwood	Total
	- - - - - - - - - - - -	Cords	- - - - - - - - - - - -
Old growth	44,500	83,000	127,500
Second growth:			
Sawlog size	988,200	349,300	1,337,500
Under sawlog size	227,000	209,100	436,100
Reproduction and clear-cut	600	1,100	1,700
Total all conditions	1,260,300	642,500	1,902,800

In table 9 the increment in board feet and cubic feet is shown for the 3 years that have elapsed since the inventory was taken. Each year the growing stock, i.e., the forest capital, was increased by the net increment of the previous season and was reduced by the amount of utilization drain, so that the increments shown are based upon the growing stock that existed there each year. Although the board-foot increment has remained relatively constant, there has been a gradual increase in the cubic-foot increment, owing in part to the large influx of small trees into the measurable sizes (5 inches d.b.h. and larger). The values for 1937 are used in the comparison of increment and drain given in the latter part of this report.

Table 9.-Forest increment in board feet and cubic feet in 1935, 1936, and 1937

Year	Saw-timber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	- - - - Thousand board feet- -			- - -Thousand cubic feet (i.b.)		
1935	409,200	144,300	553,500	96,690	41,810	138,500
1936	408,000	143,000	551,000	99,820	42,610	142,430
1937	408,900	144,600	553,500	100,540	42,810	143,350

Increment per acre of uncut stands

The estimated increment per acre of the various forest conditions, all types combined, is presented in table 10. The growing stock upon which this increment is based is that of the 1935 inventory. No deductions from the stand were made for timber removed during the year. The increment given in board feet occurred only on saw-timber material, while cubic-foot and cordwood volumes include the increment on the full usable stem of all pines and all under-sawlog-size hardwoods above 5.0 inches d.b.h., and on the saw-timber portion of sawlog-size hardwoods. Increment in cull trees or in limbs of any trees is not included. Cordwood volumes include bark, but cubic-foot volumes are for wood only.

Table 10. - Average increment per acre in the various forest conditions undisturbed by cutting in 1935

Forest condition	Pine component			Hardwood component			Total per acre		
	Bd.Ft.	Cu.Ft.	Cords	Bd.Ft.	Cu.Ft.	Cords	Bd.Ft.	Cu.Ft.	Cords
Old growth:									
Uncut	60	11.5	.15	116	15.1	.22	176	26.6	.37
Partly cut	31	6.8	.09	94	14.1	.20	125	20.9	.29
Second growth:									
Sawlog size:									
Uncut	192	43.7	.57	40	11.3	.17	232	55.0	.74
Partly cut	117	23.1	.30	43	9.6	.15	160	32.7	.45
Under sawlog size	41	14.5	.19	16	11.3	.18	57	25.8	.37
Reproduction and clear-cut	1	.3	Neg.	1	.5	.01	2	.8	.01
Weighted averages	108	25.2	.33	38	10.8	.16	146	36.0	.49

Sawmills

In 1937 there were at least 330 sawmills operating in the unit (table 11). Only five of these mills had a capacity of more than 40 M board feet per day. Although small portable mills (1 to 19 M capacity) are most numerous (fig. 6), nearly half of all the lumber produced in 1937 was cut by the 24 mills having a capacity of 20 to 39 M board feet per day. The total lumber production amounted to 331 million board feet, of which 289 million was pine and 42 million was hardwoods. Logs cut within the unit furnished 292 million board feet of the total, while logs imported into the unit for manufacture into lumber furnished 39 million board feet. Logs shipped to sawmills outside the unit amounted to 61 million board feet.

The Survey found about 300 sawmills having a board-foot capacity of less than 20 M feet per day. Nearly 100 of these were located in Smith, Anderson, Cherokee, and Nacogdoches Counties in the southwest part of the unit. Also a concentration of about 50 small mills was found in Red River and Bowie Counties, in the extreme northern part of the unit. The majority of these small mills are extremely mobile, moving frequently from one tract of timber to another. About 70 percent of them are powered by tractors or old automobile engines, while 30 percent use steam power. The cut of individual mills varies greatly, but the average for all mills in this class was 364,000 board feet during 1937. Their total cut was 109.6 million board feet, equal to 33 percent of all the lumber produced in the unit.

Table 11. - Number of sawmills and extent of employment, classified according to size of mill, 1937

Daily (10 hrs.) rated capacity 1/	Mills 2/			Employment		
	Pine	Hardwood	Total	In woods	In mill	Total
M bd. ft.	Number			Thousand man-days		
Under 20	No division		301	95	179	274
20 to 39	22	2	24	131	268	399
40 to 79	2	1	3	80	82	162
80 and over	2	-	2	77	87	164
Total			330	383	616	999

1/ The rated capacity indicates size of mill rather than actual average daily production.

2/ The data given here on the number of mills in the smallest class are estimates based upon all available records supplemented by a field check.

In 1937 there were 24 sawmills having a capacity of 20 to 39 M board feet per day. Two of these were hardwood mills and the rest cut chiefly pine. Their total production was 139.4 million board feet, amounting to 42 percent of the lumber production of the unit. About 10 percent of the pine lumber and practically all the hardwood was sold unfinished. These mills secured nearly a quarter of their requirements from outside the unit. Mills of this size are relatively stable, generally being in some town where shipping facilities are convenient. Most of them buy logs, although some of them secure timber from their own land. With the increasing use of truck transportation, this size of mill is assuming an increasingly important place in the sawmill industry, since it can practice close utilization and can manufacture quality lumber with a plant cost per thousand board feet daily capacity less than half of that of large mills.

There were only 5 mills with a capacity of more than 40 M board feet per day. Their total production was 82 million board feet or 25 percent of the lumber cut in the unit. Seven percent of the pine lumber was sold rough and 74 percent of the hardwood. Over 90 percent of their log requirements came from within the unit, and the rest from southwest Arkansas and southeast Texas. Old-growth stands furnished about 40 percent of the pine volume and 92 percent of the hardwood. At the rate of utilization in 1935, there was enough old-growth pine timber to last 8 or 10 years, but since second-growth logs are often purchased to supplement the cut, it is possible that the supply of old growth will last for a much longer period.

Other forest industries

There is an active veneer industry in this unit. During 1937 there were 16 plants engaged in producing veneer (table 12), with most of them manufacturing the veneer directly into baskets, crates, boxes, and tomato lugs. On the basis of past production, it is estimated that there were produced during the year about 15 million individual items, a large proportion of which was used in Texas and neighboring States. The 16 plants consumed slightly over 23 million board feet of wood during 1937, of which 9 percent was pine, 72 percent red gum, 8 percent black gum, 9 percent cottonwood, and 2 percent other species. Seventy-three percent of this wood came from within the unit, 20 percent from southwest Arkansas, and practically all of the remainder from areas in Texas lying south and west of the unit. All of the wood is purchased delivered at the mill, usually in bolts rather than in log lengths, as the operators believe that better utilization is obtained when the bolts are cut in the woods.

Shingle mills are numerous in this part of Texas, especially in Cass, Harrison, Morris, Marion, Shelby, and Upshur Counties. In 1937 there were at least 50 of these small plants, producing shingles chiefly from second-growth pine. They secure all of this material locally, moving from place to place as additional timber is needed. Individual mills seldom use more than 25 M board feet per year.

Other plants manufacturing wood products include one stave and heading mill and one handle plant. Red and white oaks and gums are used for cooperage and ash and hickory for handles. These two plants have been established in one locality for many years.

Contributing far more employment and handling a much larger volume of forest products in the unit than the 52 miscellaneous plants described above, are 3 treating plants, which purchase large quantities of lumber, cross ties, poles, piles, and posts for preservative treatment and also custom-treat a large amount of material, mostly pine, secured throughout east Texas as well as in Arkansas, Louisiana, and Mississippi.

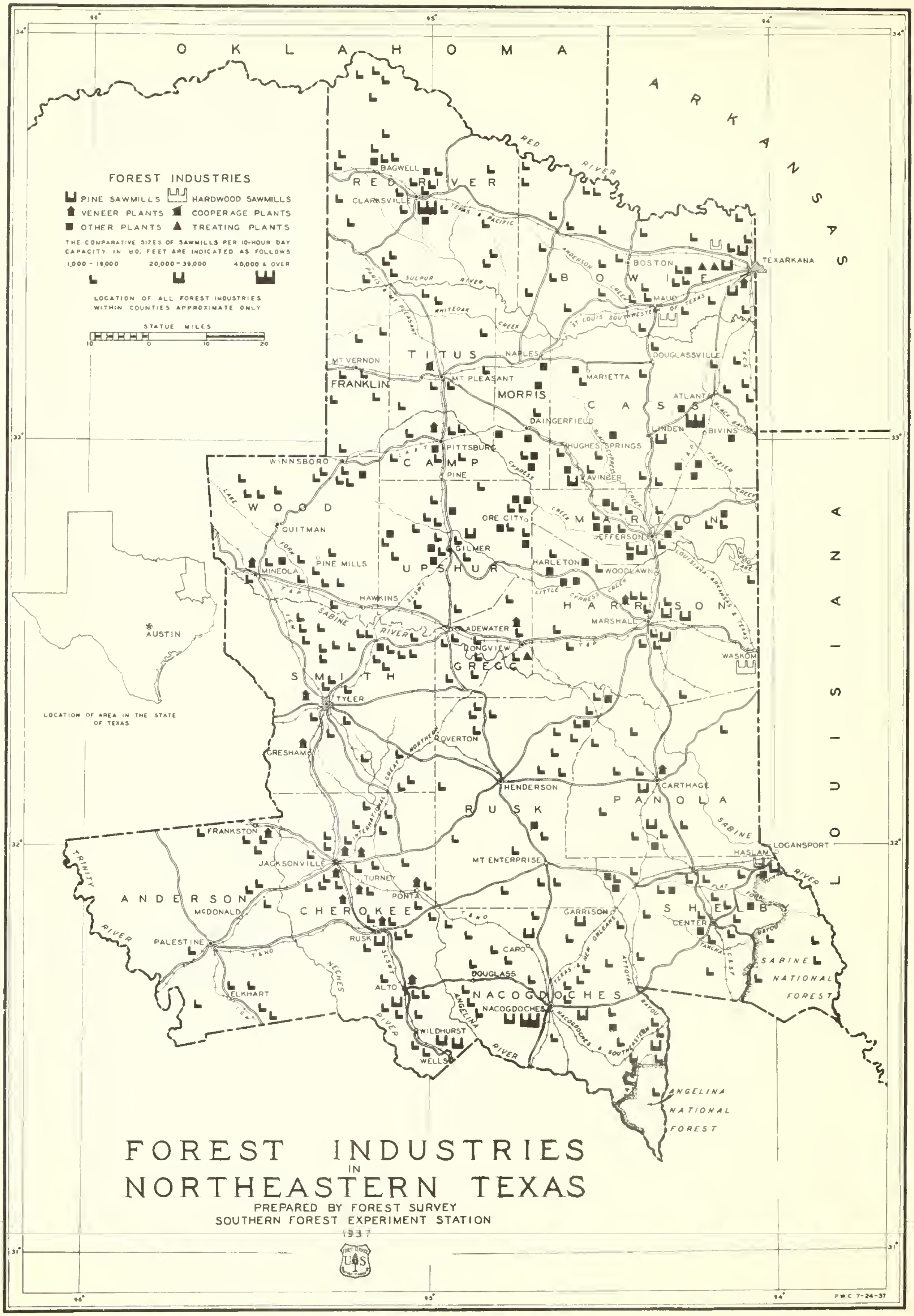


FIGURE-6 FOREST INDUSTRIES MAP

Employment

The total employment furnished by the forest industries in 1937 amounted to 2,885,000 man-days. Sixty-seven percent of this work was in the woods and 33 percent in the mills and plants. The production of fuel wood and fence posts required the expenditure of 45 percent of the total labor, but very little of this work yielded a direct cash return, as most of these materials were produced for home consumption. Employment yielding a cash income amounted to 1,578,000 man-days, of which 63 percent was provided by the lumber industry. Based on the requirements of the present forest industries, it is probable that forest employment will approximate 3,000,000 man-days per year for the next 10 years, equivalent to 12,000 man-years if 250 days is considered a full year.

Table 12. - Production and employment data, 1937

Kind of plant or commodity	Number of plants	Cut in woods	Produced or used by plants	Thousand man-days of employment		
				In woods	In plants	Total
		--- M bd. ft. ----				
Sawmills	330	353,300	331,000	383	616	999
Veneer	17 1/	19,100	23,100	31	206	237
		M cu. ft.				
Treating plants	3	-	8,620	-	100	100
		M pieces				
Cross ties	-	1,329	-	175	-	175
Poles and piles	-	173	-	23	-	23
Fence posts	-	6,374	-	101	-	101
		Cords				
Pulpwood	-	11,700	-	12	-	12
Fuel wood	-	1,118,900	-	1,206	-	1,206
Miscellaneous 2/	52	12,100	14,100	12	20	32
Total	402			1,943	942	2,885

1/ One plant idle during 1937.
2/ Includes 1 cooperage plant, 1 handle plant, and 50 shingle mills.

Utilization Drain

During 1937 the wood requirements of the various forest industries and local users amounted to 645.6 million board feet from trees of sawlog size, or a total of 145.4 million cubic feet, when the trees below sawlog size are included. This was the drain upon the sound-tree growing stock only. About 17 million cubic feet of additional material was taken from cull trees and was used chiefly for fuel wood. Table 13 shows the drain upon the sound trees, by pine and hardwood species-groups, distributed according to the use made of the material. The volume expressed in board feet includes only the saw-timber portion of the stem of both pines and hardwoods, while the material expressed in cubic feet includes saw-timber material, upper stems of sawlog-size pines, and total stems of trees below sawlog size. Utilization drain, as used here, includes material cut and utilized, as well as any additional usable material left in the woods as a result of cutting. Although the unit embraces the largest oil field in the world, and is crisscrossed by oil and gas lines, wood remains the most widely used fuel; the magnitude of this use in 1937 is shown by the fact that the use of wood for fuel was second only to its use for lumber.

Table 13. - Utilization drain from sound trees, 1937

Commodity	Saw-timber material			All material		
	Pine	Hardwood	Total	Pine	Hardwood	Total
	- -Thousand board feet- -			- -Thousand cubic feet- -		
Lumber	306,700	47,100	353,800	59,930	6,820	66,750
Cross ties	51,600	21,000	72,600	9,900	3,460	13,360
Poles and piles	8,400	500	8,900	1,970	90	2,060
Veneer	3,000	18,400	21,400	510	2,640	3,150
Misc. manufactures	2,000	6,600	8,600	360	950	1,310
Pulpwood	2,100	-	2,100	910	-	910
Fuel wood	82,700	58,300	141,000	25,210	16,950	42,160
Fence posts	400	10,000	10,400	400	2,590	2,990
Misc. farm use and land clearing	13,100	13,700	26,800	4,890	7,840	12,730
Total	470,000	175,600	645,600	104,080	41,340	145,420

Comparison of Increment and Drain

The relation of forest increment to forest drain in 1937 is presented in board feet in table 14 and in cubic feet, inside bark, in table 15. In the saw-timber material, there was an over-drain in both pine and hardwoods, as the total cut exceeded total increment by 17 percent, or 92 million feet.

This is a small reduction over 1936, in which the board-foot drain exceeded increment by 20 percent. In 1935, during which industrial activity was somewhat less than in the 2 following years, forest increment exceeded the drain by 1 percent. In 1937 the cut of old-growth pine timber was about three times its increment, and in the hardwoods it is estimated that the use of old-growth timber was about one and one-third times its increment. Although the old-growth stands will be soon exhausted at the prevailing rate of use, this does not imply any material change in the character of the forest industries of the unit, as they are all using considerable second-growth timber at the present time. Since saw timber, both the old growth and second growth, is being cut faster than it is growing, it follows that the growing stock and the increment must be increased if an eventual reduction of industrial activity is to be avoided.

Table 14. - Balance between increment and drain of saw-timber material

Item	Pines	Hardwoods	Total
	- - - Thousand board feet - - - - -		
Net growing stock Jan. 1, 1937	5,702,200	3,013,700	8,715,900
Growth, 1937	448,700	179,400	628,100
Mortality, 1937	39,800	34,800	74,600
Forest increment, 1937	408,900	144,600	553,500
Utilization drain, 1937	470,000	175,600	645,600
Net change in growing stock, 1937	-61,100	-31,000	-92,100
Net growing stock Jan. 1, 1938	5,641,100	2,982,700	8,623,800

The increment and drain for the entire sound-tree growing stock 5.0 inches d.b.h. and larger, are compared in table 15. During 1937 the cubic-foot drain exceeded the increment by 1.4 percent. The overcutting was chiefly in the pine, as the hardwoods show a slight surplus. Although the pine was overcut by 3.5 million cubic feet in 1937, the growing stock of pine at the beginning of 1938 was 17 million feet more than at the time of the inventory in 1935. In the hardwoods, the growing stock increased 7 million cubic feet during the same period. The net result was to increase the total cubic-foot growing stock nearly 1 percent during the 3-year interval, even though the saw-timber volume was reduced 2 percent.

Table 15. - Balance between increment and drain in cubic feet

Item	Pines	Hardwoods	Total
	- - - Thousand cubic feet - - - - -		
Net growing stock, Jan. 1, 1937	1,759,980	1,201,990	2,961,970
Growth, 1937	115,800	62,250	178,050
Mortality, 1937	15,260	19,440	34,700
Forest increment, 1937	100,540	42,810	143,350
Utilization drain, 1937	104,080	41,340	145,420
Net change in growing stock, 1937	-3,540	1,470	-2,070
Net growing stock, Jan. 1, 1938	1,756,440	1,203,460	2,959,900

Summary and Future Outlook

In this unit, the land is used chiefly for agriculture, timber growth, and petroleum production. The oil field occupies less than 5 percent of the total land area, but its industrial development and annual petroleum yields are worth millions of dollars. In addition, the oil industry has stimulated the leasing of land throughout the unit, providing a supplementary income to many landowners. Petroleum, however, is an exhaustible resource, and the rapid exploitation of this huge reservoir of material that has accumulated through the ages has set up temporary economic standards in parts of the unit that the renewable resources cannot, and should not be expected to, maintain. It is inevitable that there will be an economic decline when the petroleum industry is gone, but its severity can be reduced if the people and local governments take immediate steps to foster supplementary resources and industries.

Agriculture is an important activity in this area, but between 1924 and 1937 there was a shrinkage of approximately 576,000 acres in the area devoted to cotton growing. It is estimated that the area of cotton harvested in 1937 required nearly 5 million man-days of labor less than the acreage in 1924. This vitally affects the rural farm population; and that the situation has not been remedied is indicated by the Unemployment Census of November 1937, which showed in this survey unit over 38,000 people unemployed or on relief at that time.

Opportunity for increasing employment on a large scale by producing agricultural crops seems remote, unless new crops can be developed to utilize even more intensively the land formerly planted to cotton. On the other hand, timber production offers an opportunity to modify the probable economic decline in the oil-field area, as well as contribute toward a higher income for a large part of the population of the region. At the outset it should be remembered that the forest industries at present are depleting the saw-timber stands faster than they are growing, while the demand for timber probably will become even greater as small-home construction increases, industrial needs revive, and chemical uses of wood expand. In addition, the successful manufacture of newsprint by the projected pulp mill at Lufkin, Texas, may cause an unprecedented demand for forest products. To meet these increased requirements, or even to maintain the present growing stock, it is absolutely essential that improved forestry practices be immediately undertaken. Otherwise, the forest resource will steadily decrease, leaving the people more and more dependent upon a shrinking agriculture and a temporary petroleum industry.

It is obvious from the above discussion that the forest lands in this unit must be made more productive, for which purpose the following measures are necessary:

(1) The immediate need is for an intensification and extension of the present system of fire protection. Although about 70 percent of the forest land was protected in 1936, most of the forest has suffered from periodic burning, as a result of which it is greatly understocked. Fire protection is the most practical method of increasing the growing stock in this area, where all of the increment is needed to maintain the present forest industries. Reserving a portion of the increment to build up the growing stock is usually desirable, but such a program in this unit, if not done gradually and with full appreciation of the needs of the industry, would add to the already appalling total of unemployment.

(2) An extension program emphasizing the best practices of farm forestry is essential, because 52 percent of the forest land is in farm ownership. Since there are 79,000 farm operators, the task is a huge one, and it is likely that at least one extension forester would be required in each county to obtain the maximum results. Approximately $50,000 would be needed annually for salaries, but the returns from good forest practice on more than half the forest land in the unit justifies this expenditure.

(3) A planting program is needed to reforest the 700,000 acres of idle and abandoned agricultural land. The State should assist the landowner by furnishing nursery stock at nominal cost.

(4) More demonstration forests that are publicly owned should be established. These must be numerous enough to be conveniently accessible to the timber land operators, so that they may learn the best technique of timber growing.

(5) Additional State and Federal participation is required to provide funds or legislation for increased protection against fire and trespass, cheap credit for sustained-yield enterprises, assurance of reasonable taxation, an adequate research program, and the establishment of freight rates on lumber comparable with those in adjacent Southern States.

The successful accomplishment of these several measures should greatly increase the supply of raw material and permit a permanent expansion of the forest industries. New industries should be established as fast as the annual yield permits, since only through full utilization of the increment will it be possible to increase the forest employment, return idle lands to productivity, and soften the economic shock that is certain to come when the oil resource is exhausted.