REPORT

ON THE

COTTON PRODUCTION OF THE STATE OF MISSISSIPPI,

WITH A DISCUSSION OF

THE GENERAL AGRICULTURAL FEATURES OF THE STATE.

BY

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LETTER OF TRANSMITTAL.

Hon. C. W. SEATON,

Superintendent of Census.

DEAR SIR: I have the honor to transmit herewith a report on the cotton production of the state of Mississippi, with a general description of its physico-geographical and agricultural features, special descriptions of the several counties, and cultural and economic details of cotton production, with discussion thereof.

In the elaboration of this report I have conformed to the general plan originally suggested by Superintendent Walker and subsequently arranged in detail by myself, which has been substantially adhered to in the series of reports of which this forms a part, covering the whole of the cotton-producing area of the United States.

The sources of information upon which I have chiefly drawn for the substance of this report, aside from the census returns, are the published reports and unpublished records of the geological and agricultural survey of the state and the answers to schedule questions received from 42 out of the 74 counties in the state.

The published reports alluded to are the following:

I. *First Report of the Geological and Agricultural Survey of Mississippi, by B. L. C. Wailes, Jackson*, 1854.—This report contains a good deal of historic and general descriptive matter, including a chapter on culture, illustrated by plates, some general facts as to the geological formations of the state, as well as plates of fossils from the Jackson shell-beds, but without descriptions of the same.

II. *Preliminary Report on the Geology and Agriculture of Mississippi, by L. Harper, Jackson*, 1857.—This is somewhat of an oddity, both in a literary and scientific point of view, among the reports of American state surveys. It gives an account of the author's own observations on several excursions, and what purports to be a report and elaborations of the observations made by myself during a season's work in the Cretaceous, Tertiary, and Drift area of northeastern Mississippi in the capacity of assistant. The author's peculiar bias has, however, so far overshadowed both the facts and the theories that I cannot recognize either as my own work. I have subsequently fully covered again all the ground gone over by him.

III. *Report on the Geology and Agriculture of Mississippi, by E. W. Hilgard, Jackson*, 1860.—This report covers the field-work of three seasons, as also the laboratory and palæontological work done by myself personally up to the time of publication, including also, so far as relevant and reliable, the observations of my predecessors in the office of state geologist. Though printed in 1860, the intervention of the civil war prevented its actual publication and distribution until late in 1865.

By an act of the legislature, passed in 1861, the state survey was continued with a small appropriation during the war, and upon the cessation of hostilities placed *ipso facto* upon its former footing. Little progress could, of course, be made during that stormy period, but between 1866 and 1872 the field and laboratory work was continued at intervals by myself and assistants, Dr. E. A. Smith, now state geologist of Alabama, and Dr. R. H. Loughridge, since special agent of the census; also, for a short time, by Dr. George Little, late state geologist of Georgia. The work was stopped in 1872, and no publication of the field and laboratory work (mostly done by Dr. Smith) has until now been made.

IV. The MS. notes and reports of Dr. Smith, together with the laboratory record books and my own original field notes, were courteously loaned to the Census Office by consent of the board of trustees of the University of Mississippi

(under whose charge these records had passed) through the chancellor, Rev. Alexander T. Stewart, and all have been freely drawn upon for the purposes of the present report. It should be stated that of the unpublished field-work the explorations of the Mississippi bottom region, as well as of the counties lying just north of the "Central prairie region" (the territory of the Buhrstone or "Siliceous Claiborne" geological group), were made by Dr. Smith, who also made the bulk of the soil and marl analyses not given in the last published report, but here inserted. (*a*) A summary of his observations in the Yazoo bottom was, however, published in the proceedings of the American Association for the Advancement of Science for 1871, page 252.

Having made a close and detailed study of the soils of the state for many years, with a special view to the deduction and verification of the practical indications furnished by a study of their chemical composition and of all physical characters, these are naturally dwelt upon more in detail, and perhaps more with a view to showing the practical bearings of such investigations than is the case in other reports of this series, in which the subject is only casually brought up, and with respect to a few of the most characteristic and widely different soils. I trust that these discussions, as well as the report at large, may prove useful in making better known the great agricultural resources of Mississippi, and in enlisting still further the interest of her farmers on behalf of improved and progressive agriculture.

All of which is respectfully submitted.

EUG. W. HILGARD, *Special Agent.*

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a Of the 120 chemical soil analyses here reported, 22 only appear in my report of 1860, with 14 of marls and greensands, the number of which now on record is 54, although only some representative ones are here introduced. No additional full analyses have been made under the auspices of the Census Office, but the determinations of humus here communicated, as well as some of hygroscopic coefficients, have been so added.

TABULATED RESULTS OF THE ENUMERATION.

TABLE I.—AREA, POPULATION, TILLED LANDS, AND COTTON PRODUCTION.

Counties.	Land area.	POPULATION.						TILLED LANDS.		COTTON PRODUCTION.						Cotton acreage per square mile.	Bales per square mile.
		Total.	Male.	Female.	White.	Color'd.	Average per square mile.	Acres.	Per cent. of area.	Per cent. of tilled land.	Acres.	Bales.	Average per acre.				
													Bale.	Seed-cotton.	Lint.		
	Sq. mls.													*Lbs.*	*Lbs.*		
The State	46,340	1,131,597	567,177	564,420	479,398	652,199	24.4	4,927,561	16.6	42.7	2,106,214	963,111	0.46	657	219	45.5	20.8
NORTHEASTERN PRAIRIE REGION.																	
Prairie belt.																	
Alcorn	400	14,272	7,095	7,177	9,863	4,409	35.7	52,566	20.5	35.9	18,863	7,477	0.40	570	190	47.2	18.7
Prentiss	410	12,158	6,041	6,117	9,737	2,421	29.7	59,738	22.8	31.2	18,610	7,207	0.39	555	185	45.4	17.6
Lee	540	20,470	10,321	10,149	12,656	7,814	37.9	101,822	29.5	37.9	38,578	14,406	0.37	528	176	71.4	26.7
Chickasaw	500	17,905	8,925	8,980	7,696	10,209	35.8	97,233	30.4	39.6	38,477	12,861	0.33	471	157	77.0	25.7
Monroe	790	28,553	13,991	14,562	10,551	18,002	36.1	155,808	30.8	45.8	71,402	23,830	0.33	471	157	90.4	30.2
Clay	400	17,367	8,504	8,863	5,255	12,112	43.4	81,441	31.8	51.1	41,656	13,137	0.32	456	152	104.1	32.8
Oktibbeha	430	15,978	7,857	8,121	5,100	10,869	37.2	65,365	23.8	45.4	29,679	9,929	0.33	471	157	69.0	23.1
Lowndes	500	28,244	13,961	14,283	5,588	22,650	56.5	126,312	39.5	51.2	64,670	21,886	0.34	486	162	129.3	43.8
Noxubee	680	20,874	14,808	15,066	5,302	24,572	43.0	151,704	34.9	54.4	82,483	25,294	0.31	441	147	121.3	37.2
Total	4,650	184,821	91,503	93,318	71,757	113,064	39.7	891,989	30.0	45.3	404,418	136,027	0.34	486	162	87.0	29.3
Pontotoc ridge.																	
Tippah	450	12,867	6,327	6,540	9,302	3,065	28.6	55,092	19.1	34.0	18,758	7,424	0.40	570	190	41.7	16.5
Union	360	13,030	6,416	6,614	9,932	3,098	36.2	56,999	24.7	37.3	21,255	8,259	0.39	555	185	59.0	22.9
Pontotoc	530	13,858	6,932	6,926	9,609	4,249	26.1	72,848	21.5	29.4	21,448	8,085	0.38	543	181	40.5	15.3
Total	1,340	39,755	19,675	20,080	29,343	10,412	29.7	184,939	21.6	33.2	61,461	23,768	0.39	555	185	45.9	17.7
YELLOW LOAM REGION.																	
Brown loam table-lands.																	
Benton	360	11,023	5,577	5,446	5,777	5,246	30.6	55,501	24.1	40.4	22,401	8,123	0.36	513	171	62.2	22.6
Marshall	720	29,380	14,612	14,718	10,992	18,338	40.7	161,001	34.9	41.9	67,411	26,441	0.39	555	185	93.6	36.7
De Soto	460	22,924	11,613	11,311	7,581	15,343	49.8	118,342	40.1	51.1	60,488	28,469	0.47	669	223	131.5	61.9
Tate	390	18,721	9,557	9,164	9,094	9,627	48.0	124,980	50.1	38.6	48,245	22,653	0.47	669	223	123.7	58.1
Panola	680	28,352	14,252	14,100	9,521	18,831	41.7	148,445	34.1	45.2	67,060	30,055	0.45	642	214	98.6	44.2
La Fayette	720	21,071	10,962	10,709	11,385	10,286	30.1	86,493	18.8	40.8	35,309	15,214	0.43	612	204	49.0	21.1
Yalobusha	460	15,649	7,865	7,784	7,533	8,116	34.0	1,850	24.4	42.3	30,398	12,989	0.43	612	204	66.1	28.2
Grenada	440	12,071	5,990	6,081	8,236	8,835	27.4	49,600	17.6	51.2	25,390	10,228	0.40	570	190	57.7	23.2
Carroll	640	17,795	8,991	8,804	7,831	9,964	27.8	86,739	21.2	43.8	37,957	17,423	0.46	657	219	59.3	27.2
Holmes	750	27,164	13,566	13,598	6,911	20,253	36.2	204,903	42.7	30.5	62,556	30,463	0.49	699	233	83.4	40.6
Total	5,620	204,700	102,985	101,715	79,861	124,839	36.4	1,107,944	30.8	41.3	457,215	202,058	0.44	627	209	81.4	36.0
Short-leaf pine and oak upland region.																	
Tishomingo	450	8,774	4,350	4,424	7,611	1,163	19.5	38,419	13.3	19.7	7,555	2,672	0.35	498	166	16.8	5.9
Itawamba	550	10,663	5,291	5,372	9,555	1,108	19.4	51,415	14.6	28.9	14,851	5,113	0.34	486	162	27.0	9.3
Calhoun	580	13,492	6,781	6,711	10,191	3,301	23.3	60,576	16.3	31.4	19,028	9,536	0.50	714	238	32.8	16.4
Montgomery	430	13,348	6,652	6,696	6,671	6,677	31.0	60,298	21.9	40.9	24,636	10,541	0.43	612	204	57.3	24.0
Sumner	400	9,534	4,749	4,785	7,239	2,295	23.8	40,701	15.9	33.4	13,613	6,226	0.46	657	219	34.0	15.6
Choctaw	270	9,036	4,510	4,526	6,537	2,499	33.5	42,779	24.8	31.6	13,407	5,757	0.43	612	204	50.0	21.3
Winston	690	10,087	5,043	5,044	6,113	3,974	14.6	45,091	10.2	33.4	15,081	5,864	0.39	555	185	21.9	8.5
Attala	720	19,988	9,988	10,000	11,653	8,335	27.8	93,034	20.2	38.6	35,950	15,285	0.43	612	204	49.9	21.2
Leake	580	13,146	6,648	6,498	8,104	5,042	22.7	58,469	15.8	41.0	24,000	9,016	0.38	543	181	41.4	15.5
Neshoba	580	8,741	4,326	4,415	6,555	2,186	15.1	45,979	12.4	30.5	14,021	4,477	0.32	456	152	24.2	7.7
Kemper	750	15,719	7,821	7,898	7,100	8,619	21.0	78,316	16.3	36.1	28,269	8,426	0.30	429	143	37.7	11.2
Newton	580	13,436	6,735	6,701	8,428	5,008	23.2	58,019	15.6	33.8	19,589	6,341	0.32	456	152	33.8	10.9
Total	6,580	145,964	72,894	73,070	95,757	50,207	22.2	673,091	16.0	34.2	230,090	89,254	0.39	555	185	35.0	13.6

TABLE I.—AREA, POPULATION, TILLED LANDS, AND COTTON PRODUCTION—Continued.

Counties.	Land area.	POPULATION.						TILLED LANDS.		COTTON PRODUCTION.							
		Total.	Male.	Female.	White.	Color'd.	Average per square mile.	Acres.	Per cent. of area.	Per cent. of tilled lands.	Acres.	Bales.	Average per acre.			Cotton acreage per square mile.	Bales per square mile.
													Bale.	Seed-cotton.	Lint.		
CANE HILLS.	*Sq. mls.*													*Lbs.*	*Lbs.*		
Warren	600	31,238	15,342	15,896	8,717	22,521	52.1	60,031	15.6	56.8	34,127	22,950	0.67	954	318	56.9	38.3
Claiborne	460	16,768	8,228	8,540	3,910	12,858	36.5	97,175	33.0	34.1	33,121	18,518	0.56	798	266	72.0	40.3
Jefferson	510	17,314	8,473	8,841	4,260	13,054	33.9	62,218	19.1	51.7	32,141	18,512	0.58	828	276	63.0	36.3
Adams	410	22,649	10,673	11,976	4,796	17,853	55.2	67,853	25.9	47.3	32,117	19,026	0.59	840	280	78.3	46.4
Wilkinson	650	17,815	8,648	9,167	3,570	14,245	27.4	62,065	14.9	54.3	33,720	16,620	0.49	699	233	51.9	25.6
Total	2,630	105,784	51,304	54,420	25,253	80,531	40.2	349,342	20.8	47.3	165,226	95,626	0.58	828	276	62.8	36.4
MISSISSIPPI ALLUVIAL REGION.																	
Tunica	440	8,461	4,628	3,833	1,256	7,205	19.2	39,318	14.0	76.0	29,881	18,008	0.60	855	285	67.9	40.9
Coahoma	500	13,568	7,368	6,200	2,412	11,156	27.1	51,741	16.2	63.7	32,964	26,287	0.80	1,140	380	65.9	52.6
Quitman	400	1,407	784	623	592	815	3.5	5,714	2.2	59.9	3,420	2,337	0.68	969	323	8.6	5.8
Tallahatchie	640	10,926	5,605	5,321	4,168	6,758	17.1	42,501	10.4	52.9	22,463	11,570	0.52	741	247	35.1	18.1
Le Flore	610	10,246	5,419	4,827	2,230	8,016	16.8	40,158	10.3	44.2	17,730	11,025	0.67	954	318	29.1	18.5
Sunflower	720	4,661	2,542	2,119	1,764	2,897	6.5	13,908	3.0	50.8	7,107	5,707	0.80	1,140	380	9.9	7.9
Bolivar	900	18,652	10,105	8,547	2,694	15,958	20.7	73,467	12.8	59.0	43,330	36,419	0.84	1,197	399	48.1	40.5
Washington	900	25,367	13,371	11,996	3,478	21,889	28.2	95,893	16.6	66.1	63,409	54,873	0.87	1,239	413	70.5	61.0
Yazoo	1,000	33,845	17,254	16,591	8,498	25,347	33.8	156,228	24.4	53.2	83,184	48,321	0.58	828	276	83.2	48.3
Sharkey	540	6,306	3,406	2,900	1,405	4,901	11.7	23,328	6.8	73.0	17,041	14,162	0.83	1,182	394	31.6	26.2
Issaquena	390	10,004	5,291	4,713	826	9,178	25.7	32,630	13.1	56.0	18,203	16,150	0.88	1,254	418	46.9	41.4
Total	7,040	143,443	75,773	67,670	29,323	114,120	20.4	574,985	12.8	58.9	338,822	245,759	0.73	1,041	347	48.1	34.9
CENTRAL PRAIRIE REGION.																	
Madison	720	25,866	12,665	13,201	5,946	19,920	35.9	127,594	27.7	44.2	56,393	21,538	0.38	543	181	78.3	29.9
Hinds	800	43,958	22,176	21,782	11,675	32,283	54.9	184,607	36.1	43.3	80,018	36,684	0.46	657	219	100.0	45.9
Rankin	800	16,752	8,192	8,560	7,193	9,559	20.9	69,516	13.6	43.4	30,151	11,775	0.39	555	185	37.7	14.7
Scott	580	10,845	5,369	5,476	6,633	4,212	18.7	39,711	10.7	41.0	16,282	6,227	0.38	543	181	28.1	10.7
Jasper	680	12,126	6,048	6,078	5,244	6,882	17.8	58,318	13.4	34.8	20,305	6,228	0.31	441	147	29.9	9.2
Clarke	650	15,021	7,371	7,650	7,181	7,840	23.1	45,888	11.0	34.7	15,936	4,693	0.29	414	138	24.5	7.2
Wayne	790	8,741	4,320	4,421	4,971	3,770	11.1	20,977	4.1	36.0	7,559	1,979	0.26	372	124	9.6	2.5
Total	5,020	133,309	66,141	67,168	49,843	83,466	26.6	546,611	17.0	41.5	226,639	89,124	0.39	555	185	45.1	17.8
LONG-LEAF PINE AND COAST REGION.																	
Long-leaf pine, oak, and hickory uplands.																	
Copiah	750	27,552	13,605	13,947	13,101	14,451	36.7	119,866	25.0	45.6	54,616	23,726	0.43	612	204	72.8	31.6
Lincoln	580	13,547	6,846	6,701	7,701	5,846	23.4	55,409	14.9	31.2	17,272	6,286	0.36	513	171	29.8	10.8
Pike	720	16,688	8,374	8,314	8,572	8,116	23.2	53,803	11.7	36.9	19,842	6,507	0.33	471	157	27.6	9.0
Franklin	560	9,729	4,791	4,938	4,852	4,877	17.4	37,680	10.5	48.3	18,211	8,042	0.44	627	209	32.5	14.4
Amite	720	14,004	6,966	7,038	5,494	8,510	19.5	62,095	13.5	44.7	27,749	9,952	0.36	513	171	38.5	13.8
Lawrence	620	9,420	4,809	4,611	4,937	4,483	15.2	47,320	11.9	37.6	17,806	5,967	0.34	486	162	28.7	9.6
Simpson	580	8,008	4,025	3,983	4,994	3,014	13.8	31,479	8.5	28.1	8,855	3,501	0.40	570	190	15.3	6.0
Smith	600	8,088	4,063	4,025	6,452	1,636	13.5	32,155	8.4	32.8	10,543	3,721	0.35	498	166	17.6	6.2
Lauderdale	680	21,501	10,608	10,893	9,959	11,542	31.6	70,249	16.1	46.1	32,372	9,350	0.29	414	138	47.6	13.8
Total	5,810	128,537	64,087	64,450	66,062	62,475	22.1	510,056	13.7	40.6	207,266	77,052	0.37	528	176	35.7	13.3
Long-leaf pine hills and flats.																	
Covington	580	5,993	3,006	2,987	4,034	1,959	10.3	30,390	8.2	22.9	6,968	2,071	0.30	420	143	12.0	3.6
Jones	700	3,828	1,874	1,954	3,469	359	5.5	12,822	2.9	21.8	2,794	624	0.22	315	105	4.0	0.9
Marion	1,500	6,901	3,439	3,462	4,450	2,451	4.6	18,080	1.8	26.1	4,717	1,579	0.33	471	157	3.1	1.1
Perry	1,000	3,427	1,732	1,695	2,357	1,070	3.4	10,081	1.6	5.3	537	146	0.27	384	128	0.5	.....
Greene	790	3,194	1,605	1,589	2,381	813	4.0	5,997	1.2	.....	35	12	0.34	486	162	.....	.....
Jackson	1,140	7,607	3,905	3,702	5,124	2,483	6.7	4,195	0.6	.....	.....	.....	.....	.....	.....	.....	.....
Harrison	1,000	7,895	3,948	3,947	5,749	2,146	7.9	2,649	0.4	.....	26	11	0.42	600	200	.....	.....
Hancock	940	6,439	3,246	3,193	4,035	1,804	6.9	4,390	0.7	.....	.....	.....	.....	.....	.....	.....	.....
Total	7,650	45,284	22,755	22,529	32,199	13,085	5.9	88,604	1.8	17.0	15,077	4,443	0.29	414	138	2.0	0.5

II.—ACREAGE AND PRODUCTION OF THE CHIEF CROPS OF THE STATE.

Counties.	COTTON.		INDIAN CORN.		OATS.		WHEAT.		SWEET POTATOES.	
	Acres.	Bales.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
Total for the State	2,106,214	963,111	1,570,550	21,340,800	198,497	1,959,620	43,524	218,890	41,874	3,610,660
NORTHEASTERN PRAIRIE REGION.										
1. *Prairies.*										
Alcorn	18,863	7,477	22,589	381,385	3,358	31,939	1,078	5,070	224	16,714
Prentiss	18,610	7,207	23,018	368,777	3,806	35,534	993	4,798	364	31,466
Lee	38,578	14,406	36,073	590,899	4,676	48,047	1,400	7,387	643	49,703
Chickasaw	38,477	12,861	34,258	512,005	3,735	49,627	1,415	9,033	692	55,265
Monroe	71,402	23,830	53,431	700,957	7,278	76,270	4,114	18,296	1,217	100,560
Clay	41,656	13,137	26,295	400,397	3,117	35,592	431	2,137	514	46,533
Oktibbeha	29,679	9,929	25,251	395,553	3,288	39,063	1,088	6,078	611	54,631
Lowndes	64,670	21,886	42,855	582,786	3,784	41,230	1,618	8,099	515	38,875
Noxubee	82,483	25,294	50,904	741,542	5,429	74,165	39	158	825	70,446
Total	404,418	136,027	314,674	4,674,251	38,471	431,467	12,176	61,056	5,605	464,193
2. *Pontotoc ridge.*										
Tippah	18,758	7,424	23,388	385,623	3,814	36,435	3,587	17,941	375	24,853
Union	21,255	8,259	25,834	429,040	2,695	26,413	2,426	13,255	456	33,218
Pontotoc	21,448	8,085	26,588	414,335	2,169	18,826	2,751	14,692	500	42,028
Total	61,461	23,768	75,810	1,228,998	8,678	81,674	8,764	45,888	1,331	100,099
YELLOW LOAM REGION.										
1. *Brown loam table-lands.*										
Benton	22,401	8,123	22,877	330,688	1,735	16,846	1,285	6,073	245	16,313
Marshall	67,411	26,441	50,140	686,062	3,130	26,646	3,094	14,605	669	45,373
De Soto	60,488	28,469	37,452	581,272	1,688	18,008	1,236	7,283	493	40,399
Tate	48,245	22,053	33,321	467,144	1,763	17,628	1,100	6,495	280	22,735
Panola	67,060	30,055	43,091	521,193	2,119	22,016	1,603	9,351	526	45,399
La Fayette	35,309	15,214	35,809	492,614	4,091	36,375	2,052	9,222	401	31,209
Yalobusha	30,398	12,989	23,609	275,309	1,728	17,479	594	2,981	517	42,843
Grenada	25,390	10,228	15,906	163,580	568	6,223	6	63	364	27,142
Holmes	62,556	30,463	37,355	463,614	1,237	17,441	59	488	823	60,966
Carroll	37,957	17,423	30,019	315,722	1,877	22,154	337	1,973	479	45,297
Total	457,215	202,053	329,579	4,297,198	19,936	200,816	11,366	58,534	4,797	377,676
2. *Short-leaf pine and oak upland region.*										
Tishomingo	7,555	2,672	15,965	280,054	3,237	25,282	702	3,094	332	25,047
Itawamba	14,851	5,113	22,055	304,652	3,134	21,772	1,918	8,580	352	32,023
Calhoun	19,028	9,536	22,414	353,919	4,464	44,009	903	4,753	932	43,179
Montgomery	24,036	10,541	17,763	200,650	3,178	31,275	148	630	420	33,076
Sumner	13,613	6,226	18,900	287,362	3,269	29,544	1,874	8,379	457	37,544
Choctaw	13,497	5,757	18,139	243,287	3,931	38,709	2,215	9,413	430	34,157
Winston	15,081	5,864	17,131	217,786	4,170	37,075	902	4,560	451	43,737
Attala	35,950	15,285	33,784	413,532	6,888	66,106	1,400	6,931	819	68,722
Leake	24,000	9,016	21,390	256,331	4,749	44,070	294	1,527	498	41,594
Neshoba	14,021	4,477	16,752	207,784	3,512	26,810	223	1,215	409	36,861
Kemper	28,269	8,426	28,246	347,258	3,706	37,599	56	255	839	78,566
Newton	19,589	6,341	20,638	261,207	6,716	58,336	127	653	678	64,601
Total	230,090	89,254	253,182	3,373,822	50,954	460,587	10,767	49,990	6,617	539,107
CANE HILLS.										
Warren	34,127	22,950	10,371	188,567	69	1,045	.....	.....	286	19,304
Claiborne	33,121	18,518	15,744	197,568	82	1,290	.....	.....	457	49,281
Jefferson	32,141	18,512	16,365	251,586	312	3,195	.....	.....	750	66,179
Adams	32,117	19,026	9,037	128,647	57	909	.....	.....	1,043	57,489
Wilkinson	33,720	16,620	15,068	206,985	204	3,035	.....	.....	743	58,347
Total	165,226	95,626	66,585	973,353	724	9,474	.....	.....	3,279	250,690
MISSISSIPPI ALLUVIAL REGION.										
Tunica	29,881	18,008	9,447	198,252	137	2,820	.....	.....	38	4,797
Coahoma	32,964	26,287	14,297	388,054	138	2,340	76	332	105	7,035
Quitman	3,420	2,337	1,477	34,510	24	680	.....	.....	.....	.....
Tallahatchie	22,463	11,570	16,169	205,719	772	9,288	108	670	172	18,595
Le Flore	17,780	11,925	10,965	144,273	76	1,231	.....	.....	53	5,460
Sunflower	7,107	5,707	3,730	61,393	80	1,515	.....	.....	103	9,740

II.—ACREAGE AND PRODUCTION OF THE CHIEF CROPS OF THE STATE—Continued.

Counties.	COTTON.		INDIAN CORN.		OATS.		WHEAT.		SWEET POTATOES.	
	Acres.	Bales.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.
MISSISSIPPI ALLUVIAL REGION—continued.										
Bolivar	43,330	30,419	16,024	383,460	187	3,254	.....	.....	406	23,415
Washington	63,409	54,873	16,515	400,418	65	830	.....	.....	266	27,450
Yazoo	33,184	48,321	38,207	524,615	454	5,824	.....	.....	1,243	94,359
Sharkey	17,041	14,162	7,540	169,130	35	350	.....	.....	1	50
Issaquena	18,293	16,150	3,849	89,630	17	260	.....	.....	62	5,095
Total	335,822	245,759	133,820	2,549,460	1,985	28,392	184	1,502	2,449	196,496
CENTRAL PRAIRIE REGION.										
Madison	56,393	21,538	37,989	381,297	1,490	21,107	22	221	1,128	105,408
Hinds	80,013	30,684	47,510	532,636	1,962	26,380	16	130	1,388	132,920
Rankin	30,151	11,775	23,450	271,996	5,781	59,450	4	45	1,009	96,462
Scott	16,282	6,227	15,664	193,013	5,129	50,370	111	729	493	47,604
Jasper	20,305	6,228	19,934	202,643	5,467	56,380	5	100	790	70,313
Clarke	15,936	4,693	17,338	174,712	3,193	30,101	.....	.....	882	64,078
Wayne	7,559	1,979	10,411	93,890	1,408	12,044	7	42	538	45,306
Total	226,639	89,124	172,296	1,850,187	24,430	255,832	165	1,267	6,228	562,091
LONG-LEAF PINE, OAK, AND HICKORY UPLANDS.										
Copiah	54,616	23,726	38,292	447,197	5,320	59,021	.....	.....	1,339	156,590
Lincoln	17,272	6,286	19,843	209,747	5,704	49,924	.....	.....	908	67,244
Pike	19,842	6,507	19,248	206,810	6,003	55,909	8	60	979	74,838
Franklin	18,211	8,042	12,045	145,581	1,012	9,021	.....	.....	655	62,486
Amite	27,749	9,952	22,589	262,352	3,184	27,169	.....	.....	967	80,806
Lawrence	17,806	5,967	20,758	217,041	4,845	41,809	6	25	965	89,679
Simpson	8,855	3,501	14,165	147,672	4,211	34,817	5	40	435	50,832
Smith	10,543	3,721	14,614	156,952	5,009	46,959	78	478	564	65,081
Lauderdale	32,372	9,350	23,345	254,798	5,967	57,843	5	50	1,212	103,035
Total	207,266	77,052	184,899	2,048,150	41,255	382,472	102	653	8,024	751,191
Long-leaf pine hills and flats.										
Covington	6,968	2,071	10,082	115,088	3,553	32,215	.....	.....	568	50,575
Jones	2,794	624	5,664	47,269	3,481	30,992	.....	.....	369	41,560
Marion	4,717	1,579	9,087	99,941	1,348	12,202	.....	.....	729	59,039
Perry	537	146	4,466	38,446	2,615	20,208	.....	.....	465	43,165
Greene	35	12	3,563	27,271	891	5,799	.....	.....	477	33,095
Jackson	.....	.....	138	1,826	5	80	.....	.....	43	4,090
Harrison	26	11	1,064	15,130	142	2,110	.....	.....	241	23,163
Hancock	.....	.....	41	410	29	5,300	.....	.....	652	113,330
Total	15,077	4,443	34,705	345,381	12,064	108,906	.....	.....	3,544	369,117

PART I.

PHYSICO-GEOGRAPHICAL AND AGRICULTURAL FEATURES

OF THE

STATE OF MISSISSIPPI.

AGRICULTURAL MAP OF THE STATE OF MISSISSIPPI

BY
EUG. W. HILGARD, PH.D.
SPECIAL AGENT

1880.

LEGEND.

- Pontotoc Ridge
- North Eastern Prairie Region
- Red Lands
- Blackwoods Belt
- Short Leaf Pine Uplands with Oak and Hickory
- Sandy Oak Uplands
- Brown Loam Table Lands
- Pine Hills and Loess
- Mississippi (Yazoo) Bottom (Overflowed)
- Dogwood Ridge (above Overflow)
- Central Prairie Region
- Long Leaf Pine Hills
- Long Leaf Pine Flats and Meadows
- Live Oak Lands
- Upland Long Leaf Pine Uplands
- Lime sink region

Scale

25 0 25 50 75 100 MILES.

Julius Bien & Co. lith.

OUTLINE OF THE PHYSICAL GEOGRAPHY

OF THE

STATE OF MISSISSIPPI.

Mississippi lies between the meridians of 88° 6′ and 91° 37′ of west longitude, and between the parallels of 30° 11′ and 35° north latitude. The greatest dimensions of the state are 331 miles north and south and 188 miles east and west. The total area (including half of the boundary portions of Mississippi and Pearl rivers and Bay Saint Louis) is 46,810 square miles, of which 470 square miles is water surface. About 7,460 square miles are lowlands of the Mississippi bottom. Of this area, 7,100 belong to the "Yazoo bottom" plain. The rest, or five-sixths of the state's area, is rolling, hilly, or sometimes almost level timbered uplands.

CLIMATE.—The climate of Mississippi is a "warm temperate" one in the literal sense of the term, the extremes of temperature prevailing farther north being tempered materially by the influence of the winds blowing from the Gulf of Mexico. The extreme cold of winter sometimes occurring in the northern part of the state (at Oxford and Holly Springs, where ordinarily the winter minimum is from 15° to 20° F.) is 10° F., sufficient to kill fig trees six years old; but at Grenada, on the Yalobusha river, the fig rarely suffers. At Vicksburg and Natchez the extreme cold thus far observed is 17° F.; inland, at Jackson, several degrees lower. It is only near the sea-coast that the orange and lemon can ordinarily be grown without winter protection in the open air. A warm belt extends along the Mississippi river, but, unlike that of the coast, it is liable to "cold snaps" from the influence of northwest winds, which render the outdoor culture of the subtropical fruits precarious even as far south as Baton Rouge. Cool belts or regions are formed by the elevated ridge lands at the heads of the larger rivers of the state. The summers are long, practically including May and September. During this time the weather is warm (the usual range of the thermometer being from 70° to 90° F.), but excessive heat and sultriness, such as prevails so commonly during the shorter summers in the middle and northern states, is rare, and sunstroke is almost unknown.

The following table (extracted from those published by the Smithsonian Institution in 1876) gives the mean temperatures for each of the four seasons for some of the prominent points in the state where observations have been made. Where these were deficient, those for points lying near the line in Tennessee and Louisiana have been introduced:

	Spring.	Summer.	Autumn.	Winter.	Year.
INTERIOR STATIONS.					
La Grange, Tennessee	62.3	79.4	62.8	42.2	61.7
Grenada, Mississippi	61.4	78.6	63.9	46.3	62.6
Columbus, Mississippi	62.2	78.9	62.2	45.5	62.2
Jackson, Mississippi	65.0	78.7	64.6	49.3	64.4
Brookhaven, Mississippi	64.4	79.1	63.5	48.7	63.9
Paulding, Mississippi	66.9	81.3	67.3	50.8	66.6
RIVER AND COAST.					
Memphis, Tennessee	60.9	79.5	60.3	42.1	60.7
Vicksburg, Mississippi	65.8	80.5	65.5	50.5	65.6
Natchez, Mississippi	65.5	79.8	65.5	50.4	65.3
Baton Rouge, Louisiana	68.9	81.4	68.1	54.2	68.2
Pass Christian, Mississippi	.....	82.7	.....	.....	.....

It will be noted that, with one exception, the average temperatures given for interior stations are decidedly lower than for stations on the Mississippi river in corresponding latitudes. Compare in this respect Vicksburg with Jackson and Natchez with Brookhaven. In the case of Memphis and La Grange, however, the relation is reversed, from causes not thus far understood, but evidently operating so

as to cause exceptional cold waves reaching Memphis to be felt more severely in a southeasterly direction to a distance of from 50 to 70 miles inland, in the northwestern corner of Mississippi, than at similar distances due east in Tennessee. Still farther inland, at Columbus, the autumn and winter temperatures are found to be lower than at Grenada, nearly one-third of a degree farther to the north.

The observations thus far available are not sufficiently numerous to trace very accurately the limits of the several climatic divisions of the state; but the discussion of those made, as laid down in the maps of the Smithsonian Institution, may be summarized as follows:

The isothermal line indicating a mean annual temperature of 64° F. crosses the state almost centrally from east to west. Southward, the line of 65° traverses it a short distance inland from the gulf shore, while to the northward the line of the annual mean of 60° meanders near the state line. Roughly speaking, then, these lines, indicating differences of 4° in the annual mean, lie about 150 miles apart north and south, so that, on the average, there is a change of 1° in the annual mean for every 31 miles. But these general features are materially modified in many regions. The influence of elevation in reducing the temperatures both of winter and summer makes itself felt in the northeastern portion of the state, on the headwaters of the larger rivers, the Hatchie, Tallahatchie, and Tombigbee, and more or less on those of the Yalobusha, Big Black, and Pearl rivers; likewise in the ridge lands traversed by the Great Northern railroad between Jackson and New Orleans, in the counties of Copiah, Lincoln, Amite, and Pike. There is a warm belt along the Mississippi river, and a region of warm summers, especially on the waters of Pearl and Leaf rivers, in the southeastern portion of the state; on the other hand, a region of occasional low winter minima extends from Vicksburg southward along the river to Baton Rouge, apparently the eastern edge of the "Texas northers".

Late frosts sometimes injure the early vegetables, and more frequently the early blooming fruits, among which the peach and apricot are so liable to damage in the northern part of the state as to induce a horticultural convention, held at Memphis, to decide that these fruits could not be recommended as a money-crop for market purposes. Among the many varieties of peaches in cultivation, however, some always escape injury, and apples, pears, and cherries rarely suffer at all. In one case, even the half-grown foliage of the forest trees has been killed northward of Grenada late in April by a northwest storm following a rain from the west.

WINDS AND RAINFALL.—During the summer the winds are altogether predominantly from the south, and blow quite steadily and gently, greatly relieving the sun's heat and allowing sultriness only for short periods. Between southeast and due south these winds bring clear, warm weather; but as they veer toward southwest the sky clouds over, and between southwest and due west lie the winds that bring warm, steady rains, usually without any severe electrical excitement. The winds between due west and northwest in summer bring the violent thunder-storms, coming suddenly, and sometimes rising to the violence and cyclonic character of tornadoes. In winter the northwest winds bring the severe "cold snaps", usually of only a few days' duration, and accompanied by but a slight precipitation, so that snow rarely falls to the depth of more than a few inches even in the northern part of the state, and is quickly melted by the south and southwest winds with warm rains. As the wind rarely lies for any length of time between northwest, east, and southwest, either in summer or winter, the change from a cold and dry northwest wind, with snow flurries, to warm south and southwest winds, laden with moisture, is frequent and rapid in winter, giving that season a character of rather unenjoyable dampness overhead and slushiness under foot, which are, however, offset by its brevity, for the temperate and beautiful autumn often extends into the latter half of December, and the middle of February usually finds the early vegetables fairly up in the gardens, even in the northern part of the state.

The subjoined table exhibits the amount of rainfall (including snow) for some principal points at which observations have been made for a sufficient length of time to give reliable averages:

	Spring.	Summer.	Autumn.	Winter.	Year.
INTERIOR STATIONS.					
La Grange, Tennessee	18.2	10.9	8.0	11.7	48.8
Grenada, Mississippi	19.4	10.3	8.3	17.3	55.3
Columbus, Mississippi	15.7	12.0	10.3	17.5	55.5
Jackson, Mississippi	11.5	14.2	10.3	18.6	54.6
Brookhaven, Mississippi	20.0	15.5	10.7	17.7	63.9
Paulding, Mississippi	14.6	12.9	8.4	15.4	51.3
RIVER AND COAST.					
Memphis, Tennessee	13.7	9.1	9.0	12.7	44.5
Vicksburg, Mississippi	14.6	11.3	10.3	15.1	51.3
Natchez, Mississippi	14.5	12.4	11.4	16.1	54.4
Baton Rouge, Louisiana	14.1	18.6	12.5	15.3	60.5
Pass Christian, Mississippi	4.6	14.0	17.3	.....	.....

It will be noted that within the state there is quite a wide range even of these averages, from a minimum less than 50 inches in the extreme northern part of the state to nearly 65 inches near the coast and in the southwestern part as far north as Jackson. Even the minimum may be considered an abundance for agricultural purposes, and the maximum is not excessive, in view of the (on the whole) remarkably uniform distribution through the seasons; the minimum occurring throughout the autumn (the season for cotton picking), while winter and spring together sometimes include nearly two-thirds of the entire amount, but always leave a fair proportion of precipitation to occur in summer. While the spring rains are at times, and in certain localities especially, so abundant and continuous as to interfere somewhat with the proper after-cultivation of cotton (which occasionally "gets into the grass" in wet seasons), the summer showers, usually of short duration, are considered as especially conducive to the welfare and abundant fruiting of the cotton-plant. Once in a series of years excessive and long-continued rains in August may cause the "shedding of the bolls" by starting a new growth, which then comes too late to ripen its own crop.

Especially in the southern part of the state the variations in the amount of rainfall in different years is also very great. The subjoined table strikingly illustrates such variations for a number of prominent localities:

Table of maxima and minima of rainfall.

Locality.	Number of years covered by observations.	Maximum.	Minimum.
INLAND STATIONS.			
La Grange, Tennessee	3	53.3	41.0
Grenada, Mississippi	4	63.3	40.0
Columbus, Mississippi	15	68.4	45.3
Brookhaven, Mississippi	6	80.3	57.9
RIVER STATIONS.			
Memphis, Tennessee	7	57.0	44.1
Vicksburg, Mississippi	20	70.1	37.2
Natchez, Mississippi	19	78.7	31.0
Baton Rouge, Louisiana	10	116.4	41.3

While it is true that the greater number of years covered by the observations at the river stations tend to show a greater contrast between extreme maxima and minima, yet the general outcome of the comparison is sufficiently obvious to show the much greater difference between the maxima and minima at the southern river stations than at those situated inland. The average difference in the case of the latter, as well as at Memphis, is about 50 per cent., or 1 : 1½; at Vicksburg the ratio is slightly below, and at Natchez somewhat above, that of 1 : 2; while at Baton Rouge it rises to nearly 1 : 4. It should not, however, be inferred that the greater rainfall, whether by averages or by maxima and minima, necessarily implies a correspondingly greater number of rainy days. In the southern region the rain is more apt to fall in torrents several inches during comparatively brief "spells", while the time actually occupied in falling may be the same as for a more northerly station with a much smaller total rainfall.

TOPOGRAPHY AND DRAINAGE SYSTEMS.—Outside of the plain of the Mississippi or Yazoo bottom, and of the prairies and "flatwoods" of northeastern Mississippi, the surface of the state is rolling or sometimes hilly and even broken upland, with a general surface-slope from the northeast to the southwest, or in the eastern portion of the state nearly due south, as is indicated by the course of the rivers in both cases. There is no axis of elevation within the state, all the ridges of the present time owing their existence to the erosion by water of a substantially plane surface inclining away, westward to southward, from the last spurs of the Cumberland range, which just touch the northeast corner of the state. The highest elevations lie in the region dividing the waters of the Hatchie, Tallahatchie, and Tombigbee, in Tippah and Union counties, where some ridges rise to a height of between 800 and 1,000 feet above the sea, the adjacent "table-lands" of western Tennessee being themselves on the state line as much as 500 feet above sea-level. Another region of high, broken ridge lands lies on the heads of the Pearl river, in Neshoba and Winston counties, but although sometimes as high above the drainage as the "Hatchie hills" their absolute elevation is much less. The same may be said of the high ridges skirting the Pearl river in Lawrence and Marion counties, of the "Devil's backbone" skirting the Homochitto on the south, and of the broken "cane hills" bordering the Mississippi river from Vicksburg to the Louisiana line. Elsewhere in the state also high and narrow ridges occasionally form the main divides, but as a rule the ridges are broad and rounded, ranging from 50 to 120 feet only above the smaller creeks. In the southern part of the state the streams are separated largely by undulating plateau lands, covered by long-leaf pine forest.

Not all the ridges in the state, however, form water divides, nor are all the water divides ridges in the ordinary sense of the term. Thus the "Pontotoc ridge" in its northern portion is a true divide between the waters of the Tallahatchie on the west and those of the Tombigbee on the east; but farther south many of the western tributaries of the Tombigbee break through the ridge, heading in the level "flatwoods" region, where their headwaters interlace with those of the Yalobusha, Big Black, and Pearl rivers. This anomaly is especially striking in southern Pontotoc and northern Chickasaw, where the sluggish creeks of the level flatwoods are seen to flow on either side into a hilly country, to which the traveler makes a rather abrupt ascent. Farther south, the Noxubee river crosses the flatwoods belt from the hilly country on the west, but the divide still runs close to the western edge. The cause of this state of things is obviously the slight westerly dip of the hard and tough "flatwoods clay", which here overlaps the older (Cretaceous) formation (see "Geological features", page 12).

In the central portion of the state the divide between the Pearl and Big Black rivers, Madison and Hinds counties, is a region of gently rolling uplands, 15 to 25 miles wide, dotted with small prairies, whose general slope is toward the Big Black, the tributaries of which head close to the main Pearl river, while farther south high and mostly sandy pine ridges divide the waters of the Mississippi from those of Pearl river and lake Pontchartrain. The same is true of the divides between the waters of the Pascagoula on the one hand and those of the Tombigbee and Pearl on the other.

The general hilly character of the uplands continues to within a short distance of the Gulf coast, where the sandy pine hills flatten out into the "pine meadows". These in their turn abut on the coast of the Sound in a terrace 20 to 30 feet above sea-level. Toward the Mississippi river the uplands fall off pretty abruptly from 250 to 400 feet into the Yazoo bottom plain, or, southward of Vicksburg, into the Mississippi river itself, which washes the foot of the bluffs at Vicksburg, Grand Gulf, Rodney, Natchez, Fort Adams, and several intermediate points.

GEOLOGICAL FEATURES.—As remarked on page 11, the last undulations of the Cumberland range extend into the northeast corner of the state, and here we find (in Tishomingo county) a small area underlaid by the limestones, sandstones, and cherts of the Carboniferous formation. No true coal, however, exists within the state.

Around the mountain spur referred to, and inclining away from it in a direction varying from due west near the Tennessee line to nearly due south in the southeast part of the state, lie successively the several stages (*Eutaw*, *Rotten limestone*, and *Ripley* groups) of the Cretaceous formation; above, and therefore west and southward of these, and with dips similar in direction but smaller in amount, are the several stages of the Tertiary, which are exposed on the break of the Mississippi bluff from Memphis to Fort Adams. Above all these older formations, and mostly covering them to depths varying from a few to as much as 200 feet, lies the southern stratified drift, or "orange sand", a formation of *Quaternary* age, consisting chiefly of well-rounded, mostly ferruginous sand, and in certain belts of extensive beds of rolled gravel, with occasional, but mostly quite limited, beds of variously colored pipe-clays, that usually lie in proximity to clay strata of the older formations. Outside of the Yazoo bottom, the cane-hills belt, the prairies and flatwoods of northeast Mississippi, and the coast flats, the orange sand in its various modifications shapes the surface of the state. It forms the upper portion of nearly all ridges, and largely their body as well; and throughout the northern part of the state, at least, every higher ridge or point is capped by more or less extensive deposits of a peculiar ferruginous sandstone, formed by the cementation of the sand by means of limonite or brown iron ore, more rarely by silex. These caps of brown sandstone are sometimes several feet (as much as eight) in thickness, and have of course served to prevent the washing away of the underlying sand, into which elsewhere the present valleys have been excavated. Frequently this rock has taken fantastic shapes, such as tubes, plates, etc.; and sometimes, though rarely within the state, it is sufficiently rich to serve as an iron ore. Into this sand formation most of the wells are dug down to the underlying older and denser materials, which also usually shed the water, forming springs, by which the line between the two formations may often be traced for miles along the ridges. Wells and springs, with abundant water, can rarely be obtained within the orange sand, and in southern Mississippi extensive tracts, underlaid by these sands to a great depth, are destitute of springs, which only appear, sometimes with enormous volume, in the deeper valleys below the limit of this thirsty formation that has no regular stratification but the "flow-and-plunge" structure indicative of its deposition in violently flowing water coming from the northward.

These arid sands are almost everywhere overlaid by from 3 to 20 feet of a yellow or brownish loam, such as forms the subsoil of by far the greater portion of the state, varying greatly in productiveness according to the nature of the underlying formation, whose character it shares more or less. This loam is devoid of any stratification, usually increases in thickness as the larger water-courses are approached, and is absent only from the highest ridges, while covering pretty uniformly, like a blanket, the undulating uplands. It forms the basis and the subsoil of all the better class of uplands in the state.

The Tertiary strata underlie all but that portion of the state lying east of the flatwoods belt (see map), and have dips varying from less than 5 feet per mile west in the northern part of the state to 10 feet per mile south-southwest at Vicksburg and Jackson. From the Tennessee line south to Attala and Holmes counties the materials of the formation are dark-colored clays and sands, with occasional beds of lignite, that locally assume economic importance (Northern lignitic), while the clay beds furnish excellent potters' clays; but wells dug into these strata mostly have ill-tasting and sometimes mineral water. From Holmes and Carroll southeastward to Lauderdale sandstones alternate with the clays, and occasionally there occur agriculturally valuable beds of greensand ("Buhrstone" and "Claiborne" groups). Southward of this belt, which is largely quite hilly, the Tertiary beds are chiefly calcareous marls and partly limestones ("Jackson" and "Vicksburg" groups), with abundance of oyster and other sea-shells, and sometimes huge bones of extinct sea-monsters (Zeuglodon). These beds underlie the "Central prairie region" (see map), a country partly undulating, partly hilly, dotted with small prairies of varying character, but mostly with a stiff, black, and very fertile soil. Southward of this there is a rather sudden ascent into sandy ridge lands, covered with long-leaf pine forest and underlaid by the sandstones, claystones, and clays of the uppermost Tertiary ("Grand Gulf" group), which thence extends to within a short distance of the coast. The dip of this formation is very slightly to the southward. The coast flats themselves are underlaid by gray clays of *Quaternary* age (the "Port Hudson" group), more extensively developed in Louisiana and Texas. The same formation also underlies the Mississippi bottom, sometimes near the surface and forming soils ("Buckshot clay"), or else buried at a greater or less depth beneath the more recent alluvium. Along the edge of the Mississippi bottom, and especially from Yazoo City southward, there lies above the Port Hudson clays the curious deposit of calcareous silt now generally known as the loess, forming the "cane-hills" belt, and characterized by fossil land snails and bones of the mastodon, tapir, etc.

The portion of the state lying east of the flatwoods belt (see map) is mainly underlaid by the strata of the *Cretaceous* formation, of which the calcareous stages form the "Pontotoc ridge" and the "prairie belt". The former, rising suddenly from the flatwoods, is underlaid by the limestones and the shell marls of the "Ripley group". From this ridge there is an abrupt descent into the level or gently rolling and often treeless country, underlaid by the soft, whitish, or bluish "rotten limestone" and characterized by the black "prairie" soil. From this rich agricultural region we ascend again, on the east, into a hilly country, timbered with pine and oaks, and having a sandy

and inferior soil outside of the valleys. This region, reaching to the Alabama line, is underlaid by the sandy and clayey strata of the "Eutaw" group, devoid of lime and shells, but containing occasional beds of lignite of no economic value.

The Pontotoc ridge terminates near Houston, Chickasaw county; so that in the southern part of the Cretaceous region the flatwoods adjoin directly the black prairie region.

The Cretaceous strata dip nearly due west near the Tennessee line about 20 feet to the mile. Southward the direction of dip gradually changes to southwest, and the amount to 25 feet per mile. This structure renders artesian wells, or at least bored wells, successful in this territory, a point of especial importance in the prairie country, which has no springs or flowing streams in summer. The water is found beneath the impervious "rotten limestone", the thickness of which varies from 300 to 1,100 feet within the state. The water is hard, but otherwise pure and palatable, and usually rises within easy reach of, or frequently above, the surface, forming flowing wells. In a portion of the Tertiary region also such bored wells are practicable.

AGRICULTURAL SUBDIVISIONS OR REGIONS.—In accordance with the general features outlined above, the state may, for the purposes of description, conveniently be considered under the following heads and subheads:

I.—*Northeastern prairie region.*
1. Rotten limestone or black prairies.
2. Pontotoc ridge.

II.—*Flatwoods region.*
1. Post-oak flatwoods.
2. White-oak flatwoods.

III.—*Yellow loam or oak uplands region.*
1. Flatwoods hills.
2. Short-leaf pine and oak uplands.
3. The red lands.
4. The sandy oak uplands.
5. The brown loam table-lands.

IV.—*Mississippi bottom region.*

V.—*Cane hills region.*

VI.—*Central prairie region.*

VII.—*Long-leaf pine region.*
1. Long-leaf pine hills { Long- and short-leaf pine and oak lands. / Sandy pine hills.
2. Pine flats and coast region.

Each of these regions and subdivisions is described, with analyses of its soils, in the following pages.

I.—THE NORTHEASTERN PRAIRIE REGION.

This division, characterized by the more or less general occurrence of heavy, calcareous clay soils (popularly called prairie soils even when fully timbered), formed wholly or partially from the materials of the Cretaceous formation, presents two very strongly defined features, the one being largely level calcareous prairie, the other a rolling and mostly well-timbered upland region. Together they constitute one of the most important cotton-growing districts of the state, producing, in average seasons, about 17 per cent. of the crop, with a staple of very high quality.

ROTTEN LIMESTONE PRAIRIE REGION.

The rotten limestone prairie region, or (in its northern part) "white lime country", forms a belt varying in width from 6 to 25 miles, which enters the state near its northeastern corner, in Alcorn county, and, widening to the southward, after traversing Prentiss county occupies large portions of the counties of Lee, Chickasaw, Monroe, Clay, Oktibbeha, Lowndes, and Noxubee, and finally passes southeastward into Alabama through the extreme northeast portion of Kemper. Its maximum length within the state is thus 156 miles, with a total area of about 1,325 square miles.

Black prairie.—Of this area probably two-thirds is occupied by the black prairie soil in its several varieties, although not nearly as much was originally treeless. In fact, by far the greater part of the black prairie soil was simply sparsely timbered, clumps of crab and plum thickets dotting the prairie proper, while the general surface was more or less sparsely occupied by oaks, mingled with honey-locust and other lime-loving trees. Among these, both on the open and timbered prairie, the cedar (*Juniperus Virginiana*) was not uncommon. These features are spoken of in the past tense, because the prairie lands of northeastern Mississippi were among the earliest occupied by settlers, both on account of their great fertility and the comparative facility with which they could be taken into cultivation; and at the present time open fields, cultivated or "turned out", form the landscape, varied only by the scattered homesteads or poorer, sandy ridges, timbered with oaks, that occur more or less throughout the region.

The oaks most prevalent on the black soils are the black-jack and post oak, trees elsewhere known as characterizing inferior soils. They have here, however, so far changed their form that many imagine them to be different species from those occupying the poor sandy ridges or intractable gray clay soils elsewhere. The trunks

of both are sturdy and undivided, that of the post oak rapidly tapering, and when tall almost always curving to one side, while the short and crooked branches, running out squarely from the trunk, form a dense, leafy top, reaching low down. The black-jack forms an equally compact but low and rounded top, giving it the appearance of an apple tree, a habit assumed by it on all heavy soils, whether fertile or not.

The streams of the prairie region proper have no bottoms. The channels of the minor ones are mere depressions in the general surface (like the "coulées" of Louisiana) and have running water only during the rainy season, since, owing to the geological structure of the country, there are no springs. In the case of the larger streams there is sometimes a longer slope; at others the prairie abuts directly on the banks of the channel. Near the water-courses, as well as sometimes in the level prairie, the black soil sometimes reaches to a depth of 3 feet, while ordinarily it is from 15 to 18 inches deep, and is then underlaid by a yellow (or rather greenish-yellow) subsoil. Below the latter, usually at a depth of from 7 to 10 feet, lies the white or bluish, soft "rotten" limestone, which is the country rock, and varies in thickness from 250 in the northern to 1,100 feet in the southern portion of the belt. No veins of water can be found within it, but artesian water rises from beneath it when penetrated, either above or within available distance of the surface. North of Lee county "rotten limestone" is frequently so clayey and soft as to be simply a very calcareous clay or clay marl, while farther south it is generally more solid and chalk-like, though nowhere capable of making a chalk mark. The soils formed from it of course vary accordingly.

Black-jack prairie.—From the points of greatest thickness the black soil often thins out more or less rapidly until the yellow subsoil lies at or near the surface over considerable tracts. These constitute the "black-jack prairie", possessing a soil whose tenacity as well as color, when wet, justifies the title of "waxy" commonly allotted to it. When well cultivated it yields good returns in fair seasons, though much inferior to the black prairie in thriftiness.

"*Bald prairie.*"—A subordinate but very characteristic feature, occurring more or less throughout the prairie region, is the "bald prairie", so called from its being mostly destitute of any tree growth save small clumps of crab, plum, or persimmon. These are formed wherever the "rotten limestone" lies within about 3 feet or less of the surface and has contributed essentially to the formation of the soil, as is sometimes apparent from its whitish tint. This naturally happens most frequently in the more undulating northern portions of the prairie belt, in Alcorn, Prentiss, and Lee counties. Here we often find on the slopes of the loam uplands limited patches of "black" or "bald" prairie soil, passing on the one hand, by intermixture with the reddish loam, into the highly esteemed "mahogany" soils, and on the other into the very stiff, greenish-yellow clay of the black-jack prairie, here designated as "beeswax hummocks", and often too intractable for cultivation. They are more or less directly derived from the underlying stiff clay marls, which there, to a large extent, replace the harder and more chalky "rotten" limestone of the southern part of the prairie belt. In the latter region the admixture of this rock does not necessarily render the soils very heavy. This may be noted in the "Chickasaw Old Fields", a name applied to a group of small prairies in the southern part of Lee county, where the soil is often so shallow that the plow scrapes the rock.

From either the black-jack or the black prairie there may be a transition to the soils of higher ridges, which often form the divides between water-courses or the head regions of prairie streams. We then see the upland oaks gradually intermingling with those inhabiting the prairie, and in the northern portion of the belt such soils, timbered with tall, sturdy black, Spanish, and post oaks, are very prevalent and sometimes very fertile; but in the southern portion, as in Chickasaw and Clay counties, these ridges have a pale-yellow, sandy loam soil of little fertility, as is at once evidenced by their undersized growth of oaks, among which the scarlet oak (*Q. coccinea*) is very prominent.

COMPOSITION OF PRAIRIE SOILS.—The following analyses afford an insight into the characteristics of the prairie soils of this region:

Nos. 175 and 176. *Soil and subsoil* from Sec. 16, T. 5, R. 7 E., near Booneville, Prentiss county. Black soil 8 to 10 inches deep, very heavy, but crumbling in drying. Subsoil a pale greenish-yellow clay ("joint clay" from the manner in which it cracks on drying), with an obvious increase of lime as we descend, passing into a whitish marl. This is a fair representative of the "bald" prairie spots of the region, with scattered groups of crab, wild plum, and black-jack oak on the edges, where the black soil becomes thin or is wanting; a very productive soil in favorable seasons, but difficult to till, and subject to injury from drought.

Nos. 172 and 173. *Surface soil* (0 to 15 inches) and *underclay* (24 to 36 inches), taken in the main prairie belt on the Buena Vista and Aberdeen road, Sec. 20, T. 14, R. 6 E., Monroe county. Timber: black-jack oak, widely scattered. The black surface soil varies in depth from 8 to 15 inches, when there is a change of color to a brownish subsoil, reaching down to about 2 feet, and, in drying, cleaving into vertically prismatic fragments. Both contain numerous (2 to 6 per cent.) particles of globular concretions of brown iron ore, varying from the size of poppy seed to that of pease and of a reddish tint in the upper portion, olive tint in the underclay. These lands hardly deteriorate perceptibly during twenty years' exhaustive culture in corn and cotton, having yielded from 1,200 to 1,500 pounds of seed-cotton per acre, the staple rating very high in the market. The black soil has here in the highest degree the peculiarity of crumbling in drying from its water-soaked condition, so that in case of need it is even plowed while wet without materially injuring its tilth during the season, but in so doing heavy draft is required. The mud formed on the roads is tenacious and adhesive in the highest degree.

No. 125. *Black prairie soil* from J. D. Hollimon's land, near Buena Vista, Chickasaw county. A dark-gray heavy soil, nearly black when moist. Depth and subsoil not known accurately. The soil is stated to be very productive in favorable seasons, but to rust (or "blight") the cotton very badly when the seasons are at all unfavorable, especially when wet. This defect is clearly not the fault of the chemical composition, which is excellent, being superior to that of the Monroe prairie (No. 172), but is doubtless due to imperfect drainage, whereby the tap-root of the cotton plant is killed by drowning so soon as it reaches a certain depth.

No. 170. *Noxubee prairie soil* from near Macon, T. 15, R. 12 E., Noxubee county. Brownish black to mahogany, and heavy; depth, 12 to 15 inches. Subsoil, tawny to reddish. Timber, scattered post oak and hickory. Average product, 1,000 pounds of seed-cotton when fresh. Staple rates good middling.

No. 139. *Hillside prairie soil* from Sec. 12, T. 12, R. 18 E., J. J. Pettus' land, Kemper county. Occupies limited areas on hillsides below points where the rotten limestone appears. Black, rather sandy, 10 to 12 inches deep. An excellent soil for wheat and corn, but liable to rust cotton.

Analyses of soils and subsoils in the northeastern prairie region.

	PRENTISS COUNTY, BOONEVILLE.		MONROE COUNTY (SEC. 20, T. 14, R. 6 E).		CHICKASAW COUNTY, NEAR BUENA VISTA.	NOXUBEE COUNTY, MACON.	KEMPER COUNTY, RIDGE PRAIRIE.
	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Soil.	Soil.
	No. 175.	No. 176.	No. 172.	No. 173.	No. 125.	No. 170.	No. 139.
Insoluble matter	64.816	43.955	78.293	71.589	73.602	64.644	67.078
Soluble silica	3.595					11.060	
	68.411					75.704	
Potash	0.862	0.353	0.333	0.542	0.484	0.366	0.699
Soda	0.129	0.124	0.080	0.230	0.093	0.074	0.136
Lime	0.987	18.101	1.307	1.075	0.986	1.254	1.371
Magnesia	0.777	0.191	0.363	0.771	0.627	0.716	1.003
Brown oxide of manganese	0.045	0.076	0.143	0.046	0.128	0.118	0.245
Peroxide of iron	7.651	6.917	14.224	5.419	5.510	4.557	6.748
Alumina	14.365	5.978		13.153	11.155	8.918	13.068
Phosphoric acid	0.157	0.229	0.104	0.051	0.267	0.068	0.033
Sulphuric acid	0.010	0.085	0.034	0.036	0.027	trace.	0.077
Carbonic acid		11.832					
Water and organic matter	7.065	12.159	5.747	6.992	7.151	8.466	9.453
Total	100.459	100.000	100.688	99.854	100.035	100.241	99.911
Humus			1.925		1.418		1.277
Available inorganic			4.384		1.788		1.086
Hygroscopic moisture	13.07	12.03	12.82	1.35	10.30	14.29	11.45
absorbed at	18 C.°	18 C.°	19 C.°	9 C.°	16 C.°	20 C.°	8 C.°

The only mechanical analysis thus far made of soils of this region is that of No. 173, the yellow subsoil of the Monroe prairie, perhaps a somewhat extreme representative in the direction of heaviness. To the southward the soils appear on the whole to become lighter in texture.

Monroe county prairie subsoil.

	Subsoil.
	No. 173.
MECHANICAL ANALYSIS.	
Weight of gravel over 1.2mm diameter	
Weight of gravel between 1.2 and 1mm	
Weight of gravel between 1 and 0.6mm (limonite)	2.1
Fine earth	97.9
Total	100.0
MECHANICAL ANALYSIS OF FINE EARTH.	
Clay	34.1
Sediment of <0.25mm hydraulic value	36.2
Sediment of 0.25mm	8.1
Sediment of 0.5mm	9.0
Sediment of 1.0mm	7.6
Sediment of 2.0mm	2.9
Sediment of 4.0mm	1.3
Sediment of 8.0mm	0.2
Sediment of 16.0mm	
Sediment of 32.0mm	0.6
Sediment of 64.0mm	
Total	100.0

This is quite a heavy clay soil, with but a very small proportion of the coarser sediments to relieve its closeness; but to some extent it shares the peculiarity of its surface soil to pulverize of its own accord in drying, somewhat like the buckshot soil of the Yazoo bottom, and so is not as intractable under tillage as might be imagined. Moreover, the numerous fine fissures so formed give passage to the roots of cotton to the depth of several feet.

The most obvious chemical feature of all the soils analyzed is the large percentage of lime, ranging within a few tenths of 1 per cent., or nearly four times as much as is usually present in good upland soils. With this fact, leading us to class them all as calcareous, their dark tint is intimately correlated. It may be broadly stated that, as a rule, an exceptionally dark tint in any well-drained soil is a mark of the presence of a large supply of lime. This tint (so generally associated with the instinctive estimate of a soil's fertility) is always indicative of a large supply of humus, as is apparent from the figures given, the amount ordinarily contained in upland soils being about three-quarters of 1 per cent. only. Many soils possessing a much larger supply do not show the shade and depth of tint observed in highly calcareous soils. Manifestly this tint is due in a measure to the kind or quality of the humus formed under the influence of a large supply of lime, and it is at least probable that such humus possesses in the highest degree the important properties which render its presence in the soil so essential to profitable culture, viz: that of serving as a vehicle for the soil's mineral ingredients to the plant. This, added to the well-known action of lime in rendering available the inert plant-food in the soil, explains sufficiently the uniformly high productiveness of the prairie soils, notwithstanding serious differences in their ultimate percentages of plant-food. It will be noted that the potash percentage ranges from one-third to nearly nine-tenths of 1 per cent., while the phosphoric acid is even more variable, and would in the case of the Kemper (if correctly determined) and Noxubee soils be accounted deficient, while in the soils from Prentiss and Chickasaw it is quite high. It is, however, to be expected that in the former soils the supply would soon become deficient by exhaustive culture and will have to be replaced by the use of commercial phosphates. It will be seen by reference to the statements made in regard to it that, unlike the prairie lands farther north, its cotton product is reduced from 1,000 to 600 pounds in the course of five years' cultivation. The good effect of phosphate manures in these lands is already being experienced.

An important feature of all these soils is their high capacity for absorbing moisture, varying from 10.3 to 14.3 per cent., and averaging in the soils analyzed 12 per cent. This property belongs to clay soils generally, but is always heightened by the presence of a large supply of lime, and especially by that of much humus. It is important in preventing the acquisition of too high a temperature by the soil during hot and dry weather, and is therefore a factor in preventing injury from drought. So, also, is the great depth of the prairie soils; and it is curious to note that, notwithstanding their heaviness, the cotton roots penetrate them to great depths.

Ridge soils.—On the higher ridges in the more hilly prairie region of Kemper there occurs another soil equally stiff, but differing materially in composition from the prairie soil below it, its color being orange-red instead of black, although its iron percentage is but little greater. It is, of course, comparatively poor in humus, and its red tint scarcely varies down to 12 inches depth. The rotten limestone usually underlies at 2 to 6 feet. It produces fine wheat, and also cotton, whose growth is short, but well bolled. Where this soil mixes with the black prairie (on hillsides) the latter does not rust cotton. This red soil is manifestly related to the "red lands" farther west and north, and resembles in aspect, as well as in composition and tilling qualities, the "red hills" soil of western Attala. Its analysis gave the following results (the prairie soil is placed along side for comparison).

No. 141. *Red ridge soil* from Sec. 12, T. 12, R. 18 E., J. J. Pettus' land, Kemper county:

Ridge lands.

	Red ridge soil.	Hillside prairie soil.
	No. 141.	No. 139.
Insoluble matter	54.565	
Soluble silica	13.219	67.078
	67.784	
Potash	0.431	0.699
Soda	0.277	0.136
Lime	0.540	1.371
Magnesia	0.836	1.003
Brown oxide of manganese	0.079	0.245
Peroxide of iron	7.089	6.748
Alumina	16.071	13.068
Phosphoric acid	0.187	0.033
Sulphuric acid	0.009	0.077
Volatile matter	6.922	9.453
Total	100.225	99.878
Humus	0.781	1.277
Available inorganic	3.256	1.086
Hygroscopic moisture	13.07	11.45
absorbed at	11 C.°	8 C.°

The main differences between this soil and the prairie soil lying at lower levels (No. 139) are its smaller percentages of potash, lime, magnesia, and organic matter and higher amounts of phosphoric acid and alumina. These facts agree with the tendency to small development of stalk and heavy fruiting which characterize the red soil. The admixture of more vegetable matter by green manuring would seem to be the improvement most immediately suggested by the analysis.

Hickory hummocks.—In southwestern Tippah the Pontotoc ridge flattens into gently-rolling woodland, from which there is a gradual transition into the flatwoods proper by a change of soil and timber. Along the edge of the flatwoods there is thus a belt of land known as "hickory hummocks", from their being largely timbered with hickory, intermingled with post and Spanish oak, black gum, and some pine. The analysis of a specimen of this soil, which is fairly productive when well tilled, is given below.

No. 273. *Soil of hickory hummock* from Sec. 31, T. 4, R. 3 E., Tippah county. Timber as above stated; hickory (*Carya tomentosa*) mostly quite young. Soil grayish, not very heavy; depth, 5 inches.

No. 275. Subsoil of above. Color dun, heavier than soil; taken 5 to 12 inches deep.

Hickory hummock land of Tippah county.

	Soil.		Subsoil.	
	No. 273.		No. 275.	
Insoluble matter	81.176	87.134	78.083	86.048
Soluble silica	5.958		7.965	
Potash	0.217		0.217	
Soda	0.058		0.057	
Lime	0.350		0.580	
Magnesia	0.559		0.567	
Brown oxide of manganese	0.292		0.127	
Peroxide of iron	3.421		4.350	
Alumina	3.426		4.078	
Phosphoric acid	0.103		0.096	
Sulphuric acid	0.016		0.006	
Water and organic matter	4.295		3.315	
Total	99.871		100.050	
Hygroscopic moisture absorbed at	6.86 11 C.°		9.03 11 C.°	

The high lime percentage of this soil, indicating the nearness of the marl strata (although it lies within the flatwoods), ought to insure its thriftiness with deep tillage and good drainage. The latter appears to be the point of difficulty, since the stiff clay, underlying at no great depth, prevents the rapid drainage of water. The phosphoric acid percentage is fair; that of potash rather low, but doubtless adequate for the present. The greensand marls of the adjoining Pontotoc ridge afford ready means for the improvement of the soil in this respect.

Sandy upland ridges.—Of the pale-yellow, sandy loam lands forming ridges between the prairie belts but one specimen has been analyzed. It has been stated that these lands are generally of quite an inferior quality, at least for cotton culture. Their best adaptation appears to be for wheat and sweet potatoes, the better class of lands yielding, when fresh, from 20 to 25 bushels of the former to the acre; but they become exhausted in the course of a few years, after which it requires manure to make them produce. The more clayey varieties are also benefited by fallowing. On these the post, Spanish, and scarlet oaks (*Q. stellata*, *Q. falcata*, *Q. coccinea*) prevail, the development of the timber growth indicating very accurately their agricultural value, being generally the more vigorous on the darker tinted (yellow or orange) subsoil. The surface soil is generally so shallow that the subsoil forms the main mass of the cultivated surface. At times, especially in the lower ridges, the soil is whitish, and a poor stunted growth of scarlet and willow oaks (*Q. coccinea*, *Q. Phellos*) prevails. Such tracts are practically too poor for cultivation.

The specimen analyzed (No. 164) was taken in the belt of such uplands forming the divide between Houlka and Suckatonche creeks near Pikeville, northeast quarter of T. 14, R. 5 E., Chickasaw county. It is here about 4 miles wide, and on each side slopes off gradually into prairie belts, which border both streams. Timber: post, Spanish, and some scarlet oak, rather undersized; surface soil whitish, scarcely exceeding 2 inches in depth; subsoil a pale-yellow, fine sandy loam. Specimen taken to 10 inches depth.

Pikeville upland soil of Chickasaw county.

	Soil.
	No. 164.
Insoluble matter	93.622 } 94.978
Soluble silica	1.356 }
Potash	0.093
Soda	0.065
Lime	0.069
Magnesia	0.126
Brown oxide of manganese	0.023
Peroxide of iron	1.090
Alumina	1.472
Phosphoric acid	0.033
Sulphuric acid	0.005
Water and organic matter	1.990
Total	99.944
Hygroscopic moisture absorbed at	1.80 11 C.°

The cause of the poverty and want of durability of this soil is sufficiently obvious from the analysis. It is notably deficient in all the elements of mineral plant-food, even in potash, and nothing short of manure, in the widest sense of the word, can keep it productive when once its first supply is exhausted.

Bottom soils.—Ordinarily the bottom soils of the prairie region differ in no material point from those of the higher prairies. The formation of the black soil is, as a rule, determined by the nearness of the "rotten limestone" to the surface, and hence it is almost always found near the streams, which mostly have little or no definite flood plain.

Where, however, these streams traverse or head in uplands of the character just described we generally find a definite bottom, and even the timber of the uplands is present on a somewhat improved scale. Yet, even though it may have a dark tint, it is not necessarily fertile, that fact being commonly indicated by a timber growth of indifferent willow and water oaks (*Q. Phellos aquatica*). So soon, however, as the admixture of lime becomes considerable the black and white oak, tulip tree, sweet gum, etc., mingle with the two oaks mentioned, and the fresh soil, at least, is very productive. The following analyses illustrates one of these cases, which occur rather frequently near the western edge of the prairie region:

No. 177. *Black hummock soil* from the flats or second bottom (above any ordinary overflows) on Coonewah creek, Sec. 15, T. 9, R. 5 E. Timber as last mentioned above. Soil black, but only to the depth of 3 to 5 inches; heavy and putty-like when wet, although not very clayey.

No. 178. Subsoil of above, taken 5 to 15 inches deep. Color, pale yellow; a rather sandy loam, quite similar in appearance to No. 164. This land is said to produce, when fresh, 70 to 80 bushels of corn and 1,000 to 1,200 pounds of seed-cotton per acre, and in favorable seasons even more. The analysis resulted as follows:

Coonewah hummock land of Lee county.

	Soil.	Subsoil.
	No. 177.	No. 178.
Insoluble matter	86.160 } 89.964	90.688 } 93.430
Soluble silica	3.804 }	2.742 }
Potash	0.207	0.173
Soda	0.171	0.151
Lime	0.247	0.103
Magnesia	0.283	0.218
Brown oxide of manganese	0.045	0.058
Peroxide of iron	1.587	1.542
Alumina	3.023	2.838
Phosphoric acid	0.066	0.115
Sulphuric acid	0.040	0.048
Water and organic matter	4.761	1.628
Total	100.394	100.304
Hygroscopic moisture absorbed at	3.38 9 C.°	2.51 9 C.°

In this case the texture of the soil, as well as the alumina percentage and the hygroscopic coefficient, shows the surface soil to be more clayey than the subsoil, as is not unfrequently the case in alluvial soils. The potash percentage, though nearly twice that of the Pikeville soil, is still low; the same is true of the phosphoric acid. The latter, however, is nearly doubled in the subsoil, while the lime percentage in the soil is quite high, and thus explains its thriftiness. It is not likely, however, to be very durable in its productiveness.

THE PONTOTOC RIDGE.

The Pontotoc ridge is a belt of ridgy, sometimes rolling, sometimes hilly, oak uplands, whose main body lies between Ripley, Tippah county, and Houston, Chickasaw county, a distance of about 60 miles north and south, with a width varying from 5 to 15 miles, and averaging from 9 to 10 miles east and west. Northward of Ripley it forms a narrow strip only 1 to 2 miles wide, and is but faintly represented beyond the state line.

As the white "rotten limestone" formation underlying the prairie country determines its main features, so those of the Pontotoc ridge are largely determined by the alternating strata of hard, granular limestone and soft, bluish marls of the Upper Cretaceous formation that constitute the body of the hills, though often covered to a considerable depth by the orange or "red" sands that form so conspicuous a feature of the surface of the whole state (see "Geological features", page 10). Where this is the case, the soils and timber growth are very similar to those of the oak uplands region farther west; and, as in the case of the latter, long spurs of piny ridges extend in places into the body of the ridge land. As a rule, however, the influence of the underlying calcareous strata manifests itself very distinctly in the appearance of the soils, especially in their deep red tint and in the frequent presence, to a very large extent, of smooth and mostly globular concretions of brown iron ore (limonite), varying from the size of fine bird-shot to that of a fist. In the timber growth the presence of lime is also observable in the frequent appearance of the black walnut, tulip tree ("poplar"), black locust (*Robinia*), and cucumber trees (*Magnolia auriculata*) among the prevailing growth of oaks and hickories, as well as in the absence of the scarlet oak (*Q. coccinea*), whose prevalence is almost everywhere the proof of a comparatively unthrifty soil, poor in lime.

In consequence of the dip of the limestone strata toward the west the ascent to the ridge lands from the west is very gentle, although its limits are in general very distinctly marked by the contrast with the level, gray clay lands of the flatwoods region. Toward the east, on the contrary, there is usually a steep and well-marked descent of from 150 to 200 feet from the jutting edges of the hard limestone forming the crest of the ridge, into the level prairie or "white lime country". In the northern portion of the belt this crest forms the divide between the waters of the Tombigbee and Tallahatchie, but in the southern portion it is traversed by the tributaries of the Tombigbee, the divide lying in the flatwoods. In Tippah county, however, the Pontotoc ridge lands do not reach the edge of the prairie country, but pass insensibly to the eastward into the hilly pine country known as the "Hatchie hills".

Unlike the prairies, the Pontotoc ridge is well watered by streams fed by living springs, which flow partly from the red sandy surface strata and partly from between the limestone ledges, alternating with sandy marls. Well water also is usually obtainable at moderate depths, and is good, though mostly hard.

The soils of the Pontotoc ridge vary considerably, as may be expected from the variety of materials which, as above mentioned, form the body of its ridges. They may be classified as follows:

1. *Pale-yellow loam uplands*, timbered with a moderately strong oak growth, among which the post oak and black-jack form a considerable ingredient, and which, through a gradual increase of sand, accompanied by an admixture of scarlet oak, chestnut, and finally short-leaf pine, forms the transition toward the pine hills and the sandy ridges of the prairie country. It forms gently rolling plateau tracts, interspersed more or less throughout the eastern portion of the ridge belt, and is only moderately productive, yielding, when fresh, from 600 to 700 pounds of seed-cotton per acre, and wearing out in the course of from eight to twelve years.

2. The opposite extreme of the above is the soil of the "*Beeswax hummocks*"—a very heavy, greenish-yellow, intractable soil, appearing on hilltops and slopes where clayey marls (greatly resembling those of some parts of the prairie country) come to or near the surface and have mainly formed the soil. Thus are formed either true "bald prairies" or "black-jack prairie", on which the prevailing tree is itself reduced to a height of from 15 to 18 feet, with the compact habit peculiar to it on such soils, while the ground is in some cases almost bare of grass or any other undergrowth. This soil is rarely cultivated, and the roads on which it prevails are the dread of teamsters. Not unfrequently, however, it passes, as in the prairie region, into a true black and very fertile "prairie soil", which forms limited belts and patches on the hillsides.

From the intermixture of the black prairie, black-jack prairie, or "beeswax" soil with the sandy soils mentioned under No. 1 there results the most highly esteemed soil of the Pontotoc ridge, viz:

3. The *mahogany* (or *mulatto*) *soil*, in which the native fertility of its clayey ingredient is made available by the admixture of sufficient sandy loam to produce an easily tilled, durable, and highly productive soil. It usually occupies the lower slopes of ridges and the smaller valleys in irregular tracts.

4. *The "red lands"* and "*buncombe*" soils. These occur especially where the sandy marls and limestones come to or near the surface and have become mixed with the yellow loam or formed the soil altogether. They are distinguished by the deep red or orange color of the subsoil at least, and sometimes of the surface soil itself. The "red lands" proper are of a clay-loam character, and occur most characteristically to the southward of the town of

Pontotoc. They are full of small rounded concretions of brown iron ore, and the loam subsoil upon which they rest is sometimes from 7 to 10 feet in thickness. The "buncombe" soil is of a lighter character, and is evidently formed almost directly from the marls of the Cretaceous formation. The regions where it prevails (chiefly in eastern Union, on the heads of the Oconatyhatchie, and near the southern end of the ridge, in Chickasaw, on the extreme heads of the Houlka and Suckatonche) are everywhere characterized by an extraordinary predominance of smooth brown iron-ore pebbles (or, more properly, concretions) up to the size of a fist, which often impart to the land a most unpromising aspect; but it wears well, and, with little trouble, produces from 60 to 80 bushels of corn per acre and up to 1,600 pounds of seed-cotton. Here, as in the red lands of Louisiana, the broken surface, and not unfrequently the rocky nature of the soil, interfere somewhat with tillage.

By the occasional intermixture of the red lands soil with that of the "beeswax hummock" a heavier and somewhat less thrifty but very durable red soil is produced, while from the intermixture of the red soil with the yellow loam (No. 1) there results another kind of "mahogany" or "mulatto" soil, which occupies considerable tracts on the western side of the Pontotoc ridge especially, and is highly esteemed for its productiveness and easy tillage, its quality varying sensibly in accordance with the depth of its color.

The following analysis of one of this kind of "mulatto" soils is probably fairly representative of their character:

No. 226. *Mulatto soil* from Mr. Stephen Dagett's land, R. 3 E., T. 10, Sec. 33, Pontotoc county. Timber growth: Black, Spanish ("red"), and post oak, and hickory, all large, stout trees; some sweet and black gum and walnut toward lower ground. Depth of soil taken, 10 inches; a light chocolate tint when moist, mellow, and easily tilled. Average product, 1,000 pounds of seed-cotton per acre.

No. 122. Subsoil of the preceding, taken from 10 to 18 inches depth; of a pale-yellowish tint above, but deepens in color to that of the "red lands" below.

Mulatto land of Pontotoc ridge, Pontotoc county.

	Soil.	Subsoil.
	No. 226.	No. 122.
Insoluble matter	83.270	79.280
Soluble silica	5.550 } 88.836	8.463 } 87.743
Potash	0.374	0.414
Soda	0.219	0.229
Lime	0.281	0.221
Magnesia	0.284	0.469
Brown oxide of manganese	0.276	0.142
Peroxide of iron	2.359	4.525
Alumina	4.511	4.345
Phosphoric acid	0.082	0.235
Sulphuric acid	0.017	0.066
Water and organic matter	3.106	2.109
Total	100.295	100.498
Hygroscopic moisture	4.076	5.60
absorbed at	11 C.°	16 C.°

The prominent features of this soil are the high percentages of lime in both the soil and subsoil and the large amount of phosphoric acid in the subsoil, while that in the surface soil is quite moderate. The potash percentages in both are fair, though not large, and there seems to be but little difference in the mechanical constitution of the soil and subsoil, the former being deficient in vegetable matter. The latter circumstance partially explains why a soil of such excellent chemical and physical qualities produces only 1,000 pounds of seed-cotton, when soils otherwise similarly constituted, but richer in organic matter, as a rule produce a 400-pound bale per acre. The most important direct mode of improvement (by green manuring) is thus at once indicated, while for the maintenance of fertility in the future the marl beds of the region furnish excellent material.

The following analysis of a hillside or "hummock" soil from Sec. 34, T. 12, R. 3 E., Chickasaw county, shows the character of the soil near the southern end of the ridge, where it flattens and forms a gradual transition to the pale ridge lands of the prairie country.

The timber here is mainly black oak and hickory, with some chestnut-white, water, and scarlet oaks, and dogwood; in the lower land, also, some ash, wild plum, and cottonwood, indicating the presence of lime.

No. 346. The soil is a light loam, mouse color, to the depth of 6 to 9 inches, according to its position on the hillside. The subsoil (No. 347) is somewhat heavier, of a yellow or light orange tint, taken to the depth of 18 inches.

Pontotoc ridge hummock land, Chickasaw county.

	Soil.	Subsoil.
	No. 346.	No. 347.
Insoluble matter	87.044 } 90.169	70.697 } 77.266
Soluble silica	3.125 }	6.569 }
Potash	0.153	0.262
Soda	0.085	0.105
Lime	0.168	0.263
Magnesia	0.215	0.420
Brown oxide of manganese	0.106	0.134
Peroxide of iron	2.758	5.521
Alumina	3.581	11.228
Phosphoric acid	0.113	0.094
Sulphuric acid	0.018	0.022
Water and organic matter	3.066	4.796
Total	100.432	100.111
Hygroscopic moisture	4.06	9.01
absorbed at	19 C.°	19 C.°

It thus appears that this soil is materially less rich in mineral plant-food (potash and phosphoric acid) than the "mulatto soil" of Dagett's neighborhood, and it will doubtless be found to be less durable. But in present productiveness it is (according to the testimony of the inhabitants) quite equal to the former, owing doubtless to the greater amount of organic matter present, while its large lime percentage for a soil of its kind explains its present thriftiness in accordance with the indications of its timber growth.

Natural fertilizers of the northeastern prairie region.—Among the materials of the (Cretaceous) formation underlying the region there is quite a variety of marls of excellent quality for soil improvement, beside enormous deposits of limestones, which, by burning, will furnish lime for agricultural as well as other purposes. A number of analyses of such materials are given in the table on page 22.

The best natural marls, as well as the purest limestones, occur on the Pontotoc ridge. The best marls are of bluish tint. They mostly contain greensand or glauconite grains, and usually also a certain (not inconsiderable) percentage of phosphoric acid, rising as high as a quarter of 1 per cent. and even more. The potash percentage of some rises as high as $1\frac{3}{4}$ per cent., but is more frequently near three-fourths in the soft marls. The harder ones are not so rich in greensand. The lime percentage of the blue marls is, on the whole, rather low, and from half to three-fourths of their mass is commonly inert matter. They do not, therefore, as a rule, bear transportation far from the points where they occur. The inert portion is mostly sandy, and hence it will sometimes pay to use them on heavy soils needing to be rendered lighter. This is especially true of the heavy clay soil of the adjoining "flatwoods", the effect of marling upon which is abundantly apparent at the foot of the marl hills, where the two materials have naturally mingled.

In the black prairie belt the underlying whitish marly materials are mostly of a clayey character, and their chief useful ingredient is, in most cases, the lime, with small percentages of potash and phosphoric acid. The prevalent "rotten limestone" has taken part in the formation of the black prairie soils naturally; yet it has been found that when these have become "tired" a dressing even of the raw but pulverized rock is helpful, and still more helpful is a dressing of the lime made from it. This will doubtless be extensively used in the future, especially on the less thrifty soils of the "post-oak prairie" and on the sandy upland ridges dividing the prairie belts proper. At many points the limestone is very clayey and easily disintegrated, as in the case of the marl from near Chewalla, and can then, of course, be more easily applied to the fields.

In the southern portion of the region along the Tombigbee river there are extensive outcrops of greenish sands, usually glistening with mica, and often more or less indurate, frequently full of shells. The analyses made of these (see table on page 20) do not place them very high as fertilizing materials, as they contain from 80 to 90 per cent. of inert matter and only from 1 to 6 per cent. of lime, with usually little else of agricultural importance. In some cases, as in that of No. 2226, there is enough of glauconite in the mass to render it available, at least where it is convenient for application to needy soils.

No. 338. *Greensand shell marl* from Sec. 22, T. 4., R. 3 E., 2 miles west of Ripley, Tippah county (Vernor's place). Crops out in the bed of a small creek about 2 feet thick, and is full of soft, rounded grains of greensand and broken shells.

No. 708. *Blue marl* from the well of Judge O. Davis, in the town of Ripley, Tippah county. Sandier than No. 338, and greensand grains smaller and less abundant. Similar marl crops out in the bed of Town creek, just south of the town, and at numerous other localities in the region.

No. 318. *Indurate blue marl*, or marlstone, from Braddock's place, Sec. 21, T. 3, R. 4 E., Tippah county. Somewhat difficult to crumble, and for use would require to be exposed to the weather for some length of time. No greensand grains visible.

No. 271. *Blue marl* from Nabor's place, southeast of Ripley, exact locality not given. Bluish, soft, full of mica scales, somewhat clayey, with a few shells. This marl represents most of those occurring in the eastern part of the marl region of Tippah and Union, and contains, as will be noted, a good deal of inert matter, and only about 6½ per cent. of lime. The marl occurring on Owl creek is quite similar to this.

No. 123. *Bluish greensand marl* from an outcrop 1 mile south of the town of Pontotoc, Pontotoc county. Several feet in thickness, with visible greensand grains. Easily accessible, and rich in lime and potash.

No. (?) *"Rotten limestone"* from near Okolona, Chickasaw county. This is a fair sample of the "white prairie rock", and it makes fair lime for building purposes. At some points it pulverizes by exposure, and can be thus obtained for agricultural use.

No. 2221. *Yellowish clay marl* from a railroad cut southeast of Chewalla station, in Alcorn county. Quite heavy and tough when wet, but cracking and pulverizing readily in drying; similar to the subsoil of some prairie spots and materials found near Corinth and Booneville, Prentiss county.

No. 2226. *Greenish micaceous sand* from a bluff on the Tombigbee river near Dr. Tyndall's place, near Aberdeen, Monroe county. A sandy mass of light olive tint, easily pulverized; crops out abundantly on the several bluff banks on the river near and south of Aberdeen. This sand should not be confounded with the non-calcareous and agriculturally worthless loose yellowish sands that underlie it.

No. 327. *Greenish micaceous sand* from the bluff on the Tombigbee river near Waverly, Lowndes county. Abundant, and some portions consolidated into ledges showing impressions of large shells. Quite rich in phosphoric acid, but poor both in lime and potash, and therefore hardly available for hauling to any distance. The material in the bluff at Columbus is poorer than this.

Marls of the northeastern prairie region.

	Blue or Greensand Marls.					Whitish Clay Marls.		Greenish Sands.	
	Tippah county.				Pontotoc county.	Chickasaw county.	Alcorn county.	Monroe county.	Lowndes county.
	Marl two miles west of Ripley.	Ripley marl.	Braddock's indurate marl.	Nabor's shell marl.	One mile south of Pontotoc, blue marl.	Okolona rotten limestone.	Chewalla marl.	Tyndall's Tombigbee sand.	Waverly greenish micaceous sand.
	No. 338.	No. 708.	No. 318.	No. 271.	No. 123.	No. ?	No. 2221.	No. 2226.	No. 327.
Insoluble matter	48.819	62.441	40.854	78.842	49.054	10.903	55.554	81.224	88.702
Potash	1.342	0.703	0.154	0.797	1.701	0.248	0.557	0.705	0.204
Soda	0.132	0.272	0.030	0.611	0.156	0.320	0.275	0.117	0.100
Lime	12.228	7.952	21.396	6.574	16.247	45.791	13.297	4.926	1.351
Magnesia	2.333	1.560	0.910	1.445	1.091	0.877	1.314	0.824	0.723
Brown oxide of manganese	0.143	0.160	0.093	0.204	0.070	.....	0.050	0.040	.....
Peroxide of iron	18.510	11.849	11.108	3.027	8.696	1.421	4.766	3.695	5.598
Alumina		5.865	1.259	2.591	7.359	1.957	8.444	3.677	
Phosphoric acid	.....	0.266	0.292	0.180	0.199	.....	0.144	0.131	0.328
Sulphuric acid	Fe. S. 0.349	.....	0.185	0.184	0.097	.....	0.212	0.003	0.018
Carbonic acid	11.903	9.909	21.435	3.944	11.704	35.725	10.222	1.545	0.472
Water and organic matter	4.449		2.675	1.420	3.701	2.840	4.841	2.862	2.303
Total	100.208	100.977	100.341	99.819	100.075	100.082	99.676	99.809	99.884

II.—THE FLATWOODS REGION.

The flatwoods region constitutes a belt of level land, varying from 6 to 12 miles in width and averaging about 8 miles, which borders on the west the northeastern prairie region, and traverses the western portions of the counties of Tippah, Union, Pontotoc, Chickasaw, Clay, Oktibbeha, Noxubee, and tracts in northeastern Winston and Kemper counties, continuing into Alabama. In its northern portion its eastern outline is sharply defined by an ascent into the red lands of the Pontotoc ridge, while southward of Houston it merges rather imperceptibly into the equally level prairie lands. From these, however, it is distinguished by its timber growth, which differs not so much in the species of the prevailing trees as in their form and development. On the west their outline is also often marked by an abrupt ascent into the hills of the adjacent Yellow loam region, notwithstanding the fact that (as appears from an inspection of the map) the divide between the waters of the Tombigbee and Mississippi lies largely within or on the western border of the flatwoods belt.

The region is throughout underlaid by strata of heavy, gray clay belonging to the older Tertiary formation, from which its prevalent soil is almost directly derived, and into which the transition is often almost insensible within a few feet of the surface. The gray, heavy, intractable soil bears almost throughout a moderately dense growth of post oak, interspersed with short-leaf pine and black gum, and varied with occasional belts or tracts of small-sized, round-headed black-jack, where the soil is excessively heavy. The post oak, unlike that of the prairies, is of a lank, thin growth, with long, rod-like branches pointing upward, and frequently clothed with short, tuft-like, leafy boughs. Near the streams the growth becomes more sturdy, and hickory as well as oaks appear to some extent. The streams, however, have scarcely any true bottoms, their shallow, crooked channels being simply cut into the general level descending slightly toward them. The drainage is therefore exceedingly slow, and during the winter rains the country over large areas is covered with a shallow, slow-moving sheet of muddy water. This, together with the tenacity and depth of the mud, renders the flatwoods belt an almost impassable barrier to teams in winter and far into the spring. For a like reason, the soil frequently remains untillable until the planting season is nearly over, and thus subjects the crop to the uncertain chances of a short growing-season; yet in favorable years, when the water subsides early and the plowing can be done when the soil is just in the right condition, very good crops of corn and cotton are made.

The analyses below show the composition of a specimen of this soil, and of the material from which it was originally derived:

No. 230. *Heavy flatwoods soil* from Sec. 4, T. 10, R. 2 E., Pontotoc county. Timber, post oak and short-leaf pine. No perceptible difference between surface soil and subsoil; specimen taken to 12 inches depth. A yellowish-gray, massy clay, with reddish cleavage planes.

No. 288. *Flatwoods clay* from an outcrop on same section as above. A roundish nodular, slightly indurated clay, a little lighter in color than the soil, and not plastic until worked for some time, underlies the soil at a depth varying from 0 to 4 feet.

Lands of the flatwoods region.

	Heavy flatwoods soil.	Flatwoods clay.
	No. 230.	No. 288.
Insoluble matter	77.854	69.099
Soluble silica		5.016 = 74.115
Potash	0.753	0.737
Soda	0.106	0.389
Lime	0.178	0.490
Magnesia	0.831	1.787
Brown oxide of manganese	0.167	0.073
Peroxide of iron	5.899	7.123
Alumina	10.302	11.322
Phospheric acid	0.052	0.004
Sulphuric acid	0.032	0.002
Water and organic matter	3.689	4.429
Total	99.863	100.471
Humus	0.306	.....
Available inorganic	1.806	.....
Hygroscopic moisture	9.33	19.4
absorbed at	22 C.°	16 C.°

A comparison of the chemical composition of the soil and clay material shows a very close agreement, outside of such differences as are referable to the processes of soil formation, viz, a partial leaching out of lime, magnesia, and soda and an increase of the elements of plant-food that are specially deficient in the clay (viz, phosphoric and sulphuric acids), probably as the result of the additions annually made by the decaying vegetation. But as it is, the soil, though rich in potash, is extremely deficient in phosphates, and, as its color proves, is almost totally devoid of vegetable matter. In consequence, the soil is unthrifty in a marked degree, and the addition of vegetable matter, as well as the use of phosphate manures, is indicated as of first necessity in taking it into cultivation.

Another kind of soil, the extreme opposite of the one described, occupies considerable tracts in northern Pontotoc and northern Chickasaw counties. This soil is in the main a fine, almost pulverulent sand or silt, of a gray tint, with ferruginous dots, the latter in the subsoils sometimes developing into grains of bog ore or "black gravel". It shows but little change from the surface downward, even sometimes to the depth of 20 feet, except when (as is frequently the case) it is underlaid by the heavy soil or clay, in which it seems to form irregular, lake-like basins or channels. Except in the bottoms of the streams in and below the flatwoods we rarely find the two soils naturally intermingled; and while the one is remarkable for its heaviness and imperviousness, the other is equally noted for being so light and leachy that it will hold neither moisture nor manure enough for ordinary crops. Its composition is shown in the analysis on page 24.

No. 165. *Light flatwoods soil* from Sec. 36, T. 10, R. 2 E., Chickasaw county. Timber almost exclusively post oak, very little Spanish ("red") oak (*Q. falcata*); huckleberry bushes in depressions. A pale-gray, powdery soil, full of ferruginous dots, increasing downward. No perceptible difference between soil and subsoil; specimen taken to the depth of 12 inches.

Light flatwoods soil.

	Soil.
	No. 165.
Insoluble matter	93.575
Soluble silica	
Potash	0.254
Soda	0.066
Lime	0.082
Magnesia	0.175
Brown oxide of manganese	0.111
Peroxide of iron	1.445
Alumina	2.605
Phosphoric acid	trace.
Sulphuric acid	0.008
Water and organic matter	1.333
Total	99.654
Humus	0.891
Available inorganic	4.064
Hygroscopic moisture (air-dried)	1.70
	2.05

The mechanical analysis of the two soils (Nos. 230 and 165) resulted as follows:

Mechanical analysis of flatwoods lands.

	PONTOTOC COUNTY.	CHICKASAW COUNTY.
	Heavy flatwoods soil.	Light flatwoods soil.
	No. 230.	No. 165.
Weight of gravel over 1.2mm diameter		
Weight of gravel between 1.2 and 1mm	0.3	2.9
Weight of gravel between 1 and 0.6mm	0.4	7.0
Fine earth	99.3	90.1
Total	100.0	100.0
MECHANICAL ANALYSIS OF FINE EARTH.		
Clay	25.7	9.0
Sediment of < 0.25mm hydraulic value	32.7	17.3
Sediment of 0.25mm	26.8	24.5
Sediment of 0.5mm	9.1	15.9
Sediment of 1.0mm	2.7	10.8
Sediment of 2.0mm	1.6	6.0
Sediment of 4.0mm	0.2	2.2
Sediment of 8.0mm	0.2	2.0
Sediment of 16.0mm		3.1
Sediment of 32.0mm		5.2
Sediment of 64.0mm		2.8
Total	99.0	98.8

These analyses show the two soils to be even more unlike in their mechanical than in their chemical composition. The extremely small proportion of the coarser sediments in No. 230, with the high clay percentage, shows good cause for the excessive heaviness. That this can be measurably relieved by the use of the marls which abound on the Pontotoc ridge is shown by the experience had in their actual use, as well as by the great improvement of this soil when lying near the foot of the ridge and receiving its washings. The phosphates and lime carried by these marls of course take a share in this improvement.

The clay percentage of No. 165 is larger than would have been supposed from its appearance, but its sediments are so proportioned as to render it powerless toward retentiveness.

While extremely unlike in mechanical composition, the two chief varieties of flatwoods soil agree very nearly in their main deficiencies, viz, in phosphates; and apparently also in sulphuric acid; the percentage of potash in the light soil is not too small for so deep a soil, but lime is quite low, and humus fair, while very deficient in No. 230.

The mode of improvement indicated is thus nearly the same for both soils, viz: green manuring and liming to increase the vegetable matter and to render the light soil more retentive, the heavy one lighter; for the same end

intermixture of the two soils wherever this can be done by deep plowing or diversion of drainage; use of the marls of the adjacent Pontotoc ridge for a supply of lime and phosphates; on the small scale, use of bone meal on the light soil, and the same, or superphosphate, on the heavy one.

It has been found that here, as in the gray silt prairies of Louisiana, the treading of cattle improves the light soil for cultivation. In any case, however, it is far inferior to the heavy soil in durability; the latter, in fact, could readily be rendered similar to the prairie soil by the liberal use of marls and green manuring. This may sometimes be noted where it lies at the foot of the ridge and receives the washings of the marl beds; and a similar improvement is noted wherever either the plow or nature has intermingled it with the red ridge soil.

In fair seasons the cotton product averages about 500 or 600 pounds of seed-cotton on the light and 800 or 900 pounds on the heavy soil, when fresh.

WHITE-OAK FLATWOODS.

This kind of land forms belts of one-quarter to several miles in width intervening between the post-oak flatwoods and the hills on the west in southern Chickasaw and southward in Sumner and northern Oktibbeha. Here, as we traverse the flatwoods from east to west, we find the dead gray of the post-oak soil gradually changing toward the yellow, with an increasing amount of sand. The pine and post-oak becomes of sturdier growth, and the Spanish instead of the black-jack oak mingles with them. As we advance the hickory and white oak appear, and near the hills become quite prevalent. The surface of the ground also, instead of being almost bare, as in the post-oak flatwoods, is here covered with a fine growth of grass.

The soil is a rather sandy loam, with a tendency to "working like putty" and adhering strongly to the plow when wet. This is apt to occur in consequence of its being underlaid at the depth of 3 or 4 feet by a stratum of solid, impervious clay, which compels all water to drain slowly sideways. Drainage is therefore the first condition for its profitable cultivation; but the fact that its iron has not been accumulated into bog-ore grains proves that this can be easily done. In favorable seasons it yields even now very fair crops. The soil is best adapted to corn and sweet potatoes, but will make from 500 to 600 pounds of seed-cotton per acre. Its analysis resulted as follows:

No. 147. *White-oak flatwoods soil* from Sec. 33, T. 14, R. 2 E., Chickasaw county. Vegetation as described above; depth taken, 6 inches. A fine sandy loam, pale-yellow tint, drying into hard clods when taken wet.

No. 144. Subsoil of above, 6 to 18 inches. Somewhat heavier than the surface soil, but of the same tint, a little more reddish; was fairly afloat with soil water at 18 inches at the time when taken (April 11).

White-oak flatwoods.

	CHICKASAW COUNTY.	
	Soil.	Subsoil.
	No. 147.	No. 144.
Insoluble matter	89.802	83.040
Soluble silica	2.656	5.690
	92.458	88.730
Potash	0.127	0.171
Soda	0.100	0.152
Lime	0.080	0.148
Magnesia	0.147	0.119
Brown oxide of manganese	0.087	0.051
Peroxide of iron	3.057	3.936
Alumina	1.773	4.627
Phosphoric acid	0.105	0.208
Sulphuric acid	0.013	0.007
Water and organic matter	1.998	2.230
Total	99.945	100.379
Hygroscopic moisture	3.26	7.45
absorbed at	21 C.°	18 C.°

A comparison of this soil with the light soil (No. 165), which it resembles in many respects, shows it to contain less potash but considerably more phosphoric acid, and doubtless more vegetable mold. It also contains more iron, and that in a finely divided condition (in which it renders the soil more absorbent of moisture and heat), instead of being in the shape of bog-ore spots. In the subsoil the only notable difference is that the amounts of lime and phosphoric acid are notably greater than in the surface soil, and the percentage of the latter ingredient is especially quite high. This, added to the greater retentiveness of the subsoil, as indicated by the high percentage of alumina, renders its superior productiveness quite intelligible. After the primary requirement of drainage, that of potash manures (for which the greensand marls of the Pontotoc ridge are available) will probably soonest be felt.

BOTTOMS OF THE FLATWOODS REGION.—Where the heavy soil prevails exclusively the streams, as stated, have no bottom properly so called, and the soil near them is practically the same as elsewhere; but where the water-courses traverse belts of the several different kinds the alluvial soils resulting from their intermixture are often of an excellent mechanical constitution and possess considerable fertility, as indicated by their timber growth. Among the latter the chestnut-white oak is almost always prominent, and large black and sweet gums, shellbark

hickory, and willow oak are rarely wanting. Ash, elm, and tulip tree ("poplar") also occur with frequency. Notwithstanding their fertility, these bottoms are as yet but little settled, on account of their undrained condition, which makes crops late, and also renders them unhealthy.

The numerous streams heading in the flatwoods region generally preserve their characteristics for a considerable distance beyond its limits, and this is especially the case with those flowing westward toward the Yalobusha and Yockeney, whose heavily timbered bottoms become and remain submerged and impassable simultaneously with the flatwoods proper, and for that reason, and also in a measure on account of the heavy expense of clearing them, are as yet but little settled. Wherever reclaimed, these soils have proved very fertile; no analyses have yet been made of them.

The following analyses of bottom soils, taken within the hilly region adjoining the flatwoods on the west and deriving their soils from them, serve to exemplify some of their characters:

No. 180. *Bottom soil* from Potlockney creek, Sec. 15, T. 10, R. 2 W., La Fayette county. Very heavily timbered as above stated, with the addition of beech and white oak on the higher portions. Soil closely resembling that of the white-oak flatwoods (see page 23), rather sandy, and when wet "working like putty", but very productive when well cultivated and drained. Soil taken to 8 inches depth, of a tawny tint.

No. 299. Subsoil of above, 8 to 18 inches. Pale yellow, and when taken wet "working like putty" and then hardening into a rock-like mass.

No. 369. *Soil of bottom of Loosha-Scoona river* from Sec. 12, T. 13, R. 2 W., Calhoun county. Timber, the bottom oaks, tulip trees, beech, elm, and hornbeam, with some maple and ash. Soil, mouse-color when wet, whitish when dry; some ferruginous spots.

No. 370. Subsoil of above, 10 to 18 inches, and whitish, putty-like, with spots and concretions of bog ore.

Bottom lands of the Flatwoods region.

	La Fayette county (R. 2 W., T. 10, S. 15).		Calhoun county (R. 2 W., T. 13, S. 12).	
	Potlockney bottom.		Loosha-Scoona bottom.	
	Soil.	Subsoil.	Soil.	Subsoil.
	No. 180.	No. 299.	No. 369.	No. 370.
Insoluble matter	87.880	88.472	77.539	81.920
Soluble silica	1.490 } 89.370	2.168 } 90.640	7.327 } 84.866	7.228 } 89.148
Potash	0.180	0.292	0.494	0.292
Soda	0.099	0.083	0.410	0.165
Lime	0.156	0.089	0.235	0.122
Magnesia	0.277	0.394	0.442	0.306
Brown oxide of manganese	0.284	0.108	0.088	0.108
Peroxide of iron	2.725	2.936	2.057	2.579
Alumina	2.702	3.115	3.886	5.085
Phosphoric acid	0.115	0.075	0.178	0.055
Sulphuric acid	0.014	0.006	0.004	0.005
Water and organic matter	4.446	2.686	7.839	2.349
Total	100.368	100.424	100.499	100.214
Hygroscopic moisture	6.81	6.69	6.61	5.58
absorbed at	11 C.°	11 C.°	15 C.°	18 C.°

According to these analyses these bottom soils differ from the two principal flatwoods soils essentially in their considerably greater percentage of potash, and phosphoric acid, which in both, moreover, is larger in the surface soil than in the subsoil. This fact is doubtless connected with the more or less continuous formation of bog ore, by which the subsoil is being depleted of phosphates through a kind of leaching process. In the white-oak flatwoods, where this process does not occur, the phosphates in the subsoil are nearly double those in the surface soil.

The high percentages of potash, lime, and phosphoric acid in the Loosha-Scoona soil, coupled with the large amount of soluble silica (indicating a corresponding availability of the plant-food) and a desirable moisture coefficient, indicate that this soil, when reclaimed by drainage, will be highly productive and very durable. In the latter respect the Potlockney surface soil is likely to be greatly inferior, but this may be balanced by the large phosphate percentage in the subsoil.

III.—YELLOW LOAM OR OAK UPLANDS REGION.

The main body of the lands classed under this head lie in northern Mississippi between the flatwoods on the east and the Mississippi bottom on the west and north of the "Central prairie region". Minor bodies of similar lands, however, occur in the southern part of the state, as shown by the coloring on the map; and as there are all degrees of transition from its soils to those of the adjoining regions its limits cannot be very accurately defined.

The general characteristics of its soils may be thus stated: Those of the better class of uplands are formed by a yellow or brownish loam, varying greatly in thickness from a few inches to as much as 20 feet, but averaging

from 3 to 4 feet, and forming mostly light or only moderately heavy soils, underlaid at the depth stated by either hard-pan or loose sand of the Drift formation. On the poorer uplands this loam subsoil is thin or sometimes entirely wanting, so that the Drift materials themselves, or their intermixtures with the loam, form sandy soils, which, though sometimes quite productive at first, wear out very rapidly.

TIMBER TREES.—The former class of soils is timbered essentially with Spanish, black, and large, sturdy post oak (*Q. falcata, tinctoria, stellata*), and more or less hickory, to which, in case either of unusual heaviness or sandiness, the black-jack oak (*Q. nigra*) is commonly added. The scarlet oak (locally also called "Spanish", *Q. coccinea*) also occurs more or less scattered among the predominant growth mentioned, its appearance being considered a sure indication of a comparatively inferior soil, merging into the "black-jack ridge" and "pine-hill" soils of northern Mississippi. A frequent admixture of hickory, on the contrary, is as surely deemed an indication of improvement and of a strong soil, the "hickory hummocks" forming the slopes toward the streams in the hill lands being, as a rule, the best.

The appearance of the short-leaf pine (*Pinus mitis*) among the timber growth is always an indication of inferior durability of the soil, which is mostly a pale-yellow, sandy loam, bearing, in addition to the pine, post and black-jack oaks, or, in case of extreme sandiness, the latter alone, forming the hopelessly barren "black-jack ridges". An admixture of hickory indicates the existence of a more or less retentive and fertile subsoil, and commonly varies inversely as the pine, so that we usually find the latter disappearing on the lower slopes, while scarlet, Spanish, and finally the black oak set in as the bottoms are approached. The latter are, as a rule, the lands chiefly cultivated in the short-leaf pine region.

It is very essential, however, in judging by its timber-growth the position of any of these soils in the scale of comparison, to take into account not only the kind (species) of the trees, but also their mode of growth. The black-jack and post oak especially, as species, characterize the poorest as well as the richest upland soils, both of this region and of the southwestern states generally, but their mode of development is very different in each case. So of the Spanish oak (*Q. falcata*), whose range of soils is almost equally wide, and whose different forms it is not at all easy to distinguish.

A good-sized post oak of sturdy, thick-set growth, with stout, short, crooked, and rapidly tapering branches and a dense, well-shaped top, will never be found on a poor or easily exhausted soil; but let it be small and scrubby, with numerous small branches and a sparse, tattered top, or its trunk tall, thin, and tapering, with long, rod-like branches, themselves often clothed with short, leafy twigs, forming an open, irregular, tattered top, and little is to be expected of the soil's productiveness.

With the black-jack oak the characteristics are somewhat different. The short and knotty black-jack, whose trunk will sometimes scarcely yield a straight piece long enough for a fence-post and generally places the purchaser of cord-wood under a grievous disadvantage, which possesses short and very crooked branches and a tattered, open top, is characteristic of the poor "black-jack ridges", and, when very small beside, denotes the very poorest soil. Dense, rounded tops, with rather low, but straight trunks, belong to the heavy prairie soils of northeastern and central Mississippi, and, on the other hand, to the fertile but extremely sandy ridge soils of southern Noxubee, Kemper, Lauderdale, and Jasper; while on the fertile yellow loam soils of northern Marshall, Yalobusha, Holmes, and Yazoo the black-jack forms large, well-shaped, spreading trees, sometimes 50 feet and more in height, with trunks comparatively straight, or at least not whimsically knotted, like those of the pine hills, but generally leaning over to one side with a regular curve and without straggling branches on the trunk below the top.

The Spanish ("red") oak (*Q. falcata*) does not frequent soils of any extreme physical or chemical character. Soils where this tree prevails are generally easily tilled, but are yet not liable to suffer from drought. As to their quality, a great deal depends upon the size of the tree. If it be rather stout; if the main branches grow out at a large angle (more or less squarely), so as to form a rounded top, closed on all sides, the soil is sure to be a strong one; but if the trunk be lank, slender, and of a whitish hue, forking into straight, slender branches, tending upward (somewhat in the shape of a broom) and presenting a tattered top, open below, but little can be expected of the soil.

The same, though on a higher grade of soil, applies to the black oak. The white oak (*Q. alba*), when of a sturdy growth and with rounded top, belongs to the best of "hummock" soils, but is not a safe mark of strong land when it is lank and tall with a very long top. It is, of course, not only the mode of growth, but also, and very essentially, the size of the trees, that requires to be considered in judging of land by its timber growth. Very large trees of any kind will rarely be found on a poor soil. Nor will the individual trees of any region necessarily exhibit the same type throughout. It is the average or predominant form and size that must be taken as a guide; and it must not be forgotten that where the growth is crowded all peculiarities of form must be greatly modified, or even entirely lost.

Small trees of the black gum (*Nyssa multiflora*) are usually an unwelcome indication in the uplands, and the chestnut, though not always considered as characterizing a poor soil, is found almost universally in large, scattered individuals in the pine lands of northern Mississippi.

FLATWOODS HILLS.

It has been stated (page 20) that the western limit of the post-oak flatwoods is often sharply defined by a sudden descent from the hilly country of the region now under consideration. Sometimes the transition is

the case; and even when the transition from hill to level is abrupt we not uncommonly find the lower portion of the hills continue the flatwoods character far inland, while sandy knolls cap the crests of the ridges. The transition region thus formed I shall designate as the Flatwoods hills. This feature is especially developed in ranges 1 E. and 1 W., in La Fayette and Calhoun counties, where numerous strips and escalops on the heavy clay soils, with the timber growth of the flatwoods, extend westward into the hill country. North of the Tallahatchie river, in Tippah county, we also meet this feature more or less, the flatwoods belt itself, as previously stated, being there rather undulating. But inasmuch as the materials of the underlying strata are there largely sandy, the resulting soils are, as a rule, much less heavy than is the case farther south. Here, as we approach this region from the west, the change from the sandy soils of the pine hills is indicated in the shape and development of the post, Spanish, and scarlet oaks, previously referred to. These trees become lank and thin, with long branches forming open tops, and have whitish barks. The soil, instead of washing badly, as is the case elsewhere in the yellow-loam region, remains firm, and simply cracks open in summer, while in winter it forms redoubtable muddy hillsides, of bad repute with teamsters. Where the sandy strata overlying the clay are of some thickness springs usually flow from the upper surface of the latter, which can often be readily traced by the terraces running along the hillsides.

The soils formed from the heavy clays in these hills are, on the whole, safer in cultivation than those of the level flatwoods, being better drained; but they are not thrifty, and, unless well and deeply tilled, as a rule yield but poor returns. Hence here also it is the lower hillsides and bottoms of streams that are chiefly cultivated, and their soils being an intermixture of the two extremes they are mostly very productive.

In the portion of this region adjacent to the white-oak flatwoods the white oak is usually found on the hills also, and where this is the case the soil is less extreme in character, more tractable, and generally more productive. Such is the case in southeastern Calhoun and the adjacent portion of Sumner county.

Farther south the clay soils of the flatwoods hills are generally of a more reddish cast, less refractory in tillage, and more productive, as in Sumner and Choctaw counties, where they yield as much as 800 pounds of seed-cotton per acre and hold out remarkably well. In Winston county we find the "Noxubee hills", with their productive red clay soils, bordering the flatwoods on the west as far south as Winstonville. Beyond this point, in Noxubee and northern Kemper, very sandy ridges form the western limit of the flatwoods; but in eastern Kemper, on the Bodka, where the flatwoods terminate, we once more find "flatwoods hills" like those of La Fayette and Calhoun.

The following analyses of soils from this region indicate their general character:

No. 119. Soil from Sec. 25, T. 9, R. 1. W., just west of McLaurin's creek, La Fayette county. Timber, mainly post oak, with black-jack and pine, a few scattered Spanish, and sometimes a scarlet oak. Specimen taken to the depth of 6 inches; color, yellowish-buff, moderately heavy. Beneath, a very stiff, yellow or light orange tinted subsoil.

No. 374. Soil from upland near Benela, just south of the main Yalobusha, Sec. 27, T. 14, R. 1. W., Calhoun county. Timber, short-leaf pine, Spanish, black, and post oak, more or less hickory, and black gum. Trees mostly of good size, often bearing grape-vines. A fair upland soil, yielding from 700 to 800 pounds of seed-cotton per acre. Color, gray; depth, 6 to 8 inches; not heavy.

No. 367. Subsoil of the above, 8 to 18 inches. Color, dark orange; quite heavy in tillage.

No. 160. *Noxubee hills subsoil* from Sec. 7, T. 15, R. 13 E., Winston county. Timber, white and black oak and hickory; on lower hillsides, some tulip tree ("poplar", *Liriodendron*). The soil here is quite dark tinted, but is only a few inches deep. The subsoil analyzed was taken from 3 to 10 inches depth, and thus represents more nearly the arable soil, which is quite durable, and yields from 800 to 1,000 pounds of seed-cotton per acre when well cultivated. This is one of the "red lands" soils to be hereafter considered more in detail.

Lands of the flatwoods hills.

	LA FAYETTE COUNTY, M'LAURIN'S CREEK.	CALHOUN COUNTY, BENELA UPLANDS.		WINSTON COUNTY, NOXUBEE HILLS.
	Soil.	Soil.	Subsoil.	Subsoil.
	No. 119.	No. 374.	No. 367.	No. 160.
Insoluble matter	92.872	91.498	83.930	83.399
Soluble silica	1.632 } 94.504	1.722 } 93.220		2.609 } 86.008
Potash	0.152	0.137	0.355	0.198
Soda	0.058	0.054	0.087	0.068
Lime	0.144	0.173	0.167	0.082
Magnesia	0.130	0.203	0.502	0.218
Brown oxide of manganese	0.065	0.066	0.288	0.082
Peroxide of iron	1.631	1.372	4.618	3.570
Alumina	1.274	1.522	6.948	4.770
Phosphoric acid	0.040	0.088	0.080	0.271
Sulphuric acid	0.036			0.014
Water and organic matter	2.350	3.304	3.280	4.873
Total	100.384	100.229	100.255	100.154
Hygroscopic moisture absorbed at	2.71 16 C.°	3.36 11 C.°	7.72 11 C.°	10.88 17 C.°

It will be noted that, while the two soils agree very nearly in their composition, they differ widely from the two subsoils analyzed. As is in fact apparent from inspection, as well as from the statement made by those cultivating them, "the quality of their land depends more upon the subsoil than the surface soil." Deep tillage is therefore the first point indicated for profitable cultivation and improvement.

The soil from McLaurin's creek is manifestly the poorer, both in phosphoric acid and lime as well as in vegetable matter, and quite unretentive of moisture; hence subject to drought unless tillage reaches into the subsoil. The Benela soil and subsoil are twice as rich in phosphates, though even there the amount is not large, and will soon require to be supplied, while in the subsoil potash is quite abundant, though low in both surface soils. The superior fertility of the Noxubee hills subsoil is obviously due to the unusually large amount of phosphoric acid, which makes up for its deficiency in lime. The latter is comparatively abundant in the soils from La Fayette and Calhoun, but more would be beneficial, and can be added with advantage. Both subsoils have a high moisture coefficient, and thus resist drought: a property probably largely aided by the iron (ferric hydrate) with which they are tinted.

SHORT-LEAF PINE AND OAK UPLANDS.

The short-leaf pine (*Pinus mitis*) rarely occupies the ground exclusively within the state, as in Louisiana. It generally occurs intermixed to a greater or less degree with oaks, and its admixture to the oak growth is, as a rule, considered an indication of a poorer or at least a less durable soil than that which is timbered with the same oaks alone, unless, indeed, it be in the case of the sandy "black-jack ridges". The oaks usually accompanying it are the post and black-jack. Some small hickory and black gum is rarely wanting, and large chestnut trees occur scattered throughout even the poorest pine hills.

The pine is generally most abundant on the crests of the ridges, and is more and more displaced by the oaks as we descend from them. Concurrently, the scarlet and Spanish oak, and often the black oak, make their appearance, and finally prevail, with hickory in the smaller bottoms and lower slopes of the region. The latter form the bulk of the cultivated lands within the short-leaf pine districts. Where the latter border upon the oak uplands or table-lands the outposts of the pine may be seen afar in small groups, occupying high crests or knolls, usually rooted among piles of ferruginous sandstone, which caps the higher points almost throughout the hill region of northern and middle Mississippi.

Apart from such spots the soil occupied by the pine is mostly very light, often sandy, of a tawny tint, and underlaid at a few inches depth by a pale-yellow sandy subsoil. This may pass farther down into a pure sand, and then little can be done with the soil; or it may be underlaid by a sandy or more or less clayey loam or hard-pan, forming a good foundation capable of bearing any improvement. These variations, while of course more or less noticeable in the growth of the pine itself, are most strikingly indicated by the changes in the concomitant trees. Pine hill plateaus, with a vigorous growth of the tree, are often quite profitably cultivated for from four to eight years in corn and cotton, yielding from 500 to 800 pounds of the latter per acre, after which the land is usually "turned out" and a fresh tract cleared. The first, after three or four years' rest, may yield a few more crops, provided all its soil has not in the meantime been washed away or cut up by gullying, but after that manure alone will enable it to produce profitable crops. What effect the simple return of the cottonseed made from the outset would produce can only be conjectured as yet, as commercial fertilizers have probably never yet touched such lands within the state.

While, however, the lands of a large portion of the area shown on the map by the pale-red tint are of this character, and are in part so broken as to be unavailable for cultivation on that account, there are frequently interspersed upland tracts, more or less extensive, where the pine forms only a subordinate ingredient among the timber, and where the Spanish, post, scarlet, with some white or black oak, really form the characteristic growth, and for short distances the pine may be entirely absent. Such tracts occur especially on the headwaters of the Big Black and Yalobusha rivers, in southern Calhoun, in Sumner, and in Choctaw counties, and such lands, with thorough culture, will produce for eight to ten years from 800 to as much as 1,000 pounds of seed-cotton per acre. The creek bottoms in this region are wide and especially fine for cotton, and are generally very heavily timbered. Similar lands occur in the western portion of the area laid down, as well as in western La Fayette, southern Benton, eastern Tippah, and generally in the region lying east of the prairies in northeastern Mississippi. On the whole, however, it is a country of small farms, where corn, sweet potatoes, and cereals dispute the ground with cotton, and should probably over a large portion of the area replace it altogether. Where communications permit, sawing the pine into lumber forms a lucrative business.

The short-leaf pine country of southern Mississippi differs in some respects from that lying north of the "Central prairie region". Ridges timbered with short-leaf pine and oak occur interspersed more or less throughout the northern long-leaf pine region and form its best upland soils, and are usually the sites for villages. But it would be difficult to map them out in detail. A large continuous tract in eastern Rankin is, however, laid down on the map, and will be more specially mentioned hereafter.

In southwestern Mississippi there lies between the long-leaf pine region on the east and the "Cane hills" on the west a belt of hilly medium quality uplands bearing a mixed growth of oaks and short-leaf (with occasional strips of long-leaf) pine, and also interspersed with more or less extensive tracts, whose gently undulating surface and better soil have caused them to be taken into cultivation by preference, as in portions of Franklin and Claiborne counties. These lands will be again noticed in the description of the bordering regions.

SOILS OF THE SHORT-LEAF PINE AND OAK LANDS.—The following analyses of soils from the short-leaf pine and oak districts, though few in regard to the large surface to be covered, probably convey a pretty correct idea of this class of soils:

No. 142. *Oak upland soils* from Sec. 22, T. 20, R. 9 E. (about half-way between Bellefontaine and Greensboro'), Sumner county. Gently rolling; timber, almost exclusively Spanish oak (*Q. faloata*), with some post oak and hickory. Soil yellowish-buff, rather light; taken to 6 inches depth. Produces 700 to 900 pounds of seed-cotton per acre when fresh.

No. 145. Subsoil of the above, 6 to 15 inches depth; yellow, clayey.

No. 37. *Pine upland soil* from Marion, Lauderdale county. Surface somewhat hilly; timber, post oak, short-leaf pine, sturdy trees prevalent, intermixed with more or less hickory, Spanish, and some black oak and black gum. Soil down to 12 inches of a buff color, sandy, and easily tilled.

No. 118. Subsoil of the above. A yellow, sandy loam to 2 feet depth. This soil produces fairly from 600 to 700 pounds of seed-cotton per acre, and is interesting because the culture of the Catawba grape has succeeded well in the neighborhood, the soil having been worked to the depth of 2 feet.

No. 71. *Soil from "Hamburg hills"*, Sec. 11, T. 7, R. 1 E., 1 mile north of the town, Franklin county. From the level top of the ridge the country is somewhat broken. Timber, Spanish, black-jack, black and white oaks, hickory, magnolia, black gum, sweet gum, some short-leaf pine, and muscadine vines. Color, dun down to 7 inches; a medium light loam.

No. 73. Subsoil of the above, 7 to 20 inches depth, and apparently unchanged for 3 feet. This soil is said to be very durable, and when fresh produces from 700 to 900 pounds of seed-cotton per acre.

No. 108. *Upland soil* from Sec. 47, T. 13, R. 4 E. (Mr. J. F. Brock's land), near Rocky springs, Claiborne county. Ridgy upland near the western edge of the long-leaf pine region; timber, largely beech and large Spanish oak, also white and chestnut-white (or basket) oaks, much holly, small magnolias in heads of hollows, and some short-leaf pine. Soil, pale dun color, somewhat ashy down to 10 inches depth.

No. 112. Subsoil of the above, taken 10 to 18 inches deep. A moderately clayey loam, yellow to brownish, much heavier than the surface soil. The latter produces well only peanuts and sweet potatoes, and manure remains unaltered in it for a long time. It is evidently very unretentive.

Short-leaf pine and oak uplands.

	SUMNER COUNTY, NORTH OF GREENSBORO'.		LAUDERDALE COUNTY, MARION.		FRANKLIN COUNTY, HAMBURG HILLS.		CLAIBORNE COUNTY, BROCK'S PLANTATION.	
	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.
	No. 142.	No. 145.	No. 37.	No. 118.	No. 71.	No. 73.	No. 108.	No. 112.
Insoluble matter	90.226	76.325	93.702	83.212	88.750	74.894	78.902	78.804
Soluble silica	2.324 } 92.550	7.333 } 83.658	1.874 } 95.576	5.386 } 88.598	1.810 } 90.560	9.474 } 84.368	7.480 } 86.422	7.910 } 86.714
Potash	0.236	0.359	0.095	0.237	0.140	0.288	0.318	0.286
Soda	0.085	0.103	0.021	0.082	0.090	0.104	0.087	0.084
Lime	0.092	0.087	0.047	0.089	0.070	0.127	0.137	0.090
Magnesia	0.196	0.381	0.115	0.237	0.185	0.599	0.600	0.402
Brown oxide of manganese	0.072	0.071	0.021	0.037	0.075	0.144	0.072	0.022
Peroxide of iron	1.839	5.151	0.966	3.330	2.405	5.672	4.070	4.013
Alumina	1.866	7.073	1.031	4.337	2.098	6.106	5.061	5.377
Phosphoric acid	0.091	0.070	0.019	0.061	0.077	0.050	0.025	0.042
Sulphuric acid	0.007	0.008	0.005	0.007	0.005	0.006	0.007	0.056
Water and organic matter	2.834	3.321	1.651	2.728	4.310	2.699	2.477	2.767
Total	99.868	100.282	99.547	99.743	100.015	100.163	100.176	100.543
Hygroscopic moisture absorbed at	3.57 11 C.°	8.59 11 C.°	1.56 16 C.°	5.81 16 C.°	4.40 22 C.°	8.81 22 C.°	3.04 18 C.°	7.61 18 C.°

The soil from Sumner county is probably a fair representative of the best class of upland soils occurring within the short-leaf pine region of northern Mississippi, forming tracts a few miles in extent where the pine is scarce or entirely absent. It is to be regretted that we have no analyses of some pine soil of the same region, but on comparison with the poorer (though by no means the poorest) soil from Marion we find a wide difference between them as regards potash, lime, and phosphoric acid, in all of which the Marion soil is several times poorer. But the subsoils are not unlike in the two localities, though a slight advantage still remains with the Sumner subsoil. The Hamburg hills soil stands intermediate between the two former in regard to the main points, potash and phosphates, but is somewhat richer in lime, and hence is more thrifty. Brock's soil shows a considerable amount of potash, but is, on the other hand, so poor in phosphates and so unretentive of moisture that the faults complained of in regard to it are at once explained. A dressing of bone-meal and green manuring are the improvements indicated in this case.

Throughout the whole set we find that the percentage of phosphoric acid is low, the highest being 0.091, the lowest 0.019 in the soils. The average in the soils is 0.053; in the subsoils, 0.056. There can thus be little doubt that phosphatic fertilizers will be found most efficacious in sustaining their productiveness, and that deep tillage, increasing the retentiveness of the soil and its supply of potash, will be serviceable in all cases where the subsoil is not sandy. The use of lime or marl also would seem to be specially called for in order to render active, and thus available for crops, such supply of plant-food as the soil contains.

THE RED LANDS.

Interspersed among the pine lands of central Mississippi, in Attala, Winston, Leake, Neshoba, and part of Kemper and Newton counties, there occur limited areas of generally clayey land, whose deep orange tint stands in strong contrast to the peculiarly pale yellow of the prevailing pine-woods soils. The origin of these red lands is best observed in northwestern Attala, where regular strata of similar material crop out on the banks of the Big Black river and its tributaries. There, as well as in the adjacent portion of Holmes county, the orange-colored clay and sand not unfrequently contain abundant grains of greensand, so that in places a greensand fertilizer of great value can be obtained. It is doubtless this circumstance that in a large degree gives rise to the lasting fertility of these soils, which is keenly appreciated by the inhabitants throughout their region of occurrence. From the fact that the red-clay stratum is neither very thick nor always continuous, it will be readily inferred that in a hilly country it must appear sporadically in limited patches along hillsides or forming the tops of ridges or a terrace along streams, according to the level at which it may accidentally appear on the surface.

The two largest bodies of these red lands occur, respectively, in northwestern Attala, on Zilfa and Poukta creeks, and in northeastern Winston, where they form the "Noxubee hills", already referred to in connection with the "Flatwoods hills". The two bodies are connected by numerous patches lying between and not easy to map out; the characteristic features of the soil are best developed in Attala. The country occupied by it is always broken (as is the case with the red lands of Louisiana), and the creek bottoms are very narrow, but extremely fertile, and bear a very heavy growth of timber. On the hills also the timber is unusually large, and consists of white, post, and black oak, hickory, tulip tree ("poplar"), and sometimes sweet gum, always with an admixture of short-leaf pine. Sometimes the light pine-woods soil overlies the red soil for a few inches, but where the latter alone prevails there seems to be little difference between soil and subsoil, all being of a deep orange tint and quite heavy. It is not, however, very difficult to till when taken at the right time. Where instead of the clay the similarly-colored sandy strata come to the surface the soil is often scarcely distinguishable from that of the ordinary pine woods save by its timber growth. Such is largely the case in the country lying between Zilfa creek and the Big Black river.

The Noxubee hills, on the southern heads of the Noxubee river, in Winston county, greatly resemble in general character and timber growth the country on the Poukta—the surface broken, bottoms of the streams narrow but fertile, the country well settled with small farms; and the soil with very imperfect tillage produces from 800 to 1,000 pounds of seed-cotton per acre and is very durable, in strong contrast to the pale and sandy pine-woods soil, which produces from 400 to 600 pounds for a few years and is then exhausted.

The following analyses exhibit the composition of some of these soils. One of them (No. 141) has already been mentioned in connection with the prairie soils, to which it evidently bears a close relation on one hand, while on the other it manifestly, from its nature, position, and behavior in cultivation, belongs to the class of "red lands".

No. 246. *Red hills soil* from Sec. 4, T. 14, R. 7 E., about 3 miles north of Kosciusko, Attala county, from the brow of a hill, and not the best of its kind. Timber, white, post, black, and Spanish oaks, hickory, and some short-leaf pine. A deep orange, rather heavy clay, gritty with sharp sand grains, taken to 12 inches depth; no perceptible difference between surface soil and subsoil.

No. 141. *Red ridge soil* from Sec. 12, T. 12, R. 18 E., Kemper county. (See "Northeastern prairie region".)

No. 160. *Noxubee hills subsoil*, Sec. 7, T. 15, R. 13 E., Winston county. (See "Northeastern prairie region".) This soil likewise does not represent the best of its kind.

Red lands.

	ATTALA COUNTY, NORTH OF KOSCIUSKO.	KEMPER COUNTY, PETTUS' PLANTATION.	WINSTON COUNTY, NOXUBEE HILLS.	CARROLL COUNTY, VAIDEN GREENSANDS.	
	Soil.	Soil.	Subsoil.	Sandy.	Clayey.
	No. 246.	No. 141.	No. 160.	No. 265.	No. 268.
Insoluble matter	61.971	54.565	83.399	55.705	78.972
Soluble silica		13.219 = 67.784	2.609 = 86.008		
Potash	0.725	0.431	0.198	1.604	0.945
Soda	0.297	0.277	0.068	0.045	0.401
Lime	0.820	0.540	0.082	0.166	0.144
Magnesia	1.468	0.836	0.218	1.630	1.129
Brown oxide of manganese	0.120	0.079	0.082	.....	0.177
Peroxide of iron	10.500	7.089	3.570	34.347	9.435
Alumina	17.500	16.071	4.770		4.449
Phosphoric acid	0.018	0.187	0.271	trace.	trace.
Sulphuric acid	.....	0.009	0.014	0.129	0.001
Water and organic matter	6.580	6.922	4.873	7.012	4.790
Total	100.003	100.225	100.154	100.638	100.443
Humus	.....	0.781	.....	.....	.....
Available inorganic	.....	3.256	.....	.....	.....
Hygroscopic moisture	18.59	13.07	10.88	.....	.....
absorbed at	8 C.°	11 C.°	17 C.°	.....	.....

A mechanical analysis of the Attala red hills soil, No. 246, resulted as follows:

Attala county red hills soil.

	Subsoil.
	No. 246.
MECHANICAL ANALYSIS.	
Weight of gravel over 1.2mm diameter	
Weight of gravel between 1.2 and 1mm Weight of gravel between 1 and 0.6mm	2.0
Fine earth	98.0
Total	100.0
MECHANICAL ANALYSIS OF FINE EARTH.	
Clay	41.2
Sediment of < 0.25mm hydraulic value	25.8
Sediment of 0.25mm	13.6
Sediment of 0.5mm	2.8
Sediment of 1.0mm	3.7
Sediment of 2.0mm	1.8
Sediment of 4.0mm	1.3
Sediment of 8.0mm	0.7
Sediment of 16.0mm	2.1
Sediment of 32.0mm	2.4
Sediment of 64.0mm	0.7
Total	96.1

The apparent excessive amount of clay in this soil, as shown above, is, in part, to be charged to the large percentage of iron (ferric oxide) contained in it, and nearly all of which in this case accumulates in the finest portion of the soil. The ferric oxide in the entire soil amounts to 10.5 per cent., and probably at least 9 per cent. of that amount is included in the 41.2 per cent. of "clay", of which, therefore, only about 32 per cent. should be counted, adding the 9 per cent. to the finest sediment. This brings the red soil nearly to the same composition as the Monroe prairie subsoil, with which it has many points in common.

The Attala soil, by its unusually large percentage of alkalies, shows the presence of small grains of greensand. Its lime percentage is nearly as high as that of some prairie soils; its iron and alumina extraordinarily high; and the former is so finely diffused and so highly colored as to impart to the soil a very unusual character, especially as to its hygroscopic power, which is greater than that of any soil that has come under my observation, save only peat soils. The extremely low percentage of phosphoric acid is very unexpected, and I am inclined to believe it incorrect, both on account of its actual fertility and of the high percentage of the other soils of the same class. In more than one respect this peculiar soil deserves farther investigation.

Except as to phosphates, the characters of No. 141 are similar, but less pronounced.

Apart from its large amount of phosphates there is little to distinguish the Noxubee hills soil from other clay loam soils, and its heaviness is rather surprising, as is its deep tint, with an iron percentage no greater than is found in common yellow loams.

As an example of the materials from which these soils are mainly formed, I give the analysis of a coarse, sandy mass, bearing abundant greensand grains, which occurs in the railroad cut near Vaiden station, Carroll county, and has been used with advantage on other soils; also that of a stiff, gritty clay occurring near the same place and on the banks of the Big Black river opposite, forming strata of considerable thickness. Extensive deposits of these materials exist, especially in northeastern Attala, and will doubtless in the future be utilized as fertilizers.

The striking scarcity of phosphates in these materials may explain sufficiently the corresponding feature in the soil more or less directly derived from them. In all other respects the Attala red lands soil are so promising that beyond a doubt the use of phosphatic fertilizers on them would be followed by a greatly increased productiveness.

THE SANDY OAK UPLANDS.

These are ridgy lands, often intervening between the short-leaf pine country and the "table-lands" proper, or extending in ridges into them or into the prairie region of central Mississippi. They differ from the pine country in the absence of the pine and in the alternation of often sharp and sandy ridges, with broader and lower ones covered with a loam stratum resembling that of the table-lands, but more sandy, and, in most cases, inferior to them in fertility. These bear a fair growth of upland oaks, among which the Spanish oak (*Q. falcata*, "red" oak of the natives) is perhaps the most prominent, mingled more or less with black, scarlet, and post oak, and, as the soil grows sandier, with the black-jack. On the sandy ridges the latter reigns supreme, low trees, with a few long, crooked, and spreading branches, forming an open, "sprangling," tattered top, and is accompanied by huckleberry bushes. Tall, compact-topped, black-jack trees, on the contrary, denote the best class of upland soils in this region.

the soil being in that case somewhat heavier than that occupied by the other oaks mentioned. Hickory is also a common ingredient of the timber of the better class of soils, sometimes forming extensive "hickory hummock" tracts of excellent soil.

This description applies more especially to the eastern border of the table-lands of northern Mississippi, and is most extensively developed in Marshall and La Fayette counties, as shown on the map by a light-yellow color. It would scarcely be possible, or even useful, to map out in detail elsewhere this transition phase between the short-leaf pine hills and table-lands bordering the Mississippi bottom.

The subjoined analyses afford an insight into the nature of the soils of this region:

No. 228. *Oak uplands soil* from southeast ¼ T. 7, R. 3 W. (Alex. Pegues' place), La Fayette county. Face of country, rolling; timber, Spanish, black, some black-jack and post oak, and hickory; large and compact trees. Soil, dun color, light, 5 inches deep, and liable to damage by washing. Cotton product, 800 to 1,000 pounds per acre when land is fresh.

No. 221. Subsoil of above. Brownish-yellow, heavier than surface soil, taken to 18 inches depth. Total thickness, 4 to 7 feet to hard-pan or sand.

No. 345. *Black-jack ridge soil* from ridge one-half mile west of the campus of the University of Mississippi, Oxford, La Fayette county. Country somewhat broken; timber on ridge, small black-jack oaks, huckleberry bushes. Taken to the depth of 6 inches a pale-dun tint, and quite light and sandy.

Sandy oak uplands of La Fayette county.

	OAK UPLANDS.		BLACK-JACK RIDGE.
	Soil.	Subsoil.	Soil.
	No. 228.	No. 221.	No. 345.
Insoluble matter	90.150		
Soluble silica	1.636	91.786	88.677	97.092
Potash	0.119	0.364	0.073
Soda	0.119	0.135	0.020
Lime	0.147	0.358	0.142
Magnesia	0.533	0.272	0.100
Brown oxide of manganese	0.120	0.450	
Peroxide of iron	2.532	2.423	0.907
Alumina	2.652	4.526	0.640
Phosphoric acid	0.154	0.045	
Sulphuric acid	0.007	0.069	0.002
Water and organic matter	2.217	3.407	0.911
Total	100.302	100.726	99.887
Hygroscopic moisture	4.69	4.68	1.89
absorbed at	11 C.°	10 C.°	14 C.°

A comparison of the soil and subsoil Nos. 220 and 221 with those from Sumner county (Nos. 142 and 145) shows that they differ in the main as to their lime percentage, which is considerably greater in both of the La Fayette soils; hence the absence of pine. The subsoils are alike as to potash. The distribution of the phosphates is also alike, and averages about the same amount in both, while in neither is it very large, and will therefore soon require replacement.

The Black-jack ridge soil is wretchedly poor in every ingredient except lime, of which it has still a better supply than the average pine-woods soils; but its potash and phosphates are very deficient, and it is droughty beside, even more so than the pine soil.

As compared with the adjacent brown-loam table-lands, the sandy oak uplands differ in that their subsoils are generally inclined to be sandy instead of heavier than the surface soils, and also poorer in phosphates. Hence, although deep tillage is desirable, it will not be as much of an improvement as in the case of the table-lands, nor are the soils as durable under exhaustive cultivation.

THE BROWN-LOAM TABLE-LANDS.

This rolling or gently undulating upland region, producing a large proportion (about 30 per cent.) of the best upland cotton grown in the state of Mississippi, forms a belt running more or less parallel to the "bluff" of the Mississippi bottom, which bounds it on the west, while on the east it is bordered by the pine and oak uplands previously described. In western Tennessee, and down to the latitude of Ashland, about 12 miles south of the state line of Mississippi, its width east and west is from 60 to 65 miles; but it thence rapidly contracts to about 20 miles near Panola, and maintains about that width for a hundred miles to the southward (to the line of Yazoo county), where it again widens to about 40 miles, so as to reach Pearl river in the counties of Madison and Hinds, about 50 miles southward. Here it abuts against the pine hills of Copiah, while its most westerly portion,

modified by the "bluff or loess" formation which here underlies it, continues skirting the Mississippi bluff, with a width varying from 15 to 6 miles, to the Louisiana line. Its total area thus outlined is about 5,800 square miles; but the broken country lying along the river bluff from Yazoo city southward will be separately described under the designation of "the Cane hills", embracing about 1,800 square miles of the above area.

Excluding these from consideration, the character of the main body may be thus summed up:

The soil-forming material is a stratum of brown or yellowish-brown loam, usually from 6 to 8 feet thick, but sometimes as much as 20 feet or as little as 3 feet. It is commonly underlaid by sand of various colors, from white to red, more or less cemented, and sometimes entirely loose, belonging to the stratified "Drift" formation. The timber consists essentially of oaks and hickories. Of the former, the post oak is perhaps the tree most universally present. On the heavier soils it is largely accompanied by the black-jack oak (*Q. ferruginea*); on the lighter more prevalently by Spanish and black oak (*Q. falcata* and *Q. tinctoria*). The sturdy and vigorous growth of the post oak and the corresponding forms of the other trees, denoting a soil of great fertility, are very strikingly developed here. Near the eastern border of the region, often not very well defined, we often find sandy ridges extending in from the adjacent hilly lands or forming isolated outliers, whether of oak alone or mingled with short-leaved pine. From the country of the latter character the transition to the table-lands proper is generally quite sudden, while that to the sandy oak hills is often quite insensible, as in northwestern La Fayette. On the western border the gradual admixture of tulip tree ("poplar", *Liriodendron*), sweet gum, and sometimes ash and sassafras with the other timber forms a transition to the lands of the immediate Mississippi bluff. Originally all this region had the appearance of a natural park, being an open forest with little undergrowth, but waving with long grass and brilliant flowers. The ranging of cattle and the indiscriminate and injudicious firing of the dry leaves and grass have sadly changed the aspect even of such tracts as have remained uncultivated, the washing away of the surface soil and the formation of deep gullies having frequently not only rendered the fair face of the country unsightly, but also seriously impaired its agricultural value. Elsewhere the open woods have to a great extent been marred by the springing up of a thick undergrowth of young saplings, which of yore were kept down in favor of the grass pasture by the regular and judiciously-timed burning practiced by the Indians.

The surface soil as at present existing is not generally rich in vegetable matter, and often differs but little in aspect from the subsoil found at a depth of 2 or 3 feet; yet usually the surface layer to the depth of 10 or 12 inches is darker and more mellow in cultivation than the deeper layers, having at least a shade of "mulatto" tint added to the reddish brown of the subsoil. The latter is mostly a "clay loam", with a tendency to increasing heaviness as we approach the edge of the "bottom" and the reverse as we near its eastern border.

The following analyses of soils and subsoils from different portions of the table-land region illustrate their composition, although they leave unrepresented the large counties from Marshall and De Soto to Carroll. The specimens analyzed, however, agree so nearly in regard to the main points that it is fair to presume that the part of the region lying intermediate between them would not differ materially from them as to their general nature:

No. 216. *Soil from the table-lands* on the divide between Coldwater and Wolf rivers, near Lamar, Benton county, Sec. 30, T. 2, R. 1 W. (Clayton's plantation), from a level tract below the summit ridge. Timber, black-jack, post oak, and hickory, with some sweet gum and a few Spanish oaks (*Q. falcata*); all large and well-formed compact-topped trees. Depth taken, 10 inches; quite mellow, and of a "mulatto" tint.

No. 235. Subsoil of the above; depth, 10 to 20 inches—a pretty solid, brownish loam, heavier than the soil.

No. 219. Subsoil from same section of land, but taken on the summit ridge itself. Same depth as last, and altogether resembling it.

No. 53. *Soil of loam uplands* from near Richland, Holmes county, Sec. 23, T. 13, R. 5 E. (Mr. Elias Taylor's land). Gently rolling surface; timber, post and Spanish oak, large, and ground covered with fine grass. Taken 8 inches deep. When fresh yields 1,200 pounds of seed-cotton per acre; after 10 years, still 750 pounds.

No. 56. Subsoil of above, but taken in a gully some distance off, at the depth of 3 feet, the loam appearing perfectly uniform for from 6 to 15 feet, and sometimes more.

No. 55. *Cultivated soil* from same locality, taken to 6 inches depth. Has been cultivated exhaustively, all but one year of fallow, for twenty-one years in corn and cotton. Yields about 500 pounds of seed-cotton per acre.

No. 298. *Loam upland subsoil* from Dr. T. J. Catchings' place, Sec. 2, T. 4, R. 3 W., Hinds county. Gently undulating; timber, black-jack, post, and Spanish oaks, all large and sturdy, with well-formed tops; some tall hickory; undergrowth of dogwood and persimmon. Depth taken, 9 to 20 inches. A light porous loam, easily tilled; color, brownish yellow. Seed-cotton product, about 1,200 pounds per acre when fresh.

No. 348. *Loam upland soil* from H. O. Dixon's place, Sec. 26, T. 6, R. 1 W. (about half way between Clinton and Jackson), Hinds county. Gently undulating; timber, Spanish, post, and black-jack oaks, hickory, some walnut and mulberry. Depth taken, 8 inches; easily tilled, pervious enough for drainage. Yields from 1,000 to 1,500 pounds of seed-cotton per acre; after eight years' culture, 600 to 1,000.

No. 349. Subsoil of the above taken 8 to 20 inches deep. Color, yellow to red; heavier than the surface soil,

No. 232. *Brown loam upland soil* from James Watson's place, 5½ miles northeast of Port Gibson, Claiborne county. This is in the "Cane hills" region, as previously stated, and is a continuation of the loam stratum of the table-lands, but is modified by the underlying formation. Face of the country, hilly; specimen taken from level summit of

ridge; timber, white, chestnut white, black and some Spanish oaks, beech, hickory, sweet and black gum, linden, sassafras, elm, some magnolia. Soil taken to 8 inches depth; rather light, of a buff tint; fine.

No. 233. Subsoil of the above. Depth taken, 8 to 20 inches. A yellowish-brown loam, much heavier than the surface soil.

Brown-loam table-lands.

	Benton county.			Holmes county.			Hinds county.			Claiborne county.	
	Table-lands.			Richland.		Upland.	Upland loam.	Upland.		Upland loam.	
				Virgin.		Cultivated.					
	Soil.	Subsoil.	Ridge subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.
	No. 216.	No. 235.	No. 219.	No. 53.	No. 56.	No. 55.	No. 298.	No. 348.	No. 349.	No. 232.	No. 233.
Insoluble matter	83.347	83.993	{70.530 / 12.300} 82.830	89.609	85.462	92.254 / 1.891 94.145	80.788	82.198 / 0.548 92.746	74.179 / 10.617 84.796	87.573	79.477
Soluble silica											
Potash	0.549	0.700	0.630	0.304	0.702	0.129	0.634	0.417	0.519	0.458	0.741
Soda	0.082	0.041	0.090	0.054	0.175	0.043	0.185	0.042	0.131	0.124	0.248
Lime	0.245	0.139	0.270	0.250	0.392	0.159	0.266	0.156	0.204	0.244	0.238
Magnesia	0.479	0.597	0.450	0.307	0.756	0.251	1.029	0.140	0.626	0.545	0.830
Br. oxide of manganese	0.760	0.332	0.060	0.374	0.256	0.141	0.159	0.087	0.039	0.205	0.346
Peroxide of iron	4.798	3.862	5.110	2.136	4.237	1.627	4.927	1.393	4.100	3.231	5.635
Alumina	6.282	7.729	8.090	3.554	5.787	1.703	8.940	3.157	6.747	4.842	8.849
Phosphoric acid	0.068	0.236	0.210	0.074	0.037	0.071	0.151	0.038	0.050	0.105	0.092
Sulphuric acid	0.062	0.054	0.020	0.018	0.049	0.012	0.076	0 019	0.029	0.028	trace.
Water and organic matter	4.195	2.716	3.140	3.557	2.245	2.019	3.239	2.364	3.039	3.073	3.496
Total	100.867	100.399	100.900	100.237	100.098	100.300	100.394	100.559	100.280	100.428	99.952
Humus	0.787									0.718	
Available inorganic	0.668									0.718	
Hygroscopic moisture	6.84	7.42		4.70	5.84	2.43	8.54	4.26	7.23	5.18	9.09
absorbed at	17 C.°	17 C.°		17 C.°	9 C.°	11 C.°	17 C.°	9 C.°	10 C.°	21 C.°	8 C.°

The following are the mechanical analyses of soils from the oak uplands region thus far made. No. 397 is from the portion of the "sandy oak uplands" lying nearest the table-land area, while No. 219 is representative of the table-lands of Marshall and Benton counties. See the descriptive notes preceding the table.

	La Fayette county.	Benton county.
	Upland subsoil.	Table-land subsoil.
	No. 397.	No. 219.
Mechanical analysis.		
Weight of gravel over 1.2mm diameter		
Weight of gravel between 1.2 and 1mm		0.2
Weight of gravel between 1 and 0.6mm		
Fine earth	100.0	99.8
Total	100.0	100.0
Mechanical analysis of fine earth.		
Clay	17.2	19.2
Sediment of <0.25mm hydraulic value	18.9	26.7
Sediment of 0.25mm	27.3	15.1
Sediment of 0.5mm	16.6	13.1
Sediment of 1.0mm	13.1	7.3
Sediment of 2.0mm	3.6	2.8
Sediment of 4.0mm	0.8	0.8
Sediment of 8.0mm	0.2	0.8
Sediment of 16.0mm	0.8	1.2
Sediment of 32.0mm		2.3
Sediment of 64.0mm		1.5
Total	98.5	97.8

These analyses place both subsoils into the heavier class of loams, while the surface soils of both are considerably lighter. Both soils and subsoils have, when exposed to rain and followed by sunshine, the disagreeable peculiarity of forming a hard surface crust, which should be broken whenever formed, as it is a serious hinderance to the success of crops in critical seasons.

The common chemical characteristics of these soils, and especially of their subsoils, are high percentages of potash and lime, with usually a large supply of phosphoric acid in the subsoil, at least of the heavier lands; while in the case of the lighter soils, such as that of the Richland neighborhood, as well as in that from southern Hinds, the phosphates are rather low, even deficient in the latter case. The great depth and perviousness of the arable layer in these cases makes up for the smaller proportion of phosphates, but there can be no doubt that the want of these will be the first felt when the soil becomes "tired", and that supplying them will greatly increase the crops, as has in fact already been demonstrated in many cases. Potash is not likely to become deficient in the subsoils at least; but the supply of humus is not large (as is evident from inspection), and green manuring is one of the most important improvements indicated. Originally this was not the case, for the surface soils were, and in protected spots still are, dark-colored to almost black when wet; but the washing away of the surface and the burning of the woods have served to deplete the surface of this and other important ingredients, so that over a large portion of the region it is the subsoil, and not the surface soil, as given in the analysis, that the farmer has to deal with. In this case the addition of vegetable matter is, of course, doubly important, and green manuring of denuded tracts with cow-pease is one of the most convenient, as it has proved to be one of the best, means of improvement. The analyses show that so long as the subsoil remains the question of restoration of a "tired" soil is simply one of time and judicious management. But unfortunately there has been a great deal of almost irretrievable damage done to these lands by allowing them to be washed and finally gullied by the rains, the water ultimately cutting into the underlying sand, and thereafter undermining the soil stratum and converting the hill lands into unavailable sand-hills, while the valleys also have been filled up with a mixture of sand and soil, the former usually predominating, rendering them almost as unavailable for cultivation as the hills. Considering that these lands are doubly valuable from being naturally underdrained by the underlying sand and gravel, this dilapidation is doubly to be deplored. In the eastern portion of the table-land belt, especially in the counties of Benton, Marshall, western La Fayette, and southward, where the surface is somewhat rolling, the amount of injury thus done is of wide extent, and, when once begun, difficult to check. It usually originates in the practice of plowing up and down hill instead of horizontally, the plowing being very shallow at that. Deep tillage and "horizontalizing" of the hillsides are therefore the first and most indispensable measures to be taken against this evil. It is of little avail to manure the soil so long as its best portion is allowed to wash away. The unsightly red-scarred slopes, so lamentably abundant along the line of the Central railroad, can with proper management be mostly restored to productiveness; but every year the evil increases in a geometrical ratio, and if unchecked must result in the serious and permanent injury to the agricultural interests of one of the fairest and naturally most highly favored portions of the state.

BOTTOM SOILS OF THE YELLOW-LOAM REGION.—The bottom soils of the yellow-loam region are quite variable, according to the location and size of the water-courses and the direction in which they flow. The bottom soils of the smaller streams heading and emptying within the region are usually quite light, and sometimes even very sandy where ravines have been cut into the drift sands, in consequence of neglect of old fields. The same is generally true of streams flowing nearly north and south, while those having (as is mostly the case) a southwesterly course, and heading in the clay hills bordering the flatwoods on the west or in the flatwoods themselves, have heavy bottom soils, at least in the upper part of their course. Such is the case especially with the Loosha-Scoona and Yockeney-Patafa, and to a greater or less degree also with the Tallahatchie and Yalobusha rivers, while the Big Black and Pearl, whose heads remain almost entirely west of the flatwoods territory, have almost throughout light bottom soils.

The second bottoms, or "hummocks", usually elevated from 2 to as much as 5 feet above the first bottom and seldom reached by high water now, are almost throughout lighter than the corresponding first-bottom soils, and are, on the whole, considered to be less durable. They are frequently "white" or light-gray silts, with a subsoil of similar character, and usually contain more or less bog-ore spots or grains, proving that at some time they were subject to long-continued submergence or at least to drenching with water.

The following analyses, though not as numerous as could be desired for the representation of all the different classes of bottom and "hummock" soils in the region, will convey some general idea of their character:

No. 365. *Soil of the first bottom of the Tallahatchie river*, taken near the town of Panola, R. 7 W., T. 9, Sec. 6, Panola county. This is just at the point where the river bottom begins to widen out preparatory to entering the great Yazoo bottom plain. It is very heavily timbered, and is traversed by numerous cypress sloughs. The prominent trees are sweet gum, tulip tree (very large), hickories, ash, chestnut-white and water oaks, walnut, much holly, hornbeam, etc. The soil is dark-colored, rather light, and the same to the depth of 18 inches or more. Depth of the sample taken, 12 inches. A highly productive soil, but subject to annual overflows.

No. 369. *Soil of the bottom of the Loosha-Scoona river*, R. 1 W., T. 14, Sec. 4, on the Pittsborough and Sarepta road, Calhoun county. The timber is beech, sweet and black gum, ash, chestnut-white and water oaks, shellbark and other bottom hickories, hornbeam, elm, maple, holly, and box elder. Trees mostly tall and vigorous. The soil is remarkably shallow for a bottom soil, being only about 6 inches deep, and when dry does not appear to be very heavy, though when wet it forms extremely tough mud, and is heavy in tillage. The subsoil is gray, with brown dots when wet, very pale gray when dry, and pulverizes readily on exposure to the weather. Being annually overflowed until late in the season, it has hardly as yet been tried in cultivation.

No. 370. Subsoil of the above, taken 6 to 18 inches deep. Somewhat heavier than the surface soil.

No. 180. *Soil from the bottom of Potlockney creek*, R. 2 W., T. 10, Sec. 10, La Fayette county. Very heavily timbered, so as to render clearing very costly. Beech very prevalent on the higher "ridges", less so in the lower ground; white oak very prevalent; also chestnut-white oak, sweet gum, tulip tree or poplar, shellbark hickory, black gum, holly, ironwood, cucumber tree (*Magnolia acuminata*), snowdrop tree (*Halesia tetraptera*), dogwood, red-bud, ash, and maple. The soil is a fine-grained loam of a mouse color to the depth of about 15 inches; tills like putty when too wet, which is apt to be the case pretty late in spring, but is very productive in good seasons.

No. 299. Subsoil of the above, 12 to 20 inches in depth. Pale yellow, fine, sandy, disposed to be wet, putty-like. In low places becomes pale-bluish, and full of bog-ore spots.

No. 135. *Soil from the bottom of Besachitto creek*, R. 10 E., T. 19, Sec. 11, Choctaw county. Timber, beech, ash, shellbark hickory, and others, chestnut-white, water and willow, and bottom scarlet oaks (*Q. coccinea*), sweet gum, tulip tree, ironwood, holly; timber mostly large. Soil, a light loam, blackish, color nearly the same for 2 feet, when it becomes heavier and of a paler tint. Very productive. This may be considered as a type of good bottom soils of the smaller streams in the yellow-loam region.

On the Big Black river and its tributaries the hummock or second bottom lands are usually quite extensive, and lie conveniently for cultivation. The following analyses convey a general view of their composition:

No. 156. *Hummock soil* from the second bottom of the Big Black river at the crossing of the Greensborough and Bankston road, R. 9 E., T. 19, Sec. 33, Sumner county. A mellow, chocolate-colored soil, occupying a bench only 3 to 4 feet above the first bottom, about 1 mile wide, and well settled here. Sample taken to the depth of 12 inches. Timber, beech, hickory, elm, ash, ironwood, red-bud, etc. The first bottom here is so much subject to overflow as to have hardly been tried, but the soil resembles that of the hummock.

No. 58. *Hummock soil* from the flat bordering the Big Black river on the Benton-Canton road on the south side for several miles width. A light gray, sometimes white, powdery soil, taken to the depth of 6 inches; timber, a rather undersized growth of post, willow, and some black-jack oaks of the low, spreading type. The land is not very productive, and is liable to injury from drought, but is nevertheless largely in cultivation.

No. 57. Subsoil of the above taken from 6 to 12 inches depth. Nearly of the same tint as the subsoil, but somewhat stiffer, putty-like when wet, and with occasional spots of bog ore, indicating lack of drainage. Lower down the subsoil becomes somewhat darker and stiffer, and is full of bog-ore gravel.

No. 48. *Hummock soil* from the flat intervening between the uplands and the bottom of the Big Black river near Vaiden station, R. 6 E., T. 17, Sec. 17, Carroll county. A light, silty soil, of a dark-gray tint for about 12 inches depth. It is mainly treeless, but has occasional clumps of moderate-sized post oaks, and occasionally some small sweet gum. This soil when fresh produces good Irish potatoes and cereals (small grain), but is not suited to corn or cotton; is somewhat liable to injury from drought.

No. 52. Subsoil of the above, a fine, slightly clayey sand of a pale-yellow tint, very pervious. Seems to continue with little change to a depth of about 15 feet, where water is found in wells.

No. 50. *Yockanookana hummock soil*, from the lower slope of the uplands toward the Yockanookana river, R. 6 E., T. 12, Sec. 13 (John T. Donald's land), Leake county. Soil apparently the same to the depth of 18 inches; sample taken to the depth of 12 inches. It is gray, ashy, full of bog-ore spots; well timbered with mockernut hickory, white, black, scarlet, and Spanish oaks, elm, beech, and bottom pine, all moderately-sized trees. The soil produces fairly well.

Bottom lands of the Yellow-loam region.

	Panola county (R. 7 W., T. 9, S. 6).	Calhoun county (R. 1 W., T. 14, S. 4).		La Fayette county (R. 2 W., T. 10, S. 10).		Choctaw county (R. 10 E., T. 19, S. 11).
	Tallahatchie.	Loosha-scoona bottom.		Potlockney bottom.		Besachitto bottom.
	Bottom soil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.
	No. 365.	No. 369.	No. 370.	No. 180.	No. 299.	No. 135.
Insoluble matter	81.506	77.539	81.920	87.880	88.472	88.154
Soluble silica	5.094 } 86.600	7.327 } 84.866	7.228 } 90.148	1.490 } 89.370	2.168 } 90.640	2.630 } 90.784
Potash	0.788	0.494	0.292	0.180	0.292	0.228
Soda	0.234	0.410	0.165	0.099	0.083	0.038
Lime	0.265	0.235	0.122	0.156	0.089	0.076
Magnesia	0.328	0.442	0.306	0.277	0.394	0.237
Brown oxide of manganese	0.113	0.088	0.108	0.284	0.108	0.142
Peroxide of iron	2.575	2.057	2.579	2.725	2.936	1.871
Alumina	6.087	3.856	5.085	2.702	3.115	2.968
Phosphoric acid	0.125	0.178	0.055	0.115	0.075	0.083
Sulphuric acid	0.035	0.004	0.005	0.014	0.006	0.009
Water and organic matter	3.601	7.839	2.349	4.446	2.686	3.639
Total	100.751	100.499	100.214	100.38	100.424	100.075
Hygroscopic moisture absorbed at	6.12 11 C.°	6.61 15 C.°	5.58 18 C.°	6.81 11 C.°	6.69 11 C.°	5.52 13 C.°

Bottom lands of the Yellow-loam region—Continued.

	Sumner county (R. 9 E., T. 19, S. 32).	Madison county (R. 11 E., T. 10, S. 24).		Carroll county (R. 6 E., T. 17, S. 17).		Leake county. (R. 6 E., T. 12, S. 13).
	Big Black Hummock.	Big Black Hummock.		Post-oak Hummock.		Yockanookana Hummock.
	Soil.	Soil.	Subsoil.	Soil.	Subsoil.	Soil.
	No. 156.	No. 58.	No. 57.	No. 48.	No. 52.	No. 50.
Insoluble matter	85.692	90.847	88.342	89.391	86.080	93.223
Soluble silica	3.642 } 89.334		4.984 } 93.326		4.150 } 90.230	
Potash	0.172	0.341	0.142	0.192	0.212	0.207
Soda	0.084	0.044	0.063	0.080	0.076	0.042
Lime	0.093	0.163	0.063	0.075	0.059	0.132
Magnesia	0.250	0.153	0.151	0.067	0.238	0.104
Brown oxide of manganese	0.450	0.231	0.034	0.117	0.127	0.122
Peroxide of iron	2.873	1.014	1.668	1.214	3.021	0.932
Alumina	3.470	2.102	2.980	4.373	3.260	3.036
Phosphoric acid	0.175	0.079	0.064	0.054	0.076	0.041
Sulphuric acid	0.007	0.028	0.005	0.046	0.008	0.026
Water and organic matter	2.969	1.892	1.760	4.093	2.573	2.230
Total	99.877	96.894	100.256	99.702	100.780	100.095
Hygroscopic moisture	4.65	1.20	4.34	4.66	5.11	3.25
absorbed at	11 C.°	8 C.°	22 C.°	11 C.°	21 C.°	6 C.°

A prominent and coincident feature of all these bottom soils is their lightness, as indicated by the high insoluble residues, ranging from 86.6 to 90.8, and their nearly uniform moisture coefficient, ranging between 5.5 and 6.8, enhanced, no doubt, by a considerable percentage of humus. The supply of lime in the surface soils is larger than in the corresponding soils of the adjacent uplands (see previous table), and is also uniformly larger in the surface than in the subsoils. The phosphoric acid appears to follow a similar law as between soil and subsoil, but is evidently not always increased as compared with the corresponding upland soils. The potash percentages are at least not materially higher than in the uplands. It is evidently the greater depth of the soil layer proper, its easy tillage and more uniform moisture throughout the growing season, that causes the preference shown to bottom soils by cultivators.

The second bottom soils are more siliceous in character on the average, and their potash percentages are, on the whole, remarkably low, not only in this region, but elsewhere, as compared with the corresponding upland soils. This ingredient will therefore probably have to be supplied soon. The lime percentages are at least not increased, and the same is true of the phosphates, even as determined in the analyses, which includes that contained in the almost universally present bog-ore grains. The gray hummock soils are probably in the great majority of cases deficient in both lime and phosphates, as they nearly always are in humus, and their easy and convenient tillability renders their improvement by green manuring and the use of bone-meal or superphosphates specially advisable. No. 156 is exceptional in its supply of phosphates, which renders it very productive when fresh. It does not, however, lie entirely above the reach of present overflows, and differs little from the first-bottom soil. The soil from Vaiden seems to be in great need of more lime, which would probably correct its behavior toward corn and cotton crops. The low moisture absorption of No. 58 explains its droughtiness, and its color, as well as the small percentage of volatile matter, shows it to be in need of a supply of vegetable matter by green manuring.

Natural fertilizers in the yellow loam region.—The formation underlying the greater part of the region ("northern lignitic" Tertiary) furnishes no materials of any fertilizing qualities. In its southern portion, however, adjoining the "Central prairie" region, not only are the marls of that country accessible for use, but there also occur within the limits of the Short-leaf pine and oak uplands, at a number of points somewhat irregularly distributed, deposits of sandy or clayey materials rich in greensand or glauconite grains, which are rich in potash in a very available form. Similar materials occur in New Jersey and elsewhere, and are used with great advantage on lands exhausted by cultivation, in vegetable gardens, etc. When concentrated by washing, the greensand will bear shipment by rail. The occurrence of greensands near Vaiden, Carroll county, has been mentioned in the description of the red lands, where also analyses are given. Materials not quite so rich occur in the banks of the Chickasawhay river, at and near Enterprise, Clarke county, and thence northwestward are often found in outcropping in Clarke and Newton counties. Their agricultural value may be pretty correctly estimated from the amount of soft greenish grains contained in the mass, which, when cut wet, make green streaks on the smooth surface. They sometimes contain a little lime, but rarely any considerable amount of phosphoric acid.

IV.—THE ALLUVIAL REGION OF THE MISSISSIPPI.

The portion of the alluvial plain of the Mississippi river lying within the state, and popularly known as the "Yazoo bottom", forms a lozenge-shaped body of 7,200 square miles between the eastward sweep of the bluff and a corresponding westward curve of the river, at whose head lies the city of Memphis, and which terminates southward at the high ridge (the "Walnut hills") which abuts upon the river at Vicksburg. The area thus outlined has a maximum length a little west of south of about 190 miles, while its greatest width, almost at its geometrical center, is 70 miles. Southward of Vicksburg the river keeps close to the eastern highland, whose base it frequently washes (see "Cane hills region"), and between which only small and isolated alluvial areas (aggregating to a total of about 250 square miles) are found within the state. The main area includes the following counties and parts of counties: all of Tunica, Quitman, Coahoma, Bolivar, Sunflower, Le Flore, Washington, Sharkey, and Issaquena, the western portions of De Soto, Panola, Tallahatchie, Grenada, Holmes, Yazoo, and Warren.

TOPOGRAPHY.—The Mississippi river receives scarcely any of the drainage of the bottom plain until it has all accumulated in the Yazoo. This, as has been previously explained (see "general features of the alluvial plain", etc., above), arises from the fact that the main river occupies a ridge forming the highest portion of a cross section of the alluvial plain, so that its overflow at any given point will find the lowest portion at the foot of the eastern and western bluff (the Yazoo or Washita) and will tend to flood the entire intervening regions. Originally several natural channels formed outlets toward either side, in Mississippi especially, the Yazoo pass diverging from the main river at Moon lake above Friar's point and connecting with the Coldwater river about 18 miles to the eastward. But the attempt to prevent the flooding of the back country by means of levees on the main river involved the closing of these lateral outlets—a policy that has given rise to much bitter local controversy.

The surface of the entire region is apparently level, but each stream or "bayou" repeats on a small scale the feature of the main river just referred to, viz, it is bordered by a ridge formed of its own deposits, higher than the "back country" intervening between it and its next neighbor, which is usually, in part at least, occupied by low swamps. The variations of surface level do not usually exceed 15 feet, and the entire region presents a network of meandering bayous, creeks, and rivers, and is dotted with innumerable small lakes, mostly representing deserted "bends" of water-courses.

There are three chief drainage systems, parallel with each other, through which the waters find their way slowly and sluggishly southward, where they finally unite with the main Yazoo and empty into the Mississippi river. These are the *Coldwater and Yazoo basin* on the extreme east, from the Tennessee line southward; the *Sunflower basin* and its tributaries, occupying a large region centrally from Friar's point southward to the Yazoo; and the *Deer creek basin* on the southwest, a narrow but important region, nearly adjoining the Mississippi river, from Washington county southward to the Yazoo. Within these several regions the lands are so low that the bayous often form connecting links between the waters of the streams without affecting their general southward course.

The timber growth of the swamps is mostly cypress, sometimes hung with long moss (*Tillandsia usneoides*), and sometimes having an undergrowth of greenbrier, etc., though mostly open. On either side, and reaching to the ridges, the forest growth is more dense, often accompanied by a heavy undergrowth of cane (canebrakes), and comprises a great variety of trees, according as the land is of the rich buckshot character of the Deer creek region, the "white land" variety of the Sunflower basin, or of the dark loam of the Yazoo. The ridges themselves also are heavily timbered with sweet gum, oak, maple, etc.

The larger proportion of the population and of the lands under cultivation within the region is found along the highlands that border the Mississippi river and along Deer creek. Here, too, are the great cotton plantations, where the largest part of the cotton is produced, its acreage comprising from 15 to 20 per cent., or even more, of its total area. Cotton is the chief crop of the region, its product being about 30 per cent. of that of the entire state. Its average yield per acre is 984 pounds of seed-cotton, the maximum of 1,272 pounds being reached in Issaquena county.

Water for domestic purposes is throughout the bottom obtained either from shallow wells or by means of iron tubes driven into the ground, the water always rising to within 30 feet of the surface, so that even where the tubes are driven 60 or 80 feet the water can easily be drawn up with pumps. It sometimes even happens that the water approaches to within 2 feet of the surface. In some parts of the region the people prefer to use the water from the bayous. This, however, during the summer months, and when the bayous are shallow, is of a greenish tint and "very hard", *i. e.*, calcareous, and charged with vegetable matter, causing malarious diseases.

SOIL VARIETIES.—The lands of the alluvial region embrace several distinct varieties, which are thus given by Professor Smith:

1. *A dark-gray sandy loam*, forming the front-land of many of the creeks and bayous of the bottom. The timber growth is chiefly honey-locust, hackberry, and sweet gum. The soil of the Dogwood ridge and the front-lands of the Mississippi in most places are of this class.

2. *A light-gray sandy loam*, with yellowish and orange streaks. This loam is sometimes of a light-yellow color, forms the front-land of Sunflower and Tchula lake (Holmes county), and occurs frequently elsewhere. The growth is sweet gum, maple, water and willow oaks, elm, and hackberry.

3. *A light-colored sandy "clay"*, or fine-sediment, of close texture, with a few yellow spots. The growth is chiefly swamp chestnut, oak, and sweet gum, with some ash, maple, and willow oak. This is the soil of the "white lands", which occurs chiefly on Silver creek and on the bayous on both sides of the Sunflower river westward to about half way between the Sunflower river and Deer creek, while northward it is found to some extent on the east side of the Dogwood ridge, in Tallahatchie county.

4. *A light-gray tenacious "buckshot" clay*, traversed by cracks, streaked with ferruginous coloring matter, and crumbling upon exposure to the weather into angular fragments—"buckshot." This occurs chiefly in the northern part of the region.

5. *A stiff, dark-gray "buckshot" clay*, sometimes nearly black, traversed in all directions by cracks, and full of streaks and dots of ferruginous matter. This is the "buckshot" clay *par excellence*, and forms the most fertile soil in the bottom. The territory of which it forms the surface soil is generally subject to overflow, but there is usually a strip from one-half to three-fourths of a mile wide back from the banks of the streams under cultivation. The growth is sweet gum, overcup, willow and water oaks, hackberry, and pecan; near the banks of the streams an undergrowth of cane, and in the low swamps no cane, but an open cypress glade.

For convenience in a more detailed description of the alluvial region the three separate drainage systems or basins and the Dogwood ridge given above will be treated of as distinct divisions, each of which is pretty well characterized by its peculiar soil varieties.

The Yazoo basin.—The belt of country thus designated lies in the eastern portion of the alluvial region, reaching from the Tennessee line southward to Vicksburg, and is included between the "Dogwood ridge" on the west and the bluff or upland region on the east. It covers an area of about 2,600 square miles, and is drained on the north by the Coldwater river, and south by the Yazoo, the name given to the former after its junction with the Tallahatchie. These rivers have numerous tributaries, the largest and most important of which enter the alluvial region from the highlands of the east. Its surface is also interspersed with many lakes, creeks, and bayous, which often cross-connect the larger streams. The greater part of the belt is a dense swamp of low overflowed lands, the higher lands occurring only along the streams themselves in strips from one-half to a mile wide, and comprising the only areas at present under cultivation or inhabited. The soil of the lowlands in the upper half of the belt is mostly a black loam, very rich and productive when it can be cultivated. Near the junction of the Coldwater and the Tallahatchie rivers there is some "white land" having a yellowish sandy soil a few inches deep and a white clay subsoil, probably the most northerly occurrence of that variety which so largely characterizes the Sunflower river section. Its timber growth here embraces sweet gum, swamp chestnut oak, with some white oak and hickory. The bottoms of the east side of the Tallahatchie are from 10 to 15 miles wide, have a light yellowish-sandy loam soil, and a growth of sweet gum, swamp chestnut oak, with a few white oaks, holly, and an undergrowth of cane. The banks of the Coldwater river are high and more or less sandy, and are largely under cultivation to within 4 miles of the junction, yielding very fine crops of cotton.

The southern half of this Yazoo belt is more swampy in character than the northern, the low, overflowed swamps being wider and more extensive. In other respects the two are very similar, and we here find only close to the streams lands high enough above overflow to warrant cultivation, while the low swamps occupy the interior with their dark loam or "greenish-yellow, hard-baked" soils (as near the mouth of the Sunflower river), largely covered with an abundant growth of pecan, also red and willow oaks, large and symmetrical, a few water oaks, honey-locust, sycamore, sweet gum, and hackberry. At the foot of the bluff on the east the lands embrace a dark sandy loam, very rich and productive, formed to a large extent by the washings from the loess hills.

A feature of the southern half of the Yazoo river region is the occurrence of a number of so-called "prairies" upon the higher portions of the bottom lands. They have none of the characteristics of the prairies of other parts of the state, except that they were destitute of large trees when first found. They are probably simply the "clearings" made by the Indians, as shell heaps and Indian mounds usually are found near them. Their soil is apparently the same as that of the surrounding bottoms, and they are now occupied by plantations.

Honey island, in the western part of Holmes county, is formed by the Yazoo river on the west and Tchula lake and creek on the east, the latter being simply an old bed or "cut-off" of the river. The island is narrow, interspersed with lakes, the higher and tillable lands lying chiefly along the river and around the lake, and comprising the somewhat sandy, light-grayish "front-land" soils. The immediate western border of the lake is 5 or 6 feet lower than the ridge, and has a soil less sandy, breaking up into clods similar to the buckshot clay. Both ridge and lower lands have ferruginous streaks, and are timbered with overcup and very large willow oaks, sweet gum, and hackberry. On the immediate border of the lake there are large cypress trees.

At the northern end of Honey island, on the banks of the bayou connecting Tchula lake with the Yazoo river, there is a bluff bank, showing at a low stage of water a section of over 22 feet, which exhibits strikingly the structure of the beds underlying the bottom lands. These are here chiefly dark-colored clays with ferruginous concretions.

The following is an analysis of a bottom soil of the Tallahatchie river in the northern part of the basin:

No. 354. *Light sandy loam*, Tallahatchie river bottom, Tallahatchie county.

Bottom land of Tallahatchie river, Tallahatchie county.

	Soil.	
	No. 354.	
Insoluble matter	87.140	91.944
Soluble silica	4.798	
Potash		0.301
Soda		0.084
Lime		0.301
Magnesia		0.385
Brown oxide of manganese		0.158
Peroxide of iron		2.120
Alumina		2.151
Phosphoric acid		0.112
Sulphuric acid		0.005
Water and organic matter		2.644
Total		100.205
Hygroscopic moisture absorbed at	22 C.°	4.79

Dogwood ridge.—The divide between the drainage system of the Yazoo and Sunflower rivers is a low sandy ridge, or rather a series of ridges, above overflow, reaching from near the Mississippi river a few miles north of Friar's point, in Coahoma county, southward and slightly eastward to the Yazoo river, in Holmes county. The irregular outline, as determined by the United States delta survey and marked out on the map accompanying this report, places this ridge in the eastern part of Coahoma, the southwestern corner of Tallahatchie, and the central (north and south) part of Le Flore, the widths varying from about 3 miles in the north and central portions to from 6 to 9 miles in Le Flore county, the entire area being a little more than 300 square miles. It is well settled, especially in its northern part.

This ridge is a marked feature of the Alluvial region, and is doubtless the continuation of the very similar Crowley's ridge of the Arkansas region, which passes southward from the northeastern part of the state, with finally an eastern bend to Helena, on the river, and nearly opposite Friar's point. Here the river has apparently cut through it, but in Mississippi, after continuing this course for a few miles, the ridge turns southward. The soils of the two nearly adjoining portions of the ridges are very similar to each other in character; the growth also is similar, except that poplar characterizes the one and dogwood the other. It is interesting to note that the white clays of the bluffs of Crowley's ridge are in Mississippi apparently spread out over the bottoms and form the "white lands" of the bayous and creeks of the Sunflower region west of the Dogwood ridge.

The chief characteristics of the ridge are light, slightly yellowish, sandy loam soils, showing no change at a depth of 2 feet, and timbered with a growth of dogwood, sweet gum, holly, ash, sassafras, and a kind of prickly pear. The soil is as productive as that of the river-front lands, which it resembles, except in being lighter in color, is easily tilled, and when turned up and exposed to the sun and weather it turns dark, like the other soils. The lower lands or depressions in this belt have light yellowish buckshot clays similar to the clays on the bank of the Sunflower river.

The following analyses show the composition of these two soils:

No. 395. *Light sandy loam soil of the Dogwood ridge*, taken between Swan lake and Cypress bayou, from the plantation of Governor J. L. Alcorn, Coahoma county; vegetation, dogwood, sweet gum, holly, ash, and sassafras; depth taken, 2 feet.

No. 396. *Light yellow buckshot clay* from the edge of a depression or pond on the ridge near the above soil; growth, as above; depth taken, 8 inches.

Dogwood ridge soils.

	DOGWOOD RIDGE SOILS, COAHOMA COUNTY.		CROWLEY'S RIDGE, LEE COUNTY, ARKANSAS.
	Sandy loam ridge soil.	Buckshot clay bottom soil.	Sandy loam soil.
	No. 395.	No. 396.	No. 430.
Insoluble matter	83.886	75.513	89.415
Soluble silica	7.022 } 90.908	10.895 } 86.408	
Potash	0.392	0.606	0.386
Soda	0.086	0.146	0.084
Lime	0.259	0.386	0.125
Magnesia	0.596	0.972	0.831
Brown oxide of manganese	0.086	0.133	0.245
Peroxide of iron	2.691	2.804	1.965
Alumina	3.593	4.457	3.037
Phosphoric acid	0.142	0.278	0.221
Sulphuric acid	0.010	0.007	.....
Water and organic matter	2.007	4.401	3.463
Total	100.770	100.598	99.722
Hygroscopic moisture absorbed at	3.95 10 C.°	6.04 12 C.°	2.55 Air-dried.

The ridge soil, sandy as it is, shows good fertility in its percentages of potash and phosphoric acid and its abundance of lime and magnesia, while the buckshot clay in a like manner upholds the high reputation of that class of lands in other parts of this state and Arkansas. A comparison of the sandy loam ridge soil with that of Crowley's ridge of Arkansas (taken in Lee county, on the southern part of the ridge, and where the growth is nearly the same) shows marked similarity in composition, and points to a probable common origin and time of deposition.

The Sunflower basin.—The Sunflower river and its chief tributary, the bayou Phalia, drain that part of the alluvial region lying westward from the Dogwood ridge to Deer creek, and covers about 3,000 square miles. The river rises near Friar's point, in Coahoma county, and flows southward with a sluggish motion to the Yazoo. The bayou Phalia, rising in the western part of Bolivar county, unites with it in Washington county, while on the south Silver creek, Little Sunflower, and other streams aid in draining that section. The surface of the entire country is very level, well timbered, and very largely swampy, with innumerable lakes and bayous, and is subject to overflows from the Mississippi river. The only high lands occur along the larger streams or at a very short distance from them, the surface thus being shaped into parallel troughs, whose edges border the streams, and whose lowest portions, midway between, are marked by dense cypress swamps, matted with bamboo brier. The lands of the region may be classed as *front-land*, *back-land*, and *swamps*. The former, or *front-lands*, comprise the higher lands or low ridges along the streams, mostly above ordinary overflow, and, with their light-gray, sandy loam soils, are the chief farming lands of the region. The banks of the Lower Sunflower are not high, the sandy front-land soils that overlie the clays of the bottoms being only from 4 to 6 feet thick in many localities, and, being subject to overflow, are therefore not very largely under cultivation. The timber growth is mostly sweet gum, maple, water and willow oaks, elm, and hackberry. These soils, with their yellowish and orange streaks, resemble those of Tchula lake and of Honey island, Holmes county.

The lands of Indian bayou, in Sharkey county, seem to be the highest of the region, and for many miles are under cultivation. The soil of both this and Straight's bayou, as well as of Silver creek on the south, belong to that class known as *white lands*, being underlaid by a white "clay" and timbered with swamp chestnut-oak and sweet gum, some hickory, holly, water and willow oaks, dogwood, etc., and often with an undergrowth of cane.

Bayou Phalia is in a swamp, and seems not to have any ridge lands along its border.

The back-lands of the Sunflower region, viz, those of the lowlands back from the streams, are mostly stiff clays, embracing the two varieties known as *white lands* and *buckshot clays*. The former occupy nearly if not all of the region east of the Sunflower river, and 6 miles west of it, in Sharkey county, being overlaid as they approach Deer creek by the black buckshot clays. They are most extensive in the southern half of the Sunflower region, and have as a characteristic growth sweet gum and swamp chestnut oak. The white lands are not prized very highly in comparison with others of the alluvial region, though they are said to yield very largely in seed-cotton per acre.

The buckshot clays of the back-lands in the northern part of the region are light gray in color and tenacious, traversed with ferruginous coloring matter, and crumble, upon exposure to the weather, into angular fragments. (See analysis in the description of Dogwood ridge.)

In the southern part we find the dark gray or sometimes nearly black and richer variety belonging to the Deer creek region (under which it is more fully described) overlying the "white lands" of the Sunflower region just mentioned.

The following analyses are given to show the composition of the lands of the Sunflower region:

No. 394. *Sunflower river front-land soil* from a ridge on the bank of the river at Buck's ferry, Issaquena county. Depth taken, about 12 inches; a light-gray sandy loam, with a growth of sweet gum, maple, willow oak, elm, and hackberry.

No. 376. *"White land" soil* of Indian bayou front-land, taken near C. Gillespie's, Sunflower county. Depth, 5 inches; growth, sweet gum, swamp chestnut oak, hickory, holly, water, willow, and red oaks, dogwood, some maple and ash, with an undergrowth of cane. Soil is grayish, and somewhat sandy.

No. 377. Subsoil of the above. A whitish, close clay, with reddish flecks, and somewhat "jointy". Depth taken, 5 to 18 inches.

Front-lands of the Sunflower river region.

	Issaquena county.	Sunflower county.	
	Sunflower river sandy ridge.	Indian bayou white land.	
	Soil.	Soil.	Subsoil.
	No. 394.	No. 376.	No. 377.
Insoluble matter	71.164	87.898	87.898
Soluble silica	13.506 = 84.670	4.036 = 91.934	3.816 = 91.714
Potash	0.401	0.226	0.305
Soda	0.191	0.116	0.079
Lime	0.406	0.153	0.147
Magnesia	0.696	0.256	0.392
Brown oxide of manganese	0.011	0.048	0.050
Peroxide of iron	3.845	1.848	2.312
Alumina	6.889	2.565	2.998
Phosphoric acid	0.165	0.162	0.283
Sulphuric acid	0.016	0.042	.....
Water and organic matter	2.748	3.013	1.499
Total	100.038	100.363	99.779
Hygroscopic moisture	7.39	4.07	5.68
absorbed at	15 C.°	14 C.°	16 C.°

The sandy ridge soil of the Sunflower river, No. 394, is far more clayey than its name would indicate, and resembles rather the light buckshot soils of the northern part of the region both in this and the amounts of potash, phosphoric acid, lime, and magnesia. Were it higher above overflow it would be classed as the most valuable of the ridge or uplands. Its high lime percentage accounts for its superiority over the white lands. The soil and subsoil of Indian bayou show a strong resemblance to each other, the latter naturally being a little richer in its important elements, but showing little of the clayey characteristic to be expected from its popular name, "white clay lands." It is rather a fine white sediment, very close-textured, so as to appear as clay. Both soil and subsoil are fairly supplied with all of the elements of fertility, and strongly resemble in their composition the soil of the Dogwood ridge. The high phosphoric acid percentage in the subsoil suggests that its want of thriftiness may be attributable to physical defects, among which probably is want of adequate drainage for so close a soil. It could also probably be hereafter improved by liming.

The Deer Creek region.—This region embraces a narrow belt on the west between the Sunflower and the Mississippi rivers, from the southwestern part of Bolivar county south to the Yazoo river—in all not more than 1,300 square miles in area. Deer creek is the most important stream, and with its tributaries, Black and Steel's bayous, drains the country southward into the Yazoo. As in the other regions, its level surface is dotted with lakes, and has a network of bayous, which often interconnect the sluggish waters of the larger streams. The higher lands, as usual, lie along the stream, falling inland toward the low swamps, that for the most part are under water or are too boggy for cultivation, being also subject to overflows from the Mississippi river. The river lands are high and not subject to inundation, and, extending back some distance inland, embrace the chiefly settled portion as well as the largest plantations of the region. The soil of this high land is a dark alluvial loam, very rich and productive. The timber growth along the immediate river bank (often very sandy) is mostly cottonwood, while inland it embraces honey-locust, hackberry, and sweet gum.

On the immediate banks of Deer creek and Steel's bayou, as well as on Black bayou, there are low ridges of dark-gray sandy loam, some 200 yards in width, above ordinary overflows, timbered with honey-locust in great abundance; also pecan, water and willow oaks, and sweet gum. In the upper Deer Creek region these ridges are higher and largely under cultivation.

The Deer creek region is, however, especially noted for its extremely rich "buckshot" soils, that occur very extensively, and, taken as a whole, are in their percentages of plant-food the richest yet found. The "Buckshot" occupies the lowlands of the country, and is subject to overflow, levees having been constructed for protection, and is usually densely timbered with a growth of sweet gum, pecan, willow and water oaks, hackberry, and honey-locust near the streams and an undergrowth of cane. The soil is a stiff, dark clay, traversed by cracks, and mottled with

spots of ferruginous matter. Upon drying it breaks up into little angular fragments, giving rise to the popular name. Another of its characteristics is the formation of hillocks or small ridges wherever it forms the surface soil, the result of its bulging upward when drying and crumbling. There is no change in its character for several feet in depth. In the lower swamps the growth is mostly cypress, more open, the trees often being covered with long moss (*Tillandsia usneoides*). The following analysis shows the chemical composition of a fair sample of this soil:

No. 390. *Dark, stiff buckshot soil* of Deer creek back-land from the plantation of J. D. Hill, Issaquena county. Depth taken, 12 inches; growth, sweet gum, hackberry, honey-locust, pecan, willow and water oaks, with an undergrowth of cane.

Deer creek buckshot soil, Issaquena county.

	Soil.
	No. 390.
Insoluble matter	51.063 } 71.767
Soluble silica	20.704 }
Potash	1.104
Soda	0.325
Lime	1.349
Magnesia	1.665
Brown oxide of manganese	0.119
Peroxide of iron	5.818
Alumina	10.539
Phosphoric acid	0.304
Sulphuric acid	0.024
Water and organic matter	7.369
Total	100.383
Hygroscopic moisture	14.31
absorbed at	15 C.°

Taken as a whole, the plant-food percentages in this soil are probably unexcelled by any soil in the world thus far examined.

Cotton on this buckshot land grows to the height of 10 or 15 feet, and is said to yield as much as 1,000 pounds of cotton lint per acre. Much of the land is under cultivation, and to its high product per acre is doubtless due the high rank of Issaquena in this regard among the counties of the cotton states.

Cotton seems to produce best on that portion partly covered with the loam of the higher lands, thus indicating, perhaps, all that is required to make it a soil of maximum fertility.

Mechanical composition of the bottom soils.—The following analyses are of interest as showing the wide differences in the mechanical composition of some of these soils, more especially of those which may be considered as modern deposits as compared with those of more ancient origin, represented by the buckshot soil:

	PANOLA COUNTY.	SUNFLOWER COUNTY.	COAHOMA COUNTY.	ISSAQUENA COUNTY.
	Tallahatchie bottom soil.	White land subsoil.	Dogwood-ridge soil.	Buckshot soil.
	No. 365.	No. 377.	No. 395.	No. 390.
MECHANICAL ANALYSIS.				
Weight of gravel over 1.2mm diameter	.....	.....	.....	0.1
Weight of gravel between 1.2 and 1mm	0.1	.....	.....	0.1
Weight of gravel between 1 and 0.6mm				
Fine earth	99.9	100.0	100.0	99.8
Total	100.0	100.0	100.0	100.0
MECHANICAL ANALYSIS OF FINE EARTH.				
Clay	9.6	5.5	10.4	44.4
Sediment of <0.25mm hydraulic value	25.4	30.2	8.7	38.2
Sediment of 0.25mm	19.8	2.0	9.6	9.0
Sediment of 0.5mm	20.4	4.3	9.9	3.7
Sediment of 1.0mm	9.9	13.9	14.0	2.2
Sediment of 2.0mm	9.4	19.8	21.8	1.6
Sediment of 4.0mm	2.7	16.9	21.5	0.3
Sediment of 8.0mm	1.3	2.4	3.7	0.3
Sediment of 16.0mm	0.2	3.0	.....	
Sediment of 32.0mm	0.1			0.4
Sediment of 64.0mm	0.1	0.3	0.2	
Total	98.9	98.3	99.8	100.1

The buckshot soil, with its 44.4 per cent. of clay and 47.2 of the two finest sediments, contrasts strongly with the modern alluvial soils with from 5 to 10 per cent. of clay and 18 to 45 of the sediments. The Dogwood ridge soil, taken alone, contrasts even more strongly, there being a great predominance of the coarser silts.

The above results, however, do not adequately explain the singular property of the buckshot, which causes it to disintegrate with great energy on drying even when it has been worked wet. The same property is manifested, though to less degree, by the black prairie soils of the northeastern region, and is doubtless connected with the calcareous nature of both materials.

V.—THE CANE-HILLS REGION.

Along the edge of the Mississippi bottom above Vicksburg, and below that point along the river itself, we find a narrow belt of ridgy, often broken land, from 3 to 10 and in places up to 15 miles wide, rising abruptly from the bottom or river level not unfrequently to a height of from 400 to 500 feet, and probably more at the most elevated points, which seem to lie on either side of the line between the states of Mississippi and Louisiana, forming from some points of view a wilderness of veritable peaks. Thence southward the level gradually sinks, and the sharp ridges flatten out into the gently undulating plateau country on which Port Hudson and Baton Rouge are situated. The latter city stands on the last spur of the uplands, which thence fall off rapidly into the great delta plain. (See map and text, La. Rep., p. 21.)

The peculiar surface features of this bordering belt are in the main due to the presence, either at or near the surface, of a deposit of fine calcareous silt, which at one time obviously covered the entire bottom plain, but is now represented only by the belt in question, and on the Louisiana side by a few isolated patches lying on top of the hill-tops in the Washita country (see La. Rep., p. 23). It is substantially the same deposit that forms the "bluffs" of the upper Mississippi and lower Missouri, and is hence known as the "bluff" or (from its German congener) the "loess" formation, evidently deposited in fresh-water lakes or gently-flowing broad rivers. It is characterized by containing numerous oddly-shaped concretions of carbonate of lime ("tufa"), and near the landward edge by abundance of shells of land snails as well as bones of large land animals.

The loess material, though but slightly cemented and easily crushed by the hand or plow, is remarkable for its resistance to denudation or washing away by water. Hence the valleys are mostly narrow, V-shaped troughs, separated by sharp-backed ridges wherever the same material forms the surface. But very frequently there lies above the silt, and sharply defined from it, a stratum 4 to 8 feet thick of a yellow, clayey loam, similar to that of the "table-lands" above described, and forming tracts of level, high plateau land quite closely resembling that of northern Mississippi and western Tennessee, of which it is in fact the continuation. It is mainly timbered with oaks, white, chestnut-white, black, and some Spanish, with more or less hickory, sweet and black gum, and where the silt does not lie very deep (as on the brows of the hills) or mingles with the loam (as on the slopes) there is an increasing admixture of holly, linn or basswood, elm, large sassafras, tulip tree, hornbeam, and some magnolia. The "bottom" character of this timber growth is supplemented and in places protected from cattle by a dense growth of cane, covering the hills from base to top. This was originally the case all over this region, which is hence to this day designated as "the cane hills". The approach of the calcareous silt to the surface is indicated by the accession or predominance of lime-loving trees, such as "poplar" or tulip trees, mulberry, honey-locust, and, lower down, crab-apple, red haw, and sycamore. The beech is found more or less throughout. The greater part of the ridges formed of the loess alone are at this time, however, altogether treeless.

Springs are rare in the cane hills, since the water percolates into the silt very rapidly. Streams heading within the region mostly go dry in summer, and their water, as well as that of wells, is hard and limy. The larger streams traversing the region—the Big Black river, Bayou Pierre, and the Homochitto and Buffalo rivers—have rather narrow valleys within it, and the flood-plains are mostly above ordinary overflow, while the beds are very wide, often very sandy, and in them the stream meanders to and fro and sometimes loses itself in the dry season.

This having been one of the earliest settled portions of the state, but little land susceptible of cultivation has remained untouched; and the cultivated lands, originally highly productive, have by the usual process of exhaustive cultivation, turning out, and washing away of the surface soil been greatly reduced in fertility. The Bermuda grass has almost throughout taken possession of the slopes, preventing their washing and affording pasturage for cattle.

The soils of the Cane-hills region are not very much varied. Outside of the bottoms only two materials, each of nearly uniform composition, contribute to their formation, viz, the calcareous silt and the yellow or brown loam of the hill-tops, which intermingle in varying proportions on the slopes. The following analyses convey a fair idea of the characteristics of these materials:

No. 232. *Loam upland soil* from James Watson's place, 5½ miles northeast of Port Gibson, Claiborne county. Timber growth, mainly oaks, as enumerated above; sample, taken to the depth of 8 inches, of a buff color, and considerably lighter in working than the loam subsoil.

No. 233. *Brown loam subsoil* of the above, taken from 8 to 20 inches depth. A moderately clayey loam, about 7 feet in thickness, overlying the calcareous silt in the level hill-tops.

No. 113. *Magnolia upland soil* from a hilly tract on Widow's branch of the Bayou Pierre, about Sec. 8, T. 11, R. 11 E., 4 miles southwest of Port Gibson, Claiborne county. Vegetation, magnolia and cucumber tree

(*M. grandiflora* and *macrophylla*) and cane. This tract is only a few miles in extent, on which the large-leaved magnolia thrives; a tree it has been found difficult to grow in other localities of apparently similar soil and climate, *e. g.*, Natchez. The soil is a light chocolate-colored loam taken to the depth of 10 inches.

No. 114. *Subsoil of the above.* Yellowish-brown loam, heavier than the surface soil, taken from 10 to 24 inches depth.

Cane-hills lands, Claiborne county.

	WATSON'S LOAM.		MAGNOLIA UPLAND.	
	Soil.	Subsoil.	Soil.	Subsoil.
	No. 232.	No. 233.	No. 113.	No. 114.
Insoluble matter	87.573	79.477	86.304	72.348
Soluble silica			4.694 } 90.998	9.490 } 81.838
Potash	0.458	0.741	0.230	0.445
Soda	0.124	0.248	0.042	0.078
Lime	0.244	0.238	0.279	0.381
Magnesia	0.545	0.830	0.293	0.705
Brown oxide of manganese	0.205	0.346	0.137	0.051
Peroxide of iron	3.231	5.635	2.236	4.930
Alumina	4.842	8.849	3.245	7.894
Phosphoric acid	0.105	0.092	0.128	0.082
Sulphuric acid	0.028	trace.	0.013	0.038
Water and organic matter	3.073	3.496	2.941	3.319
Total	100.428	99.952	100.542	99.761
Humus	0.718			
Available inorganic	0.718			
Hygroscopic moisture	0.518	9.09	3.36	7.53
absorbed at	21 C.°	8 C.°		21 C.°

It will be seen that these soils differ from the better class of soils in the northerly portion of the yellow loam region only by a somewhat greater proportion of lime (which is especially noticeable in the magnolia soil) and a smaller supply of phosphoric acid. When fresh, they yielded a 400-pound bale, or 1,200 to 1,300 pounds of seed-cotton per acre, and some of these soils yield even now, after long exhaustive cultivation, from 900 to 1,000 pounds of the same. The perviousness of the underlying loess material, and the resistance of the latter to washing away, has greatly restricted the damage to the land, so grievously apparent in northeastern Mississippi.

The composition of the calcareous silt is shown in the following analyses:

No. 237. *Calcareous silt or loess* from a hillside cut near James Watson's place, Claiborne county (see table), about 10 feet below its highest level at this point. Vegetation, the lime-loving trees mentioned, with some oaks. A yellowish-buff, fine silt, mostly impalpable, somewhat coherent, floury to the touch; contains more or less calcareous concretions of various sizes and snail shells.

No. 116. *Loess material* from the "magnolia upland" near Widow's branch, Claiborne county (see table); resembles the preceding; a little more grayish.

Loess lands, Claiborne county.

	Near J. Watson's.	Magnolia upland.
	No. 237.	No. 116.
Insoluble matter	75.344	64.593
Soluble silica		6.446 } 71.039
Potash	0.511	0.360
Soda	0.115	0.199
Lime	5.921	7.572
Magnesia	3.278	4.507
Brown oxide of manganese	0.252	0.146
Peroxide of iron	3.272	2.947
Alumina	2.823	2.512
Phosphoric acid	0.143	0.138
Sulphuric acid	0.060	0.149
Carbonic acid	6.729	10.004
Water	1.231	0.654
Total	99.679	100.227
Hygroscopic moisture	4.12	2.74
absorbed at	20 C.°	26 C.°

The mechanical analysis of No. 237 resulted as follows:

Loess, Claiborne county.

	Near J. Watson's.
	No. 237.
MECHANICAL ANALYSIS.	
Weight of gravel over 1.2mm diameter	
Weight of gravel between 1.2 and 1mm	0.2
Weight of gravel between 1 and 0.0mm	
Fine earth	99.8
Total	100.0
MECHANICAL ANALYSIS OF FINE EARTH.	
Clay	2.5
Sediment of <0.25mm hydraulic value	33.6
Sediment of 0.25mm	5.6
Sediment of 0.5mm	20.1
Sediment of 1.0mm	16.2
Sediment of 2.0mm	14.3
Sediment of 4.0mm	2.0
Sediment of 8.0mm	1.7
Sediment of 16.0mm	0.9
Sediment of 32.0mm	0.6
Sediment of 64.0mm	0.4
Total	97.9

The large amounts of carbonates of lime and magnesia and small percentage of alumina and combined water are the prominent features of this material here as elsewhere in the world. The amounts of potash and phosphates are quite large in presence of so high a lime percentage, in view of which they must be accounted as being largely in an available condition.

The examination of the sediments obtained in the mechanical analysis shows that nearly the whole of the particles above 0.25mm diameter hydraulic value are concretions cemented by carbonates of lime and magnesia. On treatment with acids the latter dissolve and leave the residue in an impalpable condition, showing a remarkably uniform fineness of the deposit as originally formed. The subsequent formation of the concretions, acting in lieu of sand, imparts to this material the quality of remarkably easy tillage, while at the same time, in the absence of any large amount of clay, it is thus rendered somewhat leachy. Being identical in composition from top to bottom for from 5 to 50 feet, it will not hold manure well; and the rapid percolation of the rain-water, followed by air, keeps it depleted of vegetable matter also. While, therefore, the pure loess soils were at the outset very productive after the removal of their covering of cane, from which vegetable mold had accumulated for centuries, culture, with tillage and exposure to the air in the warm summers, soon allowed the vegetable mold to be burnt out, to the great damage of the soil's retentiveness and resistance to drought. This is now the capital fault of the pure loess soils, which is severely felt even by gardeners. Deep-rooted plants, whose terminal rootlets may be found at great depths in this pervious material, are best adapted to it.

While this is true of those ridges in which the calcareous silt alone prevails, those that are, or originally were, capped with the stratum of brown loam have on their slopes soils formed by the intermixture of the two materials lighter and more calcareous than the brown loam and not so leachy as the silt, and highly productive, the latter acting as a true marl. While, therefore, for obvious reasons, it may not be desirable to allow the level loam plateaus to be washed down, this washing is really not so serious a damage as elsewhere; in fact, where all the loam has been removed from the summits and the loess itself appears on the backs of the ridges its washing down upon the loam hillsides is a positive advantage. In many cases this intermixture can be effected or favored by plowing or scraping, especially in small scale cultivation, and it invariably results in an improvement of productiveness.

BOTTOM OR VALLEY SOILS OF THE CANE-HILLS REGION.—Since the streams of the cane hills run so as to cross it in the course of a few miles, the bottoms are but little influenced by their materials, which moreover do not wash down very freely. The valley soils therefore bear, as a rule, the character of the regions lying to the eastward, viz, the long-leaf pine region and the border belt of oak uplands described on page 48. Where the latter belt is very narrow, as in Claiborne and part of Warren counties, the bottoms have light sandy or silt soils of little durability, such as characterize the adjacent long-leaf pine region. Farther south, where the oak upland belt is broader and the streams largely head within it, the bottom soils are of better and partly of excellent quality. The following analyses exemplify this state of things:

No. 117. *Bottom soil* from higher ground in bottom of bayou Pierre, on Mr. J. C. Humphreys' land, near Port Gibson, Claiborne county. A light, fine sandy soil, grayish buff, to the depth of 9 inches; bears naturally but a small growth of oaks (water and post), black gum, etc.

No. 115. *Subsoil* of the above, 9 to 18 inches in depth; very sandy, and lighter colored than the soil.

No. 110. *Coles' creek bottom* (or *hummock*) *soil*, from Sec. 13, T. 9, R. 2 E., Jefferson county. Timber growth, sweet gum, sycamore, hornbeam, walnut, honey-locust, white, chestnut-white, and Spanish oaks; much cane. A gray, rather light loam, varying little to the depth of 2 feet; specimen taken to 12 inches depth.

Bottom soils of the Cane-hill region.

	Claiborne county.		Jefferson county.
	Bayou Pierre.		Coles' creek.
	Soil.	Subsoil.	Bottom soil.
	No. 117.	No. 115.	No. 110.
Insoluble matter	92.637	96.108	73.856
Soluble silica	2.562 } 95.199	1.171 } 97.279	10.127 } 83.983
Potash	0.133	0.119	0.240
Soda	0.020	0.081	0.324
Lime	0.101	0.338	0.140
Magnesia	0.167	0.095	0.355
Brown oxide of manganese	0.125	0.074	0.362
Peroxide of iron	1.004	0.785	3.135
Alumina	1.303	0.150	6.238
Phosphoric acid	0.067	0.126	0.056
Sulphuric acid	0.045	0.054	0.036
Water and organic matter	2.092	1.116	5.532
Total	100.346	100.217	100.401
Hygroscopic moisture absorbed at	2.25 14 C.°	1.60 12 C.°	6.65 12 C.°

The Bayou Pierre soil has a remarkably low potash percentage, which is not offset by any large supply either of lime or phosphoric acid. Both the latter are more abundant in the subsoil, but potash is on the decrease, and the absurdly low percentage of alumina speaks of the increasing want of retentiveness, also indicated by the low moisture absorption, the soil having, in popular parlance, "no foundation." It will, when fresh, yield a crop of 700 to 800 pounds of seed-cotton per acre for a few years; after that it will make paying crops of corn only. In most of these points, therefore, it is a "pine-woods soil".

The Coles' creek soil, derived in the main from the loess region itself, is a light loam, retentive of moisture, with a fair supply of potash and lime, and is of great depth. It produces from 1,100 to 1,200 pounds of seed-cotton when fresh; but it is evident that its supply of phosphates will soon require to be replaced, and marling with the loess materials of the hills above it would not come amiss.

The oak uplands belt, intervening between the cane hills and the long-leaf pine region in southwestern Mississippi, has already been referred to in general in connection with the corresponding region of the northern part of the state. (See page 47). Since, however, it offers many peculiarities, and is in some respects intimately connected with the cane hills, some details regarding it will be given here.

The face of the country is prevalently hilly, though usually not as abruptly so as either in the cane or long-leaf pine hills. The timber is a mixture of oaks (prevalently black-jack and post, with some Spanish and white oak) and hickory, with the short-leaf pine. The latter is sometimes rather predominant near the eastern edge of the region, while toward its western limit its gradual disappearance and the predominance of the oaks and the appearance of the chestnut-white oak and sweet gum among them announce the approach of the loess region. On the lower hillsides and in the valleys the beech is of very frequent occurrence.

The subsoil of the region varies from a yellow sandy loam on its eastern portion to a brownish or orange-colored clay loam in the western, the latter passing insensibly into the rich brown loam of the cane hills. Ridges of the two extreme kinds of soil, with their corresponding vegetation, extend from both sides into this border region.

In northeastern Claiborne the transition from the one to the other is quite sudden, so that we find, *e. g.*, on Little Sand creek, near Rocky Spring, the pine-hills soil overlying a good, brown-loam subsoil, as is shown by the timber growth.

Farther south, in Jefferson county, we find around and northward of Fayette a gently rolling tract of brown loam uplands from which the pine is absent. It is 8 to 10 miles long (northeast and southwest) by a few miles wide, being bordered by the cane hills on the west and rising into hilly short-leaf pine and oak uplands on the east and south. An analysis of the brown loam subsoil of this tract is given on page 49 (No. 109).

Still farther south, in the northern part of Franklin county, we find the "Hamburg hills", a somewhat broken tract of oak uplands with a yellow loam subsoil of fair fertility, producing from 700 to 900 pounds of seed-cotton per acre and quite durable. A good deal of hickory and magnolia mingles here with the oaks.

The country between the forks and south of the Homochitto, in Franklin county, is quite hilly ("Homochitto hills"), so that its brokenness is an obstacle to cultivation. The soil, though quite sandy, is deep, and bears a timber

growth of oaks and hickory, laden with long moss, giving evidence of considerable fertility. Hence the bottoms, though rather narrow and their soils quite sandy in most cases, are very productive. Analyses of some of the bottom soils of this region are given below.

Of the upland soils of the region the following analyses, already given in a previous table (see Oak Uplands region), furnish examples. They do not differ materially from those of the more northerly portion of the short-leaf pine and oak uplands, and their cotton product ranges from 700 to 1,000 pounds of seed-cotton per acre when fresh. It is noteworthy that the region around Fayette, of which No. 109 represents the subsoil, has been remarkably durable in its cotton production, more so than would be expected from its composition, which may not be altogether a fair sample. The circumstance may, however, be due to the considerable depth and easy penetrability of this underlying loam and to the levelness of the region, whereby little damage has resulted from washing away of the soil.

No. 108. *Upland soil* from hillside land on Mr. J. F. Brock's place, R. 4 E., T. 13, Sec. 47, near Rocky Spring, Claiborne county. A light gray, somewhat ashy soil, with occasional bog-ore spots to the depth of 10 inches. Timber, prevalently beech, with some large oaks (Spanish white and chestnut white), much holly, and some small magnolias in the heads of hollows. With all these there mingles more or less of short-leaf pine. Mr. Brock complains that this land is unthrifty and will not be benefited by manure, which remains undecomposed in the soil. Peanuts and field pease are about the only successful crops.

No. 112. Subsoil of the above. A brown loam similar to that of the cane-hills country; begins to mingle with the soil at 10 inches, and fairly sets in at 12. Depth taken, 12 to 20 inches.

No. 109. *Brown loam subsoil* from the level region near Fayette, Jefferson county. The loam stratum here is from 10 to 15 feet in thickness, with apparently little change from top to bottom. Sample taken from 12 to 18 inches depth. A brownish-orange, moderately light loam forms the subsoil of the region, which is well settled and has been long under cultivation, and when fresh yielded from 1,000 to 1,100 pounds of seed-cotton per acre, now diminished to from 700 to 800 pounds, even in favorable seasons.

No. 71. *Soil of Hamburg hills*, taken on the ridge about 1 mile northeast of Hamburg, Franklin county. This is rather a broken country with steep ridges. The crests of the ridges, however, are broad enough to give room for fine farms. The surface soil is of a tawny tint and rather light to the average depth of 7 inches, to which the sample was taken. The timber is Spanish, black, red, and white oaks, pignut hickory, magnolia, large-leaved magnolia, black and sweet gum. Small pines form the undergrowth. Down the hillsides white oak and sweet and black gum become more abundant, sometimes prevalent.

No. 73. Subsoil of the above taken from 7 to 20 inches depth. A brownish-orange colored loam, medium heavy from 18 to 36 inches in thickness, then becoming whitish, and gradually passing into the sandy materials of the drift

Lands of the belt of oak uplands.

	Claiborne county.		Jefferson county.	Franklin county.	
	R. 4 E., T. 13, S. 47.		Near Fayette, brown loam.	Hamburg hills.	
	Soil.	Subsoil.	Subsoil.	Soil.	Subsoil.
	No. 108.	No. 112.	No. 109.	No. 71.	No. 73.
Insoluble matter	78.992	78.804	81.287	88.750	74.894
Soluble silica	7.430 } 86.422	7.910 } 86.714	3.500 } 84.787	1.810 } 90.560	9.474 } 84.368
Potash	0.318	0.286	0.164	0.140	0.288
Soda	0.087	0.084	0.100	0.090	0.104
Lime	0.137	0.090	0.084	0.070	0.127
Magnesia	0.600	0.492	0.704	0.185	0.599
Brown oxide of manganese	0.072	0.022	0.136	0.075	0.144
Peroxide of iron	4.970	4.613	5.393	2.405	5.672
Alumina	5.061	5.377	5.162	2.098	6.106
Phosphoric acid	0.025	0.042	0.040	0.077	0.050
Sulphuric acid	0.007	0.056	0.011	0.005	0.006
Water and organic matter	2.477	2.767	3.338	4.310	2.699
Total	100.176	100.543	99.925	100.015	100.163
Hygroscopic moisture	3.64	7.61	9.76	4.40	8.81
absorbed at	18 C.°	18 C.°	12 C.°	22 C.°	22 C.°

The insignificant proportion of phosphoric acid in No. 108, together with its ashy character, explains sufficiently the faults complained of in its cultivation. It is too light to assimilate any but well-rotted manure or commercial fertilizers, and of the latter superphosphate would be best adapted to the case. The supply of potash is fair in both soil and subsoil, while that of lime is only moderate, and humus is sadly wanting. Phosphoric acid is also very low in the subsoil. The tree growth, however, seems to show that deep-rooted crops would, with deep tillage, succeed on this soil.

The subsoil from near Fayette likewise does not promise much durability, except it be on account of its great depth and easy penetrability, it being low both in potash and phosphates.

The Hamburg hills soil is the most promising of the three, as its subsoil contains fair supplies both of potash and lime, and the surface soil a larger proportion of phosphoric acid than either of the others. But for its brokenness this region would be a very desirable farming country.

The bottom soils of this border region are generally quite sandy and of considerable depth, are of a dark tint, and are especially adapted to the cultivation of cotton, producing a 400-pound bale, or from 1,200 to 1,500 pounds of seed-cotton per acre, with only little diminution of the product in the course of time. Among their timber the lowland oaks, beech, and magnolia are most prominent, the latter three attaining enormous dimensions, especially in the Homochitto region, noted for the fine cotton grown on its bottom lands. Analyses Nos. 68 and 64 furnish examples of the soils of the latter. No. 66, from the bottom of the West Amite, near Liberty, Amite county, as well as Nos. 67 and 70, from the same locality, are examples of the soils occurring nearer to or within the limit of the long-leaf pine region, and differ materially from those of the Homochitto.

Level "hummocks", or second bottoms, elevated from 4 to 6 feet above the first bottoms, often intervene between the latter and the hills, and sometimes extend to the banks of the streams. The soils of these hummocks are moderately light, of a buff tint, 9 to 12 inches in depth, and are then underlaid by a pale-yellow light loam, the timber being beech, white oak, hickory, sweet gum, holly, cherry, etc., but little or no magnolia. These soils also mostly produce good cotton (1,200 to 1,300 pounds per acre), but not so uniformly as the bottoms, while all produce good corn. None of the hummock soils have as yet been analyzed.

No. 68. *Bottom soil* from the middle fork of the Homochitto, Sec. 16, T. 6, R. 3 E., Franklin county. Timber, chiefly large magnolias and beech; also chestnut-white oak, sweet gum, poplar, and maple, all very large. Specimen taken to the depth of 12 inches, but no material change of tint was perceptible to the depth of 32 inches. This soil is of a light-chocolate tint when damp and very sandy, and is said to be the best cotton soil of the region and to produce indefinitely.

No. 64. Subsoil of the above, taken from 12 to 32 inches depth, nearly the same in tint as the soil, but perhaps a little sandier.

No. 66. *Dark bottom soil* from the West Amite, near Liberty, Amite county. Timber, large magnolias and holly, beech, chestnut-white oak, white oak, some large ash and sweet gum, and some poplar. The soil is a brownish loam, unchanged in color to a depth of 2 feet. Specimen taken to the depth of 12 inches; very productive, but does not occur in very large bodies.

No. 67. *White bottom soil* from the west fork of the Amite near Liberty, Sec. 36, T. 5, R. 4 E., not far from No. 66. Timber, bottom pine, chestnut-white, white and water oak, hornbeam, sweet gum, some small hickory, and black and red oak. The timber is rather under size and lank. Soil, grayish white, ashy; produces fair cotton, not large, but well bolled, and yields from 700 to 900 pounds per acre. On account of bad drainage it is difficult to obtain a full stand. Depth taken, 10 inches.

No. 70. Subsoil of the above, taken from 10 to 20 inches depth, ashy above, more clayey and adhesive below; "crawfishy," and with more or less "black pebble" or bog ore.

The above two kinds of bottom soil occur alternately in patches, the proportion of the dark soil increasing as the stream is descended.

Bottom lands of the oak uplands belt.

	Franklin county.		Amite county.		
	Middle Homochitto bottom.		West Amite, dark bottom.	West Amite, white bottom.	
	Soil.	Subsoil.	Soil.	Soil.	Subsoil.
	No. 68.	No. 64.	No. 66.	No. 67.	No. 70.
Insoluble matter	92.164	88.780	87.543	91.334	90.400
Soluble silica		3.190			3.382
		91.970			93.872
Potash	0.148	0.140	0.486	0.270	0.150
Soda	0.044	0.067	0.054	0.103	0.045
Lime	0.122	0.034	0.215	0.134	0.055
Magnesia	0.212	0.280	0.354	0.137	0.120
Brown oxide of manganese	0.284	0.084	0.690	0.141	0.085
Peroxide of iron	1.183	2.058	5.528	1.241	1.771
Alumina	3.219	2.780	2.407	3.878	2.542
Phosphoric acid	0.079	0.035	0.100	0.149	0.048
Sulphuric acid	0.045	0.006	0.048	0.022	0.005
Water and organic matter	2.697	1.847	3.507	2.961	1.028
Total	100.197	99.361	100.932	100.370	100.321
Humus				0.717	
Available inorganic				1.003	
Hygroscopic moisture absorbed at	4.05 8 C.°	4.55 21 C.°	5.52 6 C.°	2.83 20 C.°	3.77 22 C.°

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The soil and subsoil Nos. 68 and 64 are striking examples of the inadequacy of mere chemical analyses and percentage statements for a correct apprehension of the productive capacity of soils. On such a basis they would be pronounced to be absolutely poor and unfit for profitable cultivation; but when it is known that, instead of the usual 6 or 8 inches, nearly 3 feet of well-drained and aerated soil is at the command of the plant, the matter assumes a very different aspect, for the percentages of the plant-food ingredients will then appear multiplied by three or four each and show very advantageous proportions.

In the dark soil of the West Amite bottom a considerable depth of soil is combined with high percentages of potash and lime, a fair supply of phosphates, and both humus and clay enough to render it retentive. The white soil is much shallower, and has less of potash, lime, and humus and a poor, ill-drained subsoil. A comparatively high percentage of phosphates explains the free bolling of the cotton grown on this soil, whose want of retentiveness and whose depth need to be corrected by green manuring, deep tillage, and drainage.

VI.—CENTRAL PRAIRIE REGION.

The region I thus designate traverses the state near its center in a northwestern and southeastern direction as a wedge-shaped belt, varying in width from about 45 miles from Vicksburg northward to 18 miles on the Alabama line northward of Winchester, Wayne county.

Within the area thus roughly outlined prairies do not generally form the prevalent surface feature, not even to the extent to which this is the case in the "northeastern prairie region". The black prairie soil occupies bodies of land, from a fraction of an acre to several thousands in extent, intervening between more or less elevated ridges, the latter formed either of the sandy materials of the stratified drift, covered by the soils similar to those of the adjacent yellow loam and long-leaf pine regions, or consisting of the clayey and non-calcareous materials of the Tertiary, and forming the heavy and intractable pale-yellow soils popularly designated as "hog-bed" or "hog-wallow" prairie. The latter occur more especially in the eastern portion of the belt, where the fertile black prairie soil is mostly confined to the lower slopes and to the bottoms of the streams, and is contradistinguished from the unproductive clay soils of the ridges by the designation of "shell prairie", fossil shells and bones being abundantly scattered over their natural surface. These prairie soils are, of course, derived from the lower calcareous strata of the Tertiary, which are found directly underlying them. It is only in the extreme east, in Clarke and Wayne counties, that the black prairie soil occupies the ridges to any extent. It is everywhere highly productive, though from causes not well understood it is not always adapted to the culture of cotton, the latter being liable to "rust" in the low ground. The "hog-wallow" soil is thus far held in very low esteem; for although moderately productive in favorable seasons, it is too liable to injury from both wet and dry seasons, and is unthrifty and hard to till.

West of Pearl river the true "prairie" feature is but very little developed. The surface features of the upland portions of the counties of Warren and Yazoo are, in the main, those of the cane hills and adjacent table-land regions, although small patches of black prairie occur even at the Vicksburg bluff and more or less all along the Yazoo bluff, and landward up to the line of Holmes county. East of the Big Black river, in Madison and Hinds, we have a gently undulating farming region, mostly with a yellow loam soil resembling that of the table-lands farther north, but showing evidences of more lime in the soil by its tree and herbaceous growth, while occasional patches of black prairie soil, with its peculiar greenish-yellow clay subsoil and groves of crab-apple and honey-locust, show the nearer approach of the calcareous strata to the surface. At Jackson the clay marls that appear everywhere in the banks of Pearl river so far predominate as a soil ingredient that its tendency to crack and cleave during changes from wet to dry interferes somewhat with the maintenance of the foundations of houses and of cisterns, the latter being chiefly used on account of the mineral character of the well waters, when these can be obtained at all.

The soils of the bottom of Pearl River near Jackson are only locally of a "prairie" character, and no prairie soil appears to the eastward until after crossing a belt of sandy oak uplands, which here skirts the hummock of Pearl river at a distance of 3 miles from the river, and is itself about 5 miles wide. Beyond we again find gently rolling uplands with a clay loam soil and occasional black prairie spots, as well as tracts of the "hog-wallow" character, caused by the approach to the surface of the heavy gypseous clays, which are frequently seen in the banks of the stream. These "gypseous prairies" are not very productive. Their surface soil is rather light and silty, from a dun to a chocolate tint, and is underlaid by a heavy, tawny yellow subsoil, often filled with crystals of gypsum. Sometimes the heavy subsoil itself forms the surface, and it is then covered with a sparse growth of scrubby black-jack and water oak and stunted red elm. Such soils will, when well tilled, produce good corn, but invariably rust or blight cotton. But the mixed or "mahogany" soils, formed by the intermixture of this material, as well as of the black prairie soil, with the yellow upland loam (which impart to freshly-plowed slopes a very variegated appearance), are excellent cotton soils, producing a plant of rather short growth, but very heavily bolled, as is usually the case in calcareous soils.

These features—oak upland ridges with a yellow loam soil, sometimes with more or less pine, and alternating with more or less of the black and "hog-wallow" soils on the plateaus, slopes, or in the valleys—characterize the northern portions of Rankin and Smith, the southern part of Scott, and the southwest corner of Newton county. West of the head of Leaf river, in eastern Smith, pine mingles largely with the oak growth on the ridges, and the prairie soils are quite subordinate.

Beyond Leaf river, in Smith, as well as in northwest Jasper, the arrangement of soils is a very uniform one. The bottoms of the larger streams, the Hatchushe, the Tallahalas, Tallahoma, and their larger confluents, as well as sometimes the lower portions of the slopes toward them, are of the black prairie character. Above these, forming level or gently undulating upland tracts, appears the hog-wallow or hog-bed prairie soil, timbered chiefly with post oak of a lank, tattered growth, or sometimes with black-jack and short-leaf pine similarly circumstanced. When the ridges are much higher than 25 or 30 feet above the streams named their crests are formed by sandy knolls or ridges perched on the "hog-wallow" plateau and bearing a growth of pine or oaks. Sometimes the soft white-shell limestone is quite near the surface, forming "bald prairies", on which cotton is apt to blight, and here the huge bones of the zeuglodon (see "Geology") are frequently found lying about or are upturned by the plow. These, as well as the oyster shells, have been burned for lime.

In southwestern Clarke and northeastern Wayne the black prairie soil generally lies higher on the hills, forming considerable tracts, of which the smaller part only is really bare of timber, with clumps of honey-locust and crab-apple. Such tracts generally have rather a light soil, while that timbered with sturdy post oak and short-leaf pine, thickly hung with long moss and with an undergrowth of plum, crab-apple, etc., forms the larger portion, and has a heavy black or mahogany-colored soil, with a subsoil of a deep-orange tint at the depth of from 6 to 12 inches, this in its turn being underlaid at from 3 to 10 feet by more or less calcareous clays. These soils are intermediate between the black and "hog-wallow" soil, and are not as safe as those of the open prairie, but are very productive in favorable seasons.

In Wayne county the prairies are in smaller tracts, and are generally of a lighter character. On plowed hillsides the great variety of tints indicates great and frequent variations. The country is here more broken and the bottoms of streams quite narrow, but the bottom soils are very productive, formed as they are by the intermixture of so great a variety of soils and continually fertilized by the marls washed down from the hillsides.

The greatest drawback to the settlement of a large portion of the fertile tracts of the central prairie region of Mississippi is the difficulty of obtaining good water. This difficulty does not exist where sandy ridges give rise to springs; but in the more level portions well-water can sometimes be obtained only by means of the artesian auger, and is even then mostly very hard, and sometimes fetid. The use of cisterns for household purposes is therefore very common.

SOILS OF THE CENTRAL PRAIRIE REGION.

The soils of the level or gently undulating yellow loam or table-land region west of the Pearl river have been described above in connection with the closely related ones of the "table-lands" proper, from which they differ only locally by the admixture of the underlying calcareous clays.

The following analyses represent pretty fairly the chief characteristic soils of the variegated region lying east of the Pearl river to the Alabama line.

1.—*Black prairie soils.*

No. 188. *Black prairie soil* from R. 4 E., T. 6, Sec. 20, Mr. John Parker's land, Rankin county. This soil forms a spot not exceeding an acre on a hillside; is coal-black when wet to the depth of about 12 inches, when it passes into a yellow clay subsoil, and is timbered with young sweet gum, lately grown up, mingled with cherry, mulberry, wild plum, crab-apple, muscadine, etc.; scarcely any grass on the surface. Higher up on the slope, and occupying the plateau on top, lies a "hog-wallow" subsoil, gaping into wide cracks in summer, the surface soil varying from yellow loam to a gray-ashy character, the latter of little value for cultivation. As usual, black-jack and post oaks occupy these soils almost exclusively. Black prairie spots of the character above given are interspersed with the other soils on hillsides, and produce fine corn, but rust cotton very badly, unless intermixed with the other soils to form the "mahogany".

No. 210. *Black prairie soil* from R. 7 E., T. 3, Sec. 22, Smith county, Mr. L. E. Crook's place, from a tract skirting the bottom of Okahay creek. A black, stiff soil, overgrown with a thick growth of small sweet gum, some ash and mulberry, with here and there a red elm. It was originally almost treeless. The land produces splendid corn, but rusts cotton incorrigibly. Toward the uplands this land gradually passes into a true "hog-wallow" soil, or into one similar to that of Hudnall's prairie (Nos. 187 and 301).

No. 203. *Ridge prairie soil* from north slope of the dividing ridge between Shongalo and Bowland's creek, R. 8 E., T. 3, Sec. 32 (?), Smith county. The crest of the ridge is sandy, and the prairie soil forms a shelf or terrace about half way up. The surface soil, only a few inches in depth, is black or grayish, with little grass, but has the usual growth of hawthorn, crab-apple, etc. None of this soil is under cultivation so far as noted.

No. 207. Subsoil of No. 203. Very stiff, of a deep-orange tint, opening into wide cracks in summer.

No. 199. *Bottom prairie soil* from near the crossing of Leaf river, on the Raleigh and Garlandsville road, Jasper county, R. 9 E., T. 3, about Sec. 6. A deep black soil, cracking and crumbling in drying, underlaid at about 20 inches by a yellow clay subsoil. Soil taken to the depth of 12 inches. Timber, honey-locust, crab-apple, wild plum, and red haw. Not cultivated here, but farther above; said to grow splendid corn, but to rust cotton.

No. 195. *Bottom prairie soil* from Suanlovey creek, near Garlandsville, Jasper county, from the land of Mr. Elias Brown, Sec. 8, T. 4, R. 12 E. Deep black, 2 to 3 feet in depth; timbered prevalently with large sweet gum, and ash, elm, cottonwood, water oak, mulberry, sycamore, and maple. But little of this soil is in cultivation as yet, it being very stiff, dry, and hard and full of gaping cracks. Whether or not it rusts cotton could not be definitely ascertained. It produces splendid corn.

No. 44. *Upland prairie soil* from General W. B. Trotter's plantation, Clarke county, R. 7 W., T. 10, Sec. 3, taken from a hillside belt of black soil to the depth of 15 inches, there being no change of color for at least two feet; stiff, deep, black, and shining; growth of grasses and clumps of crab-apple and red haw. Produces excellent cotton.

No. 40. *Bald prairie soil* from same section as 44. Soil whitish, passing insensibly into a marly mass at 8 to 10 inches depth, and is sandy rather than clayey. No timber growth; scant grass and some verbenas. None cultivated.

No. 363. *Under-subsoil of black prairie* from R. 9 E., T. 4, Sec. 15, Nichols' place, Smith county. This is a small prairie tract bordered by low hills, with a stiff (hog-wallow) soil, timbered with short-leaf pine, post and black jack oak. Near the edge of the prairie the pine disappears and red and Spanish oak come in. The black soil is shallow, and only occurs in spots; frequently the pale, greenish-yellow subsoil forms the surface, and continues with little change to from 3 to 5 feet. It is a heavy, greenish-yellow clay without definite structure, and smooth, shining cleavage, showing some ferruginous concretions and crystals of gypsum, and effervesces strongly with acids. It is full of the bones of the zeuglodon, but little petrified, and in consequence of the tendency of the mass to crack into wide fissures when drying gullies are washed into it in many places, and in these the bones are abundant. The soil in favorable seasons will grow good corn, but invariably rusts cotton so much that the plant will not even reach the time of blooming. The sample analyzed was taken at the depth of 3 feet from the side of a gully. It may be considered as forming a transition between the black and the hog-wallow prairie materials.

2.—*Gypseous and hog-wallow prairie soils.*

No. 187. *Soil of McRae's or Hudnall's prairie*, R. 4 E., T. 6, Sec. 17, Rankin county. This is a gently rolling, treeless tract, with a growth of stunted persimmon, sumach, and short grass. The soil to the depth of 8 inches is rather light and silty, of a brownish-buff tint, and tills easily. It becomes heavier lower down, and is underlaid at the depth of from 1 to about 3 feet by the heavy clay subsoil No. 301. It is said to be very droughty, and apparently the spatters of rain on the leaves of cotton seem to corrode them.

No. 301. *Under subsoil* of the preceding, taken at 3 feet depth. A greenish-gray, heavy clay, with numerous small white specks (of gypsum) and some round, smooth concretions of limonite; cleaves into prismatic fragments in drying. The gypseous prairies are generally bordered by a low, dense-topped growth of black-jack oak, from which there is a transition into oak upland, with short-leaf pine, having a light, ashy surface soil and a heavy, droughty subsoil, cracking open in summer.

No. 242. *Hog-wallow prairie soil* from the level region east of West Tallahala creek, R. 10 E., T. 3, about Sec. 2, Jasper county. A brownish-gray, very stiff soil, dotted with minute, dark-brown spots of bog-iron ore, which, when washed out, forms irregularly shaped grains with a rough surface, mostly soft enough to be crushed with the finger-nail. Depth, 6 inches, underlaid by a yellow clay subsoil; cracks open into wide gaping fissures in summer, the lumps being of stony hardness and having, when cut, a shining surface. The soil will hardly produce corn, but in good seasons, and when plowed just in the right condition, will make a fair crop of cotton. The timber where this soil was taken is slender post oak, with tattered, open tops, short-leaf pine, and here and there a Spanish oak. When lying higher on the hills it is usually timbered with black-jack.

No. 38. *Hog-wallow upland soil* from Clarke county, R. 7 W., T. 10, Sec. 3. Level plateau land, timbered with slender pine, sturdy but very leafy post oak, some black-jack and hickory. Soil, pale-yellow, and stiff to the depth of about 8 inches; then stiff clay, speckled yellow and orange; at the lower levels on the hillsides, black prairie. This soil is droughty and unfit for corn, but brings a short, fairly bolled cotton stalk when the season is favorable.

No. 33. Subsoil of the above, 8 to 18 inches depth. A heavy, tawny-yellow clay, mottled with orange.

LANDS OF THE CENTRAL PRAIRIE REGION.

1.—*Black prairie soils.*

	Rankin county.	Smith county.		Jasper county.		Clarke county.	
	R. 4, T. 6, S. 20.	R. 7 E., T. 3, S. 22.	R. 8 E., T. 3, S. 32, Rowland's creek.	R. 9 E., T. 3, S. 6, Leaf River, near Pineville.	R. 12 E., T. 4, S. 8, Suanlovey creek, near Garlandsville.	R. 7 W., T. 10, S. 3, Trotter's plantation.	
	Black prairie.	Post-oak prairie.	Ridge prairie.	Bottom prairie.	Bottom prairie.	Upland prairie.	Bald prairie.
	Soil.	Soil.	Soil.	Subsoil.	Soil.	Soil.	Soil.	Soil.
	No. 188.	No. 210.	No. 208.	No. 207.	No. 199.	No. 195.	No. 44.	No. 40.
Insoluble matter	69.949	80.264	51.749	42.523	63.435	67.562	43.615	31.504
Soluble silica	4.455 } 74.404			6.597 } 49.120		9.926 } 77.488	16.095 } 59.710	7.826 } 39.330
Potash	0.904	0.573	0.534	0.288	0.796	0.384	0.686	0.589
Soda	0.244	0.114	0.220	0.385	0.127	0.059	0.237	0.223
Lime	1.040	0.966	0.484	0.786	1.815	1.728	2.017	22.570
Magnesia	0.910	0.529	1.005	1.621	1.112	0.881	1.327	1.094
Brown oxide of manganese	0.120	0.292	0.098	0.035	0.479	0.128	0.152	0.111
Peroxide of iron	4.768	10.361	23.786	20.790	6.996	3.899	7.341	4.004
Alumina	7.246		10.854	17.080	15.895	7.680	17.829	7.446
Phosphoric acid	0.466	0.128	0.151	0.050	0.232	0.104	0.115	0.102
Sulphuric acid	0.159	0.035	0.022	0.021	0.085	0.005	0.112	0.246
Carbonic acid								17.411
Water and organic matter	10.739	6.738	11.385	9.966	9.028	7.772	10.726	6.779
Total	101.000	100.000	100.288	100.742	100.000	100.128	100.252	99.995
Humus	1.371				1.669			
Available inorganic	0.932				0.743			
Hygroscopic moisture	16.22	11.14	19.73	22.13	20.92	13.78	18.08	12.10
absorbed at	14 C.°	20 C.°	17 C.°	19 C.°	22 C.°	16 C.°	9 C.°	11 C.°

2.—*Gypseous and hog-wallow prairie soils.*

	Rankin county.		Smith county.		Clarke county.	
	McRae's prairie, R. 4 E., T. 6, S. 17.		Tallahala creek waters, R. 10 E., T. 3, S. 2.	R. 9 E., T. 4, S. 15.	General W. B. Trotter's plantation, R. 7 W., T. 10, S. 3.	
	Gypseous prairie.	Gypseous underclay.	Hog-wallow.	Gypseous underclay.	Hog-wallow.	Upland.
	Soil.	Subsoil.	Prairie soil.	Soil.	Soil.	Subsoil.
	No. 187.	No. 301.	No. 242.	No. 363.	No. 38.	No. 38.
Insoluble matter	82.558	67.027	76.758	43.539	76.518	70.982
Soluble silica					9.710 } 86.228	
Potash	0.339	0.518	0.525	0.038	0.363	0.300
Soda	0.023	0.414	0.190	0.136	0.199	0.127
Lime	0.432	5.695	0.424	14.867	0.133	0.108
Magnesia	0.513	1.233	0.674	1.004	0.274	0.140
Brown oxide of manganese	0.092	0.509	0.559	0.238	0.040	0.074
Peroxide of iron	3.084	4.344	4.121	17.035	3.951	23.040
Alumina	7.424	10.751	10.059		6.367	
Phosphoric acid	0.076		0.063	0.139	0.039	0.100
Sulphuric acid	0.058	5.751	0.059	7.764	0.018	0.050
Carbonic acid		1.018		7.466		
Water and organic matter	5.322	2.740	5.733	7.174	2.806	5.148
Total	99.921	100.000	99.165	100.000	100.418	100.147
Humus			0.729			
Available inorganic			2.168			
Hygroscopic moisture	5.43		6.83	16.71	6.40	15.80
absorbed at	air-dried.		air-dried.	20 C.°	11 C.°	18 C.°

Of the preceding soils only the "Hog-wallow", No. 196, has thus far been mechanically analyzed, with the following result:

Jasper county Hog-wallow subsoil.

	Subsoil.
	No. 196.
MECHANICAL ANALYSIS.	
Weight of gravel over 1.2mm diameter	
Weight of gravel between 1.2 and 1mm	0.8
Weight of gravel between 1 and 0.0mm	1.2
Fine earth	98.0
Total	100.0
MECHANICAL ANALYSIS OF FINE EARTH.	
Clay	48.0
Sediment of < 0.25mm hydraulic value	24.7
Sediment of 0.25mm	10.6
Sediment of 0.5mm	5.6
Sediment of 1.0mm	3.7
Sediment of 2.0mm	2.5
Sediment of 4.0mm	0.2
Sediment of 8.0mm	0.3
Sediment of 16.0mm	0.9
Sediment of 32.0mm	1.6
Sediment of 64.0mm	2.0
Total	100.1

The 48 per cent. of clay in this soil is the highest figure for that substance that has thus far come under my observation, and it is no wonder that the soil is found excessively refractory in tillage, as it lacks entirely the quality of many of the black prairie soils of "slaking" or pulverizing in passing from the wet to the dry condition. In that process it simply cracks open into widely gaping fissures, and is wetted with difficulty. When wet, it becomes excessively tenacious; still, when taken under the plow in just the right condition, it assumes very fair tilth, and in good seasons yields fair crops. Deep and very thorough tillage is evidently of first necessity.

The obvious characteristic of the black prairie soils here is, as in the case of the Northeastern prairie region, a large lime percentage, ranging from somewhat less than 1 to 2 per cent. and over. The potash percentage is also high, ranging between one-half and nearly 1 per cent. The phosphoric acid varies greatly, from one-tenth to over four and a half tenths per cent. (in No. 188). The humus is probably in all cases above 1 per cent. A notable feature, doubtless connected with the latter substance, is the extraordinarily high absorption of moisture, exceeding 10 per cent. in all cases, and rising as high as 21 per cent. in No. 199. The alumina is in some cases very high (as in Nos. 203 and 199), but in others no greater than in many loam soils (as in Nos. 188 and 195), and on comparison of the two last-named with No. 44 it seems as though there was little direct relation between the alumina percentage obtained in analysis and the moisture coefficient. On the other hand, the effect of the presence of ferric oxide upon the absorption of moisture is very strikingly illustrated in the case of Nos. 203 and 207, the latter, containing scarcely any humus, having nevertheless the highest moisture coefficient, obviously on account of the great iron percentage of nearly 21.

In view of the great depth and somewhat extreme character of the black prairie soils, rendering them liable to injury from drought, deep and thorough preparation of the soil, as well as good drainage, cannot be too strongly recommended. When "tired", phosphate manures will probably be the first called for to restore productiveness.

In the hog-wallow soils the lime percentage is uniformly lower, falling below five-tenths—from 0.13 to 0.43. The latter, however, is itself by no means a low amount. The phosphoric acid is low; the humus a little over half of that in the black prairie soils, and about the same as in other good upland soils.

The obvious inference is that in order to render the hog-wallow soils more similar, chemically, to the black prairie soils they should be supplied with more lime, which, with green manuring, would soon supply the deficient humus, and that phosphates should be used as manures.

It is quite obvious, however, that the mechanical condition of the hog-wallow soils stands chiefly in the way of their productiveness. This also would in a measure be remedied by the application of lime and vegetable matter, but, in addition, thorough tillage and good drainage are indicated as first essentials. It is probable that simple underdrainage and use of lime would render these soils fairly and uniformly productive.

A difficult question arises in regard to the tendency of the black prairie soils to "rust" cotton. It is probable that in many cases what is commonly called rust in this region is in reality simply blight, caused primarily by a faulty condition of the soil in respect to moisture and aeration; in other words, by an impervious and ill-drained subsoil, such as commonly underlies the black prairie soils. This indication is confirmed by the fact that the small prairie tracts lying on hillsides (such as No. 44 and others occurring near the southern limit of the prairie region) do not produce the blighting, but bear excellent crops, and also by the fact that corn, a shallow-rooted crop, does excellently well on the "rust soils".

It would, however, remain to be explained why it is that the heavy and ill-drained "hog-wallow" soils are not charged with rusting cotton, but on the contrary are reputed as bearing moderately good crops in favorable seasons. The facts well observed are perhaps hardly sufficient to determine the point, for, as has been stated, the hog-wallow lands lie mostly on higher levels, and may be better drained than the black-bottom prairie, reputed as rusting cotton. It may also be that the greater thriftiness imparted to the plant by the rich soil of the latter turns the scale to its disadvantage whenever the check of the tap root in the subsoil occurs. The entire subject is greatly in need of much closer study than has heretofore been bestowed upon it, for the area of land for cotton culture in this region would be more than trebled if the rich bottom prairie and the hog-wallow uplands could be rendered available.

SANDY RIDGE LANDS.—The non-calcareous sandy soils which form the higher portions of the dividing ridges in the central prairie region differ but little from the lands similarly situated northward and southward of the prairie belt. In the eastern portion of the region these ridge lands usually bear the long-leaf pine, with a transition belt of oak between them and the hog-wallow lands, while in the western portion the short-leaf pine plays a similar part. In northern Rankin there are some quite extensive tracts of gently undulating oak lands, with a yellow non-calcareous yellow loam soil, and low ridges of a similar character are found in Scott county. Some of these ridges are directly connected with the regions on either side, but many are insular outliers.

The bottom soils of the central prairie region, as has been stated, are largely themselves of a "prairie" character, especially in the eastern portion of the belt. Elsewhere they relate more or less directly to the soils of the country lying to the northward. West of Pearl river especially the soils are often light and very productive, while the hummocks have prevalently the gray silty type.

MARLS OF THE CENTRAL PRAIRIE REGION.—Marls of various kinds and agricultural value underlie the greater portion of the region as outlined on the map, and they frequently crop out on the banks of streams and on hillsides. Not unfrequently they can be reached by digging pits in the fields themselves, so that on the whole they are very generally available for soil improvement. The important results achieved by the use of the same class of fertilizers in Virginia and the Carolinas render a brief description of the chief varieties a matter of direct interest to the agricultural system of Mississippi. Some of these marls are purely calcareous so far as their useful ingredients are concerned; in other words, they are a mass of soft carbonate of lime, mixed with more or less sand and clay, as the case may be. These are very widely diffused, and often pass insensibly into hard limestone on the one hand and into subsoils and soils on the other. The clayey varieties of these marls occur chiefly in the northern portion of the Central prairie region ("Jackson" Tertiary), and are often characterized by the huge bones of the zeuglodon, while the sandy or purely calcareous varieties lie more generally near the southern edge of the region adjacent to the northern limits of the long-leaf pine ("Vicksburg" Tertiary). Their tints are usually white or yellowish-white. The following analyses show the composition of some representative samples:

No. 1794. *Yellowish clay marl* from the banks of the Chickasawhay river, near Dr. Ogburn's, R. 16 E., T. 1, Sec. 21, about 30 feet in thickness, underlaid by brown and reddish clay.

No. 336. *Yellowish clay marl* from Moody's branch, near Jackson, Hinds county, sometimes forming a soft marlstone. Varies in the neighborhood of Jackson from 20 to 45 feet in thickness, and is usually underlaid by a blue shell marl, often too sandy for profitable use.

No. 335. *White marl* from the farm of Dr. Quin, 4 miles southeast of Brandon, Rankin county; a rather friable mass, easily pulverized; forms a stratum 15 to 20 feet in thickness in bluff banks above the drainage.

No. 39. *Yellowish, friable marl* from General W. B. Trotter's plantation, on Chickasawhay river, R. 7. W., T. 10, Sec. 3. Occurs in strata of variable thickness up to 10 feet between limestone ledges on the hillsides and in the river banks. Some is much less pure than the sample analyzed, containing as much as 60 per cent. and over of sand.

White and yellowish marls of central prairie region.

	CLARKE COUNTY.	HINDS COUNTY.	RANKIN COUNTY.	CLARKE COUNTY.
	Dr. Ogburn's. clay marl.	Moody's branch, clay marl.	Dr. Quin's place, white marl.	Trotter's plantation, yellowish marl.
	No. 1794.	No. 336.	No. 335.	No. 39.
Insoluble matter	39.110	37.400	13.074	17.972
Potash	0.436	0.445	0.265	0.321
Soda	0.103	0.208	0.031	0.292
Lime	25.325	28.821	40.222	39.003
Magnesia	1.601	1.407	0.614	0.940
Brown oxide of manganese	0.043		0.067	0.111
Peroxide of iron	3.598	5.133	2.722	2.475
Alumina	6.289			0.298
Phosphoric acid	(?)	0.256	trace.	0.223
Sulphuric acid	0.085		0.058	0.035
Carbonic acid	19.203	23.084	34.754	30.768
Water and organic matter	4.661	3.246	2.050	2.617
Total	100.454	100.000	99.857	100.455

It will be noted that these marls, aside from the carbonate of lime, contain from one-fourth to one-half per cent. of potash, and some as high as one-fourth per cent. of phosphoric acid also. The decided effect produced by a dressing of these marls, diminishing after eight or ten years, long before the lime introduced can have been sensibly diminished, proves that the above ingredients are present in an available form, although the mass contains no visible greensand grains. Dressings may profitably range from 200 to 500 bushels per acre.

The white marls are usually richest in phosphoric acid where the large zeuglodon bones occur within them, but in some cases they are too clayey to be profitably used (as is the case especially in the extreme northern belt of the region) with the stiff subsoil of the black prairies in Madison, Smith, and Scott counties.

The blue marls are more commonly sandy than clayey, and mostly contain well-preserved shells ("shell marls") and some grains of greensand or glauconite, which are rich in available potash. When not too sandy for profitable use (that is, on account of handling too much inert material) they usually contain from one-half to as much as one per cent. and over of available potash, with usually a notable amount of phosphoric acid. On the whole, then, the blue marls are richer in potash and phosphoric acid than the white marls, but also very commonly poorer in lime, because of containing more inert matter.

The following analyses exemplify the composition of some representative samples of blue marls:

Blue greensand marls Nos. 314 and 2224 occur together in the bank of Garland's creek, on Sec. 21, R. 16 E., T. 1, Clarke county. No. 4314 overlies, with a thickness of about 2 feet, the bed represented by No. 2224, with a visible thickness of 5 feet. The first is a greensand shell marl of extraordinary richness both in potash and phosphoric acid; the second, while still having a fair amount of potash, is almost destitute of phosphates, showing how widely and essentially such materials may differ in value even at the same locality. Almost a precisely parallel case occurs in the banks of Pearl river near Byram station, Hinds county.

No. 2232. *Blue marl* from Smith's bridge, Warren county. Details not known.

No. 337. *Blue shell marl* from the bluff at Vicksburg, about midway down the face, about 5 feet thick between ledges of limestone. Somewhat compact, clayey, with visible grains of greensand, and numerous shells not well preserved.

No. 2231. *Blue marl* from the bed of Chickasawhay river, at the mouth of Limestone creek, Wayne county. A rather sandy marl, of which about 2 feet is visible at low water, underlying a heavy bed of white marl similar to that from Quin's (see above, No. 335).

No. 304. *Blue shell marl* from the bed of Shongalo creek, near Austin's mill, about 2 miles north of Raleigh, Smith county. Rather clayey, and somewhat compact.

Analyses of blue greensand marls.

	CLARKE COUNTY.		WARREN COUNTY.		WAYNE COUNTY.	SMITH COUNTY.
	Garland's creek greensand shell marl.		Smith's bridge, greensand marl.	Vicksburg blue shell marl.	Limestone creek, greensand marl.	Austin's mill blue shell marl.
	No. 314.	No. 2224.	No. 2232.	No. 337.	No. 2231.	No. 304.
Insoluble matter	45.881	29.733	21.464	20.967	53.126	62.221
Soluble silica		8.487 = 38.220	9.751 = 31.215		3.661 = 56.787	
Potash	1.717	0.978	0.838	0.753	0.369	0.170
Soda	0.465	0.166	0.193	0.283	0.178	0.056
Lime	14.785	28.167	30.194	37.543	20.793	13.206
Magnesia	2.476	1.482	1.704	2.082	0.830	2.858
Brown oxide of manganese	0.403	0.059	0.084	.....	0.032	0.040
Peroxide of iron	13.020	5.626	4.631	4.722	1.928	2.410
Alumina	7.751	2.602	2.850		0.855	2.965
Phosphoric acid	0.327	0.069	0.038	0.135	0.121	0.159
Sulphuric acid	0.596	0.005	0.220	.....	0.085	1.328
Carbonic acid	12.492	20.019	23.318	30.838	16.273	12.958
Water and organic matter	.....	2.559	4.415	2.657	1.100	2.176
Total	99.883	99.952	99.750	99.980	99.351	99.938

It will be noted that the Warren county marls, while not as rich in potash as those from Clarke, are richer in lime; moreover, other samples analyzed from the neighborhood of Vicksburg show over a fourth of one per cent. of phosphoric acid. As they contain but a moderate amount of inert matter, they may be considered of very good quality. Almost precisely the same kind of marl occurs in the banks of Pearl river at Byram station, and doubtless at many intermediate points in Hinds and Warren, as well as in Rankin.

The marls from Wayne and Smith counties represent the poorer qualities of blue marls, containing too much inert matter for transportation to any distance, but still useful when they can be applied near at hand, especially on the adjacent pine lands. But where the white marls are equally accessible they should be given the preference, on account of their higher percentage of lime.

These marls are especially useful on the "sour" lands of the pine region south of their localities of occurrence, where the gallberry takes possession of the valleys and level lands generally, and they would be eminently useful in the marshes of the coast if they could be cheaply conveyed, as *e. g.*, by floating down the Chickasawhay, Pascagoula, and Pearl rivers.

VII.—LONG-LEAF PINE REGION.

The long-leaf pine region embraces about one-third of the area of the state, viz, 14,800 square miles. It comprehends nearly the entire portion lying south of the "central prairie" belt, and a triangular area north of the same adjoining the Alabama line, which may be roughly circumscribed by lines drawn through Gainesville junction to Lake station, in Scott county, thence to the southeast corner of Clarke county, and thence back to the initial point. On the west, it reaches to within 20 or 30 miles of the Mississippi river, where a belt of loam uplands, timbered with oaks and short-leaf pine, forms a transition to the cane hills that skirt the Mississippi on the east. (See "Oak Uplands Region.")

Within this wide area there is, on the whole, a remarkable uniformity of general character, broken most obviously near the Gulf coast by a narrow belt of land similar to the "pine flats" of Louisiana. The rest of the region is popularly known as the "pine-hills country", with little discrimination as to the quality of the land. A closer discussion, however, both of the timber growth, the soil, and the average product of cotton per acre, as shown by the census returns, justifies a subdivision, as given on the map, of the northern and western part of the region, with its stronger soils and partial oak and hickory tree-growth, from the southeastern portion, where the long-leaf pine prevails almost exclusively, even in the bottoms, where the soil is very sandy, and produces even in the creek bottoms not more than an average of one-fourth of a bale of cotton per acre, as against about one-third in the counties embraced within the division marked by the yellowish-green color on the map. The two divisions, however, grade off into each other so insensibly, and have so much in common, that they are best described together, with special references to the differences in particular localities.

THE LONG-LEAF PINE HILLS.

The surface of the long-leaf pine hills country is generally undulating or rolling, but sometimes it is hilly, especially where the uplands fall off toward the larger water-courses. Between these we frequently find dividing plateaus, which are gently undulating or almost level, this being especially the case where the strata of the drift formation (which underlies the whole region) consist of pervious sands without water-shedding layers. Here the rain-water sinks into the ground, instead of washing out deep valleys and ravines (as is mostly the case in northern Mississippi), and then reappears at or near the drainage level in the form of copious springs.

The surface soil of the uplands is almost throughout quite sandy, partly pebbly or intermixed with coarse sand, as is commonly the case west of Pearl river, or more generally a fine, grayish-white, ashy material, very siliceous,

light, and unretentive. On the larger dividing plateaus the depth of this soil varies from 10 to 18 inches, at which depth it is mostly underlaid by a yellow sandy loam; but sometimes the soil passes directly into the sand strata of the drift, and is then very poor, and scarcely capable of successful cultivation.

The prominent forest tree of the region is the long-leaf pine (*Pinus australis*, Michx.), which near the northern and western border occupies only the higher ridges, but gradually, as we progress southward and eastward, descends, until we find it on the very verge of the bottoms, although it rarely occupies the latter themselves.(*a*) In the uplands it is accompanied by more or less of the black-jack and post oaks, and almost invariably, especially on the hill sides, by some black gum (*Nyssa multiflora*), generally also dogwood (*Cornus Florida*), and, where the soil is stronger, small or medium-sized hickory.

The frequency, size, and shape of these accompanying trees (as well as, less markedly, that of the long-leaf pine itself) mark the variations in the fertility of the soil where, as in the most southerly portion, the short-leaf pine (*P. mitis*) is rare or absent. In the northern and western portions, however, the partial or complete replacement on the ridges of the long-leaf pine by the short-leaf species is the most common intimation of an improvement of the soil. This generally consists of the nearer approach to the surface of the sandy loam subsoil already referred to and its increased clayeyness. In this case also the black-jack and post oak increase in frequency and improve in aspect and the Spanish and scarlet oaks make their appearance. It is chiefly in patches of this character, varying in extent from a few acres to several sections, that the uplands are cultivated to any considerable extent in this region.

Where the long-leaf pine alone prevails the soil is generally so poor that cultivation is altogether confined to the lower hillsides and bottoms. The latter are mostly quite narrow, those of Leaf river and Okatoma and Okahay creeks, in southern Smith county, for instance, rarely exceeding a quarter of a mile. On the larger streams (as on Pearl, Lower Leaf, and Pascagoula rivers) they are often skirted by a second bottom or hummock of equal or greater width, ordinarily inferior in fertility to the first bottoms, but still in general superior to the uplands. The soil of both bottoms and hummocks are of course mostly quite light, but the former especially are quite productive, probably on account of the great depth to which the roots of crops can go. Those of the streams heading in the prairie region, such as Leaf river, the Tallahalas, etc., are of very high quality for some distance below the line of that region from the intermixture of the heavy "bottom prairie" soils with the lighter materials of the pine country. Among the timber of the bottoms the beech generally forms a very prominent ingredient; besides the magnolia, the bottom pine (*P. Tæda*) and black gum are rarely wanting, while the undergrowth is formed by the witch-hazel, calico bush, star anise (*Illicium Floridanum*, here popularly known as "stinking bush"), various species of black haw (*Viburnum nudum*, *V. dentatum*, etc.), bay (*Magnolia glauca*), bay galls (*Laurus Carolinensis*), various species of *Andromeda*, *Leucothoë*, *Vaccinium* or low huckleberry, and especially to the southward the ink-berry (*Prinos glaber*), buckwheat tree or ti-ti (*Mylocarium*), *Cyrilla*, and others.

The herbaceous vegetation and undergrowth of the long-leaf pine uplands is scarcely less characteristic than the timber growth. Wherever the regular burning of the woods, as practiced by the Indians, has not been superseded by the irregular and wasteful practice of the white settlers, the pine forest is almost destitute of undergrowth and appears like a park, whose long grass is beautifully interspersed with bright-tinted flowers. The prevailing grasses are of the broom-sedge tribe (*Andropogon*, *Erianthus*), and next to these those of the millet relationship (*Paspalum*, *Panicum*) in numerous species. The "wire-grass" of Alabama and Georgia is represented only by *Agrostis juncea*, to which the name is here applied; in the southern portions, the curious toothache grass (*Monocera aromatica*) is abundant. Among the flowers there are conspicuous in spring the New Jersey tea (*Ceanothus Americanus*), devil's shoestring (*Tephrosia Virginica*), which in southern Mississippi rarely bears perfect flowers, *Phlox pilosa*, *Hedyotis purpurea*, *Rudbeckia hirta*, *Coreopsis lanceolata*, *Silene Virginica* (crimson catch-fly), *Viola palmata* (wild pansy), *Delphinium exaltatum* (the bright blue larkspur), *Pentstemon pubescens*, and the beautiful *Malva papaver*, whose flowers resemble closely those of the red poppy. Somewhat later, two small species of cassia (*C. nictitans* and *C. Chamæcrista*, sometimes called sensitive plants), *Lobelia glandulosa*, *L. puberula*, two species of Saint Andrew's cross (*Ascyrum Crux-Andreæ* and *A. stans*), the white morning-glory (*Ipomœa pandurata*), and a kind of wild lettuce (*Hieracium Gronovii*), also *Pycnanthemum linifolium* (fine-leaved horsemint), become very prominent. Thereafter the autumnal flora consists of many plants of the sunflower family: of true sunflowers, *Helianthus angustifolius*, *H. occidentalis*, and *Chrysopsis sericea*, *Mariana;* of golden rods, *Solidago odora*, *S. altissima*, *S. leptocephala*, many species of aster, among which *A. conecla* is characteristic; also *Sericocarpus tortifolius*, *Diplopappus ericoides*, *Eupatorium rotundifolium* (wild hoarhound), *parviflorum*, and in the bottoms several species of *Stevia*. Several species of *Liatris*, as *L. odoratissima* (vanilla plant), *L. pycnostachya*, *L. gracilis*, *L. squarrosa*, *L. scariosa* (rattlesnake's master), *Gnaphalium margaritaceum* (wild everlasting), and many other *compositæ*. Of the mint tribe, *Monarda punctata* (horsemint), *Hyptis capitata*, and *Pycnanthemum incanum* are prominent, while *Gerardia pedicularis*, *Herpestis nigrescens*, and sometimes *Gerardia purpurea* represent the *Scrophularineæ*.

The farther we advance southward the more numerously various species of huckleberry and whortleberry (*Vaccinium*), most of which flower in spring, are represented among the undergrowth; and similarly the gallberry (*Prinos glaber*) and candleberry (*Myrica cerifera* and *M. Carolinensis*) increase in a southward direction, until, near the sea-coast, they become very abundant.

a This fact should exclude from use, as misleading and contrary to facts, the earlier name of "*Palustris*", applied to the species by Linnæus.

Where strata not pervious to water underlie the soil at no great depth wet places, terminating in little branchlets, which afterward often sink into the sand, are formed. In these "pine hollows" we find a flora somewhat resembling that of the "pine meadows" of the coast, such as the candleberry, cord-rush (*Eriocaulon decangulare, E. villosum*), the yellow star grass (*Aletris aurea*), the *Xyris*, *Pinguicula*, sundew (*Drosera brevifolia*), the *Mitreola sessiliflora, Rhexia ciliosa, Eryngium virgatum*, and in the more southern portion the pitcher-plants (*Sarracenia variolaris, S. Psittacina*) and gallberry. The dark-colored soil, or muck, of these pine hollows is not unfrequently used for the improvement of garden plots, and where they are not too wet the hollows themselves are cultivated by preference.

Such being with considerable uniformity the character of the bulk of the long-leaf pine region, its description requires the mention of the exceptions rather than of the rule.

Along the northern limit of the region as far east as Raleigh, Smith county, we generally find some rather abrupt rocky ridges overlooking the prairie country to northward. The body of these ridges is formed by the white or gray "Grand Gulf sandstone" (see Geological features), often capped on top with some of the brown sand-rock of the drift. Southward the sandstone is gradually replaced by blue and green clays, which, east of Pearl river, lie mostly low down on the hillsides or in the valleys, covered by sometimes as much as 200 feet of sands of the stratified drift. Hence the region east of Pearl river is more of a plateau character, while on the west, where the white sand-rock extends as far south as the Louisiana line, it is frequently broken into abrupt ridges or "backbones". Such is the case especially in Copiah and in portions of Lincoln and Franklin, extending into Wilkinson, and to a less degree in the region intervening between the pine hills and the Mississippi river. A corresponding state of things exists in the upland portion of Louisiana lying opposite (see description of Louisiana, p. 20).

As in Louisiana, we occasionally meet in the pine hills of Mississippi isolated bodies of more fertile soil, where the long-leaf pine is partially or wholly replaced by the short-leaf species, or even altogether by oaks. One of the largest of such "coves" lies in Covington county, south of Mount Carmel, on the waters of White Sand creek (see analysis below), occupying several sections, and similar ones are met with more or less in the northern and western long-leaf pine region, where they are usually marked by flourishing settlements. Elsewhere, the fact that cultivation is restricted to the narrow bottoms of necessity causes the inhabitants to be much scattered along the streams.

Broadly speaking, the soils in the county lying east of Pearl river are more sandy than those to the westward, where, as we advance toward the Mississippi, the retentive subsoil comes nearer the surface, and thus gives rise to soils which, if not naturally thrifty, are at least susceptible of ready and permanent improvement, having a good foundation of loam subsoil of considerable depth. At the same time the bottom soils are correspondingly stronger. Such is the case in Copiah, Lincoln, Pike, and adjacent counties, while from Jones and Marion counties, east and southward, the soils of both uplands and lowlands become in general lighter and less retentive. As a matter of course, the bottoms of the larger streams, such as the Chickasawhay, Pascagoula, and in part Leaf river and its larger tributaries, are frequently of great fertility.

SOILS OF THE LONG-LEAF PINE REGION.—No. 205. *Soil* from the dividing ridge between the waters of Strong river and Silver creek, R. 19 W., T. 10, about Sec. 9, 2 miles east of Westville, Simpson county. This is one of the ridges timbered with short-leaf pine and oaks, post, Spanish, scarlet, and some black oak, and more or less hickory. The undergrowth is mainly copal sumach (*Rhus copallina*). This is substantially the same kind of land as that on which the town of Westville stands. The soil is gray and very ashy or sandy for an inch from the surface, then becomes of a dun color and more compact for about 6 inches, when it merges into the subsoil.

No. 192. *Subsoil of the above*, taken from 6 to 15 inches depth. A coarse, sandy loam, of a deep yellow or orange tint.

No. 206. *Soil from the long-leaf pine plateau* forming the divide between Okatoma and Okahay creeks, in the north half of T. 10, R. 16 W., Smith county. This is an open, long-leaf, pine country, with here and there a post oak, and more rarely a medium-sized black-jack, black gum, or hickory, the ground being covered with broom-sedge (*Andropogon*), devil's shoestring (*Tephrosia*), etc. Soil, about 5 inches; an ashy, yellowish-white material, with very little coarse sand.

Subsoil of the above, from 5 to 12 inches depth. A pale yellow, sandy loam. Not analyzed.

No. 209. Under subsoil of the above, dark yellow or orange loam, much stiffer than the subsoil. Specimen taken from the depth of 12 to 18 inches, but continues to 25 inches and more, when it is underlaid in its turn by stratified sand.

No. 292. *Subsoil of level oak uplands* on the waters of White Sand creek, R. 19 W., T. 7, Lawrence county. The soil here is a red or orange loam, mixed with much coarse sand, and produces good cotton and excellent corn. The subsoil, taken at 8 to 18 inches depth, is a kind of coarse, sandy hard-pan of a deep orange tint.

No. 249. *Subsoil loam* from the landward edge of the hummock of the Bogue Chitto river, R. 9 E., T. 3, S. 26, H. M. Quin's land. A yellow, rather light loam, resembling the subsoil of the pine woods, but here forming a deposit about 23 feet thick, skirting the bottom to the hills. Timber, oak and hickory; soil little different from the subsoil, which was taken at the depth of 10 to 18 inches.

No. 218. *Pine land soil* from near Summit station, on the Chicago, Saint Louis, and New Orleans railroad, Pike county, on the dividing ridge between the Bogue Chitto and the Tangipahoa rivers, 480 feet above tide-water. A rolling or sometimes hilly country, timbered in the main with long-leaf pine, with which the short-leaf species occasionally mingles; also more or less of oaks, as black-jack, post, black, and Spanish. The ashy surface soil is generally much more shallow here than farther eastward, and is frequently replaced by the sandy loam that elsewhere forms the subsoil. The sample analyzed was taken to the depth of 9 inches, and is a sandy loam of a buff tint.

No. 222. Subsoil of the above, taken from 9 to 20 inches depth. An orange yellow, rather sandy loam.

Long-leaf pine lands.

	Simpson county.		Smith county.		Lawrence county.	Pike county.		
	Dividing ridge between Strong river and Silver creek (R. 19 W., T. 10, S. 9).		Dividing ridge between Okatoma and Okahay creeks (R. 16 W., T. 10, N. ½).		White Sand creek, level oak uplands (R. 19 W., T. 7 S.).	R. 9 E., T. 3, S. 26.	Summit station (R. 6 E., T. 4, S. 25).	
	Pine ridge.		Pine hills.		Red subsoil loam.	Bogue Chitto underclay.	Soil.	Pine land subsoil.
	Soil.	Subsoil.	Soil.	Under subsoil.				
	No. 205.	No. 192.	No. 206.	No. 209.	No. 292.	No. 249.	No. 218.	No. 222.
Insoluble matter	92.626	86.756	93.257	83.030	81.229	87.144	89.801	77.931
Soluble silica	2.024	4.778			6.689	3.824		
	94.650	91.534			87.918	90.968		
Potash	0.074	0.169	0.259	0.485	0.269	0.140	0.218	0.266
Soda	0.048	0.034	0.065	0.061	0.105	0.075	0.076	0.072
Lime	0.061	0.038	0.129	0.073	0.059	0.059	0.034	0.152
Magnesia	0.112	0.229	0.180	0.519	0.243	0.145	0.396	0.352
Brown oxide of manganese	0.117	0.114	0.146	0.153	0.046	0.080	0.072	0.095
Peroxide of iron	1.268	2.219	1.251	4.145	3.647	2.744	2.402	5.456
Alumina	1.475	3.600	2.356	8.393	5.114	3.705	3.783	11.870
Phosphoric acid	0.069	0.041	0.030	0.022	0.101	0.065	0.038	0.043
Sulphuric acid	0.004	0.004	0.024	0.021	0.138	0.306	0.036	0.035
Water and organic matter	2.075	1.645	2.330	3.117	2.681	2.191	3.446	3.261
Total	99.948	99.627	100.027	100.519	100.321	100.478	100.212	99.533
Hygroscopic moisture	2.19	4.04	2.48	7.09	6.68	2.20	4.11	10.00
absorbed at	22 C.°	22 C.°	19 C.°	19 C.°	18 C.°	18 C.°	21 C.°	21 C.°

The mechanical analysis of a representative soil and its subsoil gave the following results:

Smith County pine hills.

	Soil.	Subsoil.
	No. 206.	No. 209.
MECHANICAL ANALYSIS.		
Weight of gravel over 1.2^{mm} diameter		
Weight of gravel between 1.2 and 1^{mm}	0.4	0.4
Weight of gravel between 1 and 0.6^{mm}	3.0	0.8
Fine earth	96.6	98.8
Total	100.0	100.0
MECHANICAL ANALYSIS OF FINE EARTH.		
Clay	4.6	10.9
Sediment of <0.25^{mm} hydraulic value	30.7	38.3
Sediment of 0.25^{mm}	14.8	17.0
Sediment of 0.5^{mm}	14.6	7.9
Sediment of 1.0^{mm}	6.8	5.4
Sediment of 2.0^{mm}	3.6	2.6
Sediment of 4.0^{mm}	1.2	0.6
Sediment of 8.0^{mm}	1.6	1.5
Sediment of 16.0^{mm}	3.0	3.9
Sediment of 32.0^{mm}	8.1	3.4
Sediment of 64.0^{mm}	6.9	6.3
Total	95.9	97.8

A comparison of the composition of these soils with that of the soils analyzed from the short-leaf pine and oak uplands of northern Mississippi does not show any wide divergence. As regards the physical properties, it appears from the hygroscopic coefficients that the long-leaf pine surface soils are, on the whole, less retentive, being more sandy than the latter, and continuing so to a greater depth, viz, from 8 to 12 inches, while in the northern Mississippi soils the more retentive and fertile subsoil lies generally within from 5 to 7 inches of the surface, and can readily be made to form a part of the tilled soil. Hence the long-leaf pine soils are generally more droughty, as even their subsoil is usually underlaid at no great depth by loose sand; otherwise the mechanical analyses given show for the latter subsoil a composition of a light but adequately retentive loam, whose intermixture with the soil by means of deep tillage should be accomplished whenever practicable.

In regard to chemical composition, a low percentage of phosphoric acid seems to prevail throughout, ranging between 0.020 and 0.040 of 1 per cent., while in the short-leaf pine soils the average is above 0.050. The average potash percentage ranges between 0.250 and 0.300 in both regions, and may be considered adequate, but is doubtless to a great extent unavailable in the absence of a sufficient supply of lime. An application of lime, here as elsewhere, at once causes a disappearance of the pine growth and its replacement by oaks, as is abundantly shown near the edge of the pine region lying toward lime formations.

Summarily, deep tillage and the use of lime and phosphates are indicated as the proper or at least the most direct, and therefore cheapest, means of improving the upland soils of the long-leaf pine region wherever a reasonably thick layer of loam subsoil underlies. Where this is wanting the soil is hardly susceptible of profitable improvement for general culture for many years to come. It is scarcely fair, however, to gauge the possible utility of these soils by the results obtained in the culture of cotton and corn, almost the only crops ordinarily attempted. There are many crops specially adapted to soils of this character which will in time find their way into practice. Prominent among these is the peanut or goober pea. Among forage plants the lupins and others of the pea family grown in the dry regions of southern Europe should command attention.

The marls of the adjacent "prairie region" will doubtless in time be extensively used for the improvement of the pine lands, and will relieve one of the great obstacles to thriftiness: deficiency in lime. There is another resource available to a considerable extent, and even now utilized by thrifty farmers in this region, viz, the fallen leaves or straw of the pines themselves. This can be obtained in enormous quantities at the proper season at very little expense, and this practice should altogether replace the wasteful and irrational one of burning the woods every autumn, whereby not only the pine straw, but also the roots of the pasture grasses, have been almost destroyed, converting the park-like slopes of the long-leaf pine forest into a dreary waste of useless weeds and blackened trunks and seriously injuring the pine timber, especially where it has been used for the gathering of turpentine. In this case the annual fires soon destroy the trees, smeared as they are with the combustible pitch; and it is thus that many entire townships of once splendid forest now stand almost valueless for any present purpose, and with little prospect of practical utility for many years to come unless restocked with pasture grasses by artificial means.

PINE STRAW.—As regards the possible utility of "pine straw" for soil improvement, the following analysis will give some light.

The leaves were collected, freshly fallen, about October 1, 1858, in southern Smith county, on the plateau land where the soil samples Nos. 206 and 209 were taken. The air-dried "straw", carefully freed from adhering impurities, yielded 2.5 per cent. of ash. The composition of the latter (calculated exclusive of about 6.5 per cent. of carbonic acid) was found to be as follows:

Ash of long-leaf pine straw.

	Per cent.
Silica	65.242
Potash	5.530
Soda	0.416
Lime	13.860
Magnesia	5.208
Brown oxide of manganese	1.681
Peroxide of iron	0.141
Alumina	4.539
Phosphoric acid	1.154
Sulphuric acid	0.839
Potassium chloride	1.479
Total	100.089

Notwithstanding the unusually low percentage of phosphoric acid shown by this analysis, the composition of this straw is such that about 1,400 pounds of it would amply replace the drain upon the soil caused by the growing of one bale of cotton lint, provided the seed and stalk be also returned.

In the sandy, unretentive soils of the region, however, the pine straw turned under by the plow directly will sometimes not decay for one or two seasons, and thus renders the soil too open for cultivation in the interval. It

should therefore be first used as a material for composting, whether with earth, muck, stable manure, or marls, bone-meal, etc., as the case may be, and only applied to the land after it is decayed. This practice is already pursued in the older states with excellent results.

It is thus possible to concentrate the fertility of a large area of pine land upon a small portion kept in a high state of culture, instead of, as heretofore, laboriously clearing large areas, whose profitable fertility lasts only a few years and then suddenly "gives out", in consequence, probably, of the exhaustion of the plant-food, accumulated near the surface during many years by the decay of the pine leaves. Whether it will be best to apply this system to the production of cotton on these pine lands, or whether other branches of husbandry could, on the whole, be more profitably pursued, is a question that must be largely determined by local and commercial conditions. Since cotton, so long as the seed is regularly returned to the soil, is probably the least exhaustive crop known, its culture would seem to be specially adapted to lands of limited natural resources under an intelligent system of farming.

BOTTOM SOILS OF THE LONG-LEAF PINE REGION.—The bottom soils of the long-leaf pine region are usually, of course, very light, often positively sandy, and in that case often not very durable. This condition of things is, however, measurably varied and relieved by the circumstance that over a large portion of the area the streams cut into the clayey strata underlying the drift sand prevailing on the hills, and thus, by an intermixture of the two materials, the alluvial soils of the larger streams especially are rendered much stronger and more thrifty than is the case with those derived alone from the washings of the uplands. Moreover (as has already been mentioned), the streams heading northward of the pine region, in the heavy clay areas of the "central prairie region", carry the character of the latter down with them for some distance into the pine hills.

It thus happens that the character and productiveness of the bottoms of this region vary very greatly from one stream to another, and cannot be defined in a general manner. In some cases, the older and the newer deposits of the same stream (the "first" and "second" bottoms) differ to an extreme degree, proving a progressive, but occasionally a very abrupt, change of conditions in respect to the sources from which the alluvial soils were derived.

These variations are exemplified in the subjoined analyses of soils from the various portions of this extensive region, although not nearly all the practically important differences are here represented.

No. 361. *Soil from the hummock of bayou Pierre*, R. 2 W., T. 14 N., Copiah county. The exact locality from which this soil was taken is not known. The timber was mainly beech, and the soil was originally very fairly productive, but is becoming exhausted. It is a gray, rather silty or powdery soil, moderately retentive, and is very easily worked.

No. 360. *Subsoil of the above.* Whitish-gray, lighter colored than the surface soil, and containing more or less of small, roughish bog-ore concretions; a shade more sandy or silty than the soil.

No. 343. *Soil from the hummock or second bottom of Bûhala creek*, R. 9 E., T. 9, Copiah county. Very similar in appearance to No. 361; whitish, silty, with but little coarse sand. Taken to 10 inches depth.

No. 344. *Subsoil of the above*, taken from 10 to 20 inches depth. Quite similar to No. 360.

No. 67. *Bottom soil from the west fork of Amite river*, R. 4 E., T. 5, Sec. 36, Franklin county, land of Mr. Joseph R. Coten. White, "crawfishy;" timber, bottom pine (*P. Tæda*), chestnut-white, white, and water oaks, some black and red (?) oaks, ironwood, sweet gum, some small hickory, holly, and red haw. The soil at the surface is ashy, but becomes more clayey downward. Samples taken to the depth of 10 inches. It produces good cotton, a small stalk, but well bolled; corn does not succeed. Being low and ill-drained, it is difficult to obtain a stand. This soil does not occur in large bodies here, most of the bottom being of the character of No. 66, but is more prevalent lower down on the stream. A soil similar in appearance to this, but much poorer, and characterized by post oak and huckleberry, occurs in the "upland ponds" of this region.

No. 70. *Subsoil of the above*, taken to the depth of 10 to 20 inches. Apparently less retentive than the surface soil and lighter tinted, but containing small grains of bog ore intermixed.

No. 66. *Dark bottom soil from the west fork of the Amite*, same locality as the preceding, and but a short distance from the spot. Dark brownish black, without change for 2 feet; a moderately clayey loam. Timber, large magnolias and hollies, beech, chestnut-white and white oaks, some ash, sweet gum, and poplar (tulip tree), all very large; a highly productive soil, making a 400-pound bale of cotton per acre, but not occurring in large tracts, and scarcer farther down the stream. Its timber is tall and stout, in contrast with the comparatively thin and lank growth on the white soil.

No. 80. *Second bottom or hummock soil* from Bogue Chitto creek, R. 9 E., T. 3, Sec. 17, H. M. Quin's land, Pike county. Timber growth, magnolia, sweet gum, "poplar," sassafras, hickory, all very large; some beech (chiefly on the bank itself and in sandy spots), white oak, chestnut-white oak, hornbeam, ironwood, holly, black or stag-horn sumach (*Rhus typhina*, here called "white sumach", a name elsewhere given to *Rhus venenata*, or varnish tree). The soil is a dark-colored, light loam, scarcely varying to the depth of 30 inches; sample taken to that of 12 inches. It is a highly esteemed soil, very productive when fresh, and has scarcely diminished its product in six years.

No. 194. *Bottom soil from the first bottom of Okahay creek*, R. 15 W., T. 10, about S. 21, Smith county. A brownish-gray, light loam, bearing a heavy growth of white and chestnut-white oak, as well as hickory and beech;

also water and willow oaks, black and sweet gum, etc., and, close to the stream, large magnolias. Very productive, but very limited in area, the bottom being scarcely over one-fourth of a mile wide, but well settled.

No. 11. *Bottom soil from the bottom of Buckatunna creek*, Wayne county, near the crossing of the Mobile and Ohio railroad, south side. This soil is rather heavy, of a brownish tint for 10 inches, then getting heavier and of a lighter tint to 20 inches depth. The timber is sweet gum and bottom pine (*P. Tæda*). Near the creek, where the soil is somewhat lighter, large magnolias occur. The soil of the second bottom (about 3 feet higher and more extensive than the first, which is subject to overflow) is nearly the same, and ought to be profitable in cultivation.

No. 19. *Bottom soil from the first bottom of Chickasawhay river*, near Mr. W. P. Avera's, R. 6 W., T. 5, Sec. 36, Greene county. A high bottom, rarely overflowed; soil light "mulatto" color, of variable depth, underlaid partly by sand and partly by orange-colored clay. Timber mostly very large, consisting of ash, red elm, willow and Spanish oak, sweet gum, magnolia, tulip tree, and some very large black gum; undergrowth, buckeye (*Æsculus discolor*), *Illicium Floridanum* (star anise), and red-bud. Yields about 30 bushels of corn; cotton not tried. There is not much of this high bottom land; most of it is low and sloughy, but the character of the soil is about the same.

No. 8. *Soil from the first bottom of Pascagoula river*, R. 7 W., T. 2, Sec. 6, Jackson county. A dark-colored, heavy soil (hence is designated as "bottom prairie") down to 9 inches depth, where it is underlaid by a heavy gray clay subsoil to 30 inches depth. Timber, prevalently chestnut white oak, sweet gum, holly, Spanish oak (*Q. falcata*), magnolia (*grandiflora*), all very large trees; also some water and willow oak, a good deal of hornbeam, some mulberry, and staghorn sumac, and a little bottom white pine. This soil produces fine corn when not overflowed too late; cotton not yet tried.

No. 18. *Soil from second bottom or hummock of Pascagoula river*, same locality as the preceding, but lying from 4 to 6 feet higher than the first bottom, and not subject to overflow. Timber, white oak, bottom white pine, magnolia, water oak, chincapin, some holly and ironwood, and a good deal of very large staghorn or black sumach. The soil is of a dark chocolate tint and quite light, underlaid at 10 inches depth by a very sandy, yellow subsoil. This soil is also very productive, and, being much safer than that of the first bottom, is chiefly cultivated in the region. Cotton is hardly grown here; has a disposition to run to weed.

No. 25. *Subsoil of the above*, 10 to 20 inches depth.

Bottom and hummock lands of the long-leaf pine region.

	COPIAH COUNTY.				FRANKLIN COUNTY.		
	R. 2 W., T. 14, Bayou Pierre hummock.		R. 9 E., T. 9, Bahala second bottom.		R. 4 E., T. 5, S. 36, West Amite white bottom.		R. 4 E., T. 5, S. 36, West Amite.
	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.	Bottom soil (dark).
	No. 361.	No. 360.	No. 343.	No. 344.	No. 67.	No. 70.	No. 66.
Insoluble matter	86.169	88.511	81.570	81.420	91.384	90.490	87.548
Soluble silica			4.003 = 85.573	3.925 = 85.345		3.382 = 93.872	
Potash	0.253	0.333	0.499	0.357	0.270	0.150	0.486
Soda	0.050	0.067	0.257	0.208	0.103	0.045	0.054
Lime	0.121	0.125	0.090	0.129	0.134	0.055	0.215
Magnesia	0.180	0.277	0.546	0.377	0.137	0.120	0.354
Brown oxide of manganese	0.245	0.342	0.041	0.089	0.141	0.085	0.690
Peroxide of iron	2.700	2.369	3.233	3.409	1.241	1.771	5.628
Alumina	6.301	6.106	6.182	6.885	3.729	2.542	3.407
Phosphoric acid	0.100	0.087	0.047	0.091	0.149	0.048	0.100
Sulphuric acid	trace	0.049	0.035	0.009	0.022	0.005	0.048
Water and organic matter	4.177	2.516	3.788	3.354	2.961	1.628	3.507
Total	100.296	100.782	100.291	100.253	100.221	100.321	100.932
Humus							
Available inorganic					0.717		
Hygroscopic moisture					1.603		
absorbed at	5.30 19 C.°	5.23 10 C.°	6.74 8 C.°	6.18 4 C.°	2.83 20 C.°	3.77 22 C.°	5.52 6 C.°

Bottom and hummock lands of the long-leaf pine region—Continued.

	PIKE COUNTY.	SMITH COUNTY.	WAYNE COUNTY.	GREENE COUNTY.	JACKSON COUNTY.		
	R. 9 E., T. 3, S. 17, Bogue Chitto.	R. 15 W.. T. 10, S. 21, Okahay.	R. 5, W., T. 6, S. 6, Buckatunna.	Avera's place, R. 6 W., T. 5, S. 36, Chickasawhay.	R. 7 W., T. 2, S. 6, Pascagoula.	R. 7 W., T. 2, S. 6, Pascagoula hummock.	
	Second bottom soil.	Bottom soil.	Bottom soil.	Bottom soil.	"Prairie" bottom soil.	Soil.	Subsoil.
	No. 80.	No. 194.	No. 11.	No. 19.	No. 8.	No. 18.	No. 25.
Insoluble matter	85.376	84.000	71.332	91.816	71.069	94.200	90.336
Soluble silica	3.802 } 89.178	3.037 } 87.736	9.321 } 80.653	1.724 } 93.540	8.729 } 79.798	0.741 } 94.941	1.850 } 92.186
Potash	0.136	0.149	0.211	0.122	0.312	0.115	0.173
Soda	0.060	0.078	0.139	0.076	0.057	0.025	0.035
Lime	0.090	0.418	0.157	0.091	0.082	0.076	0.132
Magnesia	0.188	0.099	0.489	0.142	0.321	0.081	0.153
Brown oxide of manganese	0.150	0.262	0.216	0.035	0.140	0.029	0.083
Peroxide of iron	1.821	2.107	4.580	1.210	4.638	0.604	1.373
Alumina	3.497	2.107	8.526	1.373	6.358	1.158	1.941
Phosphoric acid	0.063	0.149	0.132	0.060	0.042	0.086	0.057
Sulphuric acid	?	0.007	trace	0.005	0.008	trace	trace.
Water and organic matter	4.571	6.619	7.372	3.307	7.904	2.777	4.496
Total	99.754	99.731	102.475	99.961	100.160	99.892	100.629
Hygroscopic moisture	4.72	6.61	9.01	4.29	11.96	2.14	4.15
absorbed at	18 C.°	22 C.°	10 C.°	22 C.°	22 C.°	22 C.°	22 C.°

As might be expected, these soils are extremely variable in composition, according to location. The greatest differences are manifestly due to the derivation of the soils from sources lying outside of the pine region, especially in the case of such as head among the rich, heavy clays of the central prairie region, like the Okahay and Buckatunna. The character of a great majority of these soils is that of a light sandy loam of no great depth, and, in view of that fact, very deficient in lime and phosphoric acid and not rich in potash, as might be expected from the character of the uplands from whose washings they have been derived. In the more southern portion of the region, where heavy, impervious clays underlie everywhere at no great depth, the subsoil, though itself still light, is frequently ill-drained, and remains water-soaked until late in the season: a condition of things usually made manifest by the prevalence of the ink-berry or gallberry, wax myrtle, and other plants of like habit. These disappear very strikingly as we approach the calcareous regions on either side, and equally striking is the increased thriftiness of the soils, concurrently with the increase of their lime percentage, even while that of the phosphates and potash percentage remains small. The natural inference is that among the most important improvements to be made within the long-leaf pine region, both on uplands and lowlands, is the use of lime or of the calcareous marls so abundantly present in the "central prairie region". Phosphate manures are indicated as next in importance by the uniformly small amounts of these substances shown by the analysis. In this, as in other respects, it is interesting to compare the analyses of the two kinds of bottom soils occurring on the west fork of the Amite in Franklin county. The two lie nearly at the same level in immediate proximity, and must have been originally of the same composition; but the white soil and subsoil (Nos. 67 and 70) have been subjected to the leaching action of stagnant water in consequence of imperviousness of the underlying hard-pan. Perhaps these very leachings have contributed to the high percentages of potash and lime found in the dark soil (No. 66), which is little inferior in quality as well as in depth to the bottom soils of the Tallahatchie river (see Mississippi bottom region). Nos. 194 and 11, though somewhat deficient in potash, show good cause for their exceptional thriftiness in the proportions of lime and phosphoric acid, which are considerably above the average.

The white hummock soils from Copiah rank as of medium quality only, that of bayou Pierre being superior to the Bahala soil both as regards lime and phosphates, the more so as a portion of the phosphoric acid shown for the subsoil is doubtless contained in the unavailable form of bog ore. Both would be materially improved by the use of the marls occurring on Pearl river, not far away; but bone-meal or superphosphate will be wanted on them before long.

The second bottom soil of Bogue Chitto, No. 80, is rather a remarkable case as showing high fertility, both from its timber and from the results of cultivation, and yet containing low percentages of all the chief ingredients of plant-food. But the fact that it is almost the same to the depth of 3 feet, and pervious and well-drained, explains the apparent anomaly. It is a parallel to the esteemed cotton soil of the middle Homochitto, No. 68, which would be thought a poor soil from its low percentage of plant-food, but makes up for this deficiency by its extraordinary depth of from 3 to 4 feet. (See cane hills region under head "Oak Uplands Belt".)

A similar saving clause applies to the Chickasawhay bottom soil, No. 19, almost identical in composition with the Bogue Chitto soil just referred to, but not quite so deep nor so well drained, and hence less productive.

The analyses of the Pascagoula soils are also very instructive. The prairie bottom soil, No. 8, looks by far most promising, but until late in the season it is very heavy and ill-drained. Hence in cultivation the hummock soil, No. 18, is preferred, which has not only the advantage of a larger supply of phosphates, though less of potash, but is well drained, and is of considerable depth. It would require heavy dressings of lime or marls and the use of phosphate manures to render No. 8 at all available for profitable culture, because in it the roots can only penetrate to one-third or one-half the depth that is easily reached in the lighter hummock soil.

PEARL RIVER SOILS.—Almost throughout its course Pearl river is bordered by comparatively narrow bottoms and rather wide second bottoms or hummocks. At Jackson, for instance, the first bottom is about half a mile in width, and beyond it lies an almost level second terrace, 5 to 6 feet above the flood-plain, 2½ to 3 miles wide, and differing widely both in soil and timber from the first bottom. Southward this feature becomes perhaps even more pronounced, the first bottom being often of insignificant width only in the long-leaf pine region, while the second bottom, or "flat", as it is there commonly called, is from one mile to several miles wide. It thus forms an important portion of the readily available arable area of the region, and numerous soil specimens representing these lands have been collected at different points. The following are the only analyses thus far made, but they afford an insight into the general character of these lands:

No. 181. *Hummock soil* from the flat of Pearl river, R. 21 W., T. 7, Sec. 23, opposite Monticello, Lawrence county. The level country here is from 1 to 1½ miles wide and is well cultivated. The land is timbered with bottom pine (*P. Tæda*), sweet and black gum, water and willow oaks, etc. The soil is of a pale mouse-color, quite light, and rather silty to about 6 inches depth.

No. 182. Subsoil of the above, taken from 6 to 18 inches depth. This soil is a little heavier than the surface soil, so as to retain manure, and is of a pale-yellow tint. Below the depth mentioned the material becomes gradually lighter, and finally white and more sandy, with numerous brown spots of bog ore, occasionally washed out as "black pebble". The surface of the flat is about 20 feet above low-water level.

No. 61. *Hummock soil* from the flat of Pearl river, R. 18 W., T. 2 N., Sec. 26 (?), 3 miles below the mouth of South Little river, Marion county. Soil light, rather silty, and of a mouse color; taken to the depth of 6 inches. Timber: bottom pine prevalent; water, willow, white, and Spanish oaks, not large; small sweet gum, some small sassafras, staghorn sumac, dogwood, Spanish mulberry (*Callicarpa*), grape-vines, and huckleberry. No settlements near, but a similar soil at Spring Cottage post-office yields fair crops.

No. 62. Subsoil of the above, taken from 6 to 20 inches depth. Pale yellow, more retentive than the surface soil, and apparently more so than No. 182.

No. 60. *Bottom soil* of Pearl river, from R. 17 W., T. 1 N., Sec. 6, Mr. Ford's land. Soil blackish, apparently rather heavy, cracking open in the dry season. Taken to the depth of 10 inches. Timber mostly very large, especially the sweet gum, which is very prevalent; pignut hickory, water, Spanish, basket, and black oaks, hornbeam, ironwood, snowdrop tree, styrax, some mulberry, beech in low places, grape-vines (*V. æstivalis*), cissus, hop tree (*Ptelea*), staghorn sumac, and but little magnolia. The timber denotes a strong soil, which produces very well and tills easily, but the late overflows often belate the crops.

No. 63. Subsoil of the above, taken from 10 to 20 inches depth. Differs little from the surface soil in aspect, and seems to continue unchanged to a greater depth.

Pearl River hummock and bottom lands.

	Lawrence county.		Marion county.			
	R. 21 W., T. 7, S. 23.		R. 18 W., T. 2 N., S. 26 (?).		R. 17 W., T. 1 N., S. 6.	
	Hummock.		Hummock.		Bottom.	
	Soil.	Subsoil.	Soil.	Subsoil.	Soil.	Subsoil.
	No. 181.	No. 182.	No. 61.	No. 62.	No. 60.	No. 63.
Insoluble matter	94.384	89.008	87.520	85.354	87.024	85.212
Soluble silica	1.738 } 96.122	4.494 } 93.502	2.696 } 90.216	4.824 } 90.178	0.802 } 87.826	3.992 } 89.204
Potash	0.107	0.155	0.124	0.169	0.174	0.212
Soda	0.053	0.077	0.068	0.076	0.069	0.051
Lime	0.660	0.058	0.113	0.054	0.078	0.071
Magnesia	0.060	0.167	0.141	0.212	0.278	0.167
Brown oxide of manganese	0.066	0.077	0.124	0.065	0.078	0.090
Peroxide of iron	0.612	1.660	1.830	2.774	2.511	3.021
Alumina	0.818	2.187	3.526	4.134	2.674	4.084
Phosphoric acid	0.014	0.130	0.069	0.059	0.146	0.100
Sulphuric acid	0.006	0.006	0.016	0.005	0.008	0.006
Water and organic matter	2.182	1.723	4.251	2.320	5.041	3.563
Total	100.100	99.742	100.278	100.046	99.783	100.569
Hygroscopic moisture	2.35	4.15	4.41	5.67	8.49	9.60
absorbed at	19 C.°	19 C.°	21 C.°	.....	23 C.°	22 C.°

On the whole, the composition of these soils agrees with that of corresponding soils in the rest of the long-leaf pine region. The low potash percentage of the hummock soils is quite striking, and the same feature is apparent in the bottom soil. No. 181 is in fact throughout a very inferior soil in every respect, but is somewhat redeemed by the high phosphate percentage of its subsoil. Both are poor in lime, and little durability can be expected of them. When "tired", the land will require complete manures to restore profitable productiveness. Nos. 61 and 62 reflect the better quality of the timber in their composition, especially in the higher percentages of potash and lime, to which is added a greater depth of the more substantial subsoil. Still these soils cannot be durable in their natural productiveness, and manuring must soon be resorted to by those cultivating them.

The bottom soil, Nos. 60 and 63, differs materially by the higher percentages of phosphoric acid in both soil and subsoil, with likewise a somewhat larger amount of potash. In lime it is still low, and the use of marl would doubtless be one of the most important improvements in its cultivation. The large timber seems to indicate that some important supplies of plant-food come from a greater depth than the 20 inches represented above, whose composition does not, apparently, justify either the character of the natural growth or the good reports from its cultivation. As compared with the hummock soils, it has, of course, the advantage of abundant moisture, for the crop failures in the "flat" are largely due to droughts, which quickly injure such leachy lands.

THE PINE FLATS REGION.

The "pine flats" are not as extensively represented in Mississippi as in Louisiana. At several points (as near bay Saint Louis) the long-leaf pine ridges, with their characteristic soil and vegetation, reach almost to the Gulf coast. Unlike the marshy belt that fringes the Louisiana coast, the shore-line of Mississippi sound is almost throughout characterized by a bluff bank 10 to 25 feet high, consisting of sandy materials in its upper portion at least, while near the water's edge there appear not unfrequently gray or black clays, with cypress stumps, precisely as is the case at Côte Blanche, Petit Anse, and Grande Côte, in Louisiana. The marshes are small and local, so as to scarcely deserve representation on the map until the mouth of Pearl river is approached. Here also, however, all but a small area of marsh falls within the limits of the state of Louisiana.

Almost throughout this region thus far agriculture is practiced only on a very limited scale, chiefly along the coast and on the higher lands lying along some of the bayous. The raising of stock on the natural pastures, lumbering, and charcoal burning constitute the chief pursuits in the back country, while immediately along the coast there lie numerous towns, settlements, and residences, occupied mainly as places of summer resort, and to a limited extent by manufacturing establishments, connected closely by rail as well as by steamers with the cities of New Orleans and Mobile.

In approaching the coast from the interior the transition from the pine hills proper is at first announced by the appearance, on the very summits of the pine ridges, of marshy flats or shallow ponds, occupied by a peculiar vegetation, partly of rushes and sedges and partly of pitcher-plants (*Sarracenia*), long-leaved sundew (*Drossera filiformis*), cord rush (*Eriocaulon*), bright colored orchids, etc. As we advance southward this feature becomes more prevalent. The tall and stout pines become small and lanky and widely scattered, and among them appears on the very uplands an equally diminutive and sparse growth of cypress. These incongruous trees, sadly worsted apparently by their mutual concessions of natural habit, here rarely exceed 25 feet in height. The undergrowth is formed by low but closely packed and profusely flowering and fruiting bushes of the gallberry (*Prinos glaber*), and the shallow depressions through which the surplus water of these bogs finds outlets are skirted, or at times completely overgrown, with low thickets of bay (*Magnolia glauca*), the Carolina laurel or bay galls (*Laurus Carolinensis*), the candleberry or bayberry (*Myrica*), and a few others, frequently interspersed with tracts of dwarf palmetto (*Sabal minimus*). The latter, with some oaks, likewise form the chief growth of the very sandy bottoms of the larger streams (such as Red and Black creeks), and along these streams the bluff banks exhibit the explanation of the state of things on the surface. The uppermost 2 or 3 feet of the profile show almost pure sand; but at the depth of 4 or 5 feet there underlie heavy, impervious gray or yellowish clays, which shed all the water falling on the surface. The latter is therefore compelled to drain slowly sideways through the sand to the larger channels that at long intervals intersect this plateau land. In so doing it converts the entire surface into a bog, and becomes so impregnated with vegetable matter that the water of the streams appears of a coffee color, although perfectly clear and transparent, showing distinctly every object on the bottom, including the magnificent trout that abounds in these deep channels.

Occasionally, especially near the streams, we find low ridges, on whose flanks there appears a yellow loam subsoil, stretching in from the pine hills and creating a distinction between upland and lowland, both in soil and vegetation; but in the more southerly portion (such as that lying on Bluff creek) the landscape appears like a level park or meadow land, whose sparse growth of diminutive pine and cypress scarcely interferes with the view—the ground covered with bright flowers in spring, but with no other inhabitants than the prairie lark. The soil is a grayish-white sand, water-sodden, and hopeless for cultivation, though doubtless to a great extent available as a pasture ground for cattle.

The "pine meadow" character continues usually to within one or two miles of the beach, with little change, save near the larger streams, where the "loam ridges" come in. In the belt immediately along the coast the drainage is better, probably in consequence of a more rapid slope of the clay stratum toward the sea. The cypress disappears, the long-leaf pine improves in stature and appearance, and there mingles with it another pine, commonly

called pitch-pine, and frequent all along the sound and on the islands. It has of late been recognized as distinct, and is described by Dr. George Engelmann, under the name of Elliott's pine (*P. Elliottii*). (*a*) It is very resinous, and is used to some extent as firewood. Together with the live-oak, it is characteristic of the "sand hummocks" of the coast.

The soil of the "sand hummocks" is little else than sand, though near the surface it has sufficient substance to bear crops for a few years, and frequently has a more compact subsoil, allowing of the profitable use of manure. As the roots can penetrate to great depths, tap-rooted crops do not suffer from drought as much as might be anticipated.

At many points the sand hummocks abut directly upon the beach. Frequently, however, their character is materially changed by the presence on the surface of the "shell-heaps", which have given rise to so much speculation all along the Gulf coast. Where these masses of shells (mainly, in most cases almost exclusively, the gnathodon or common "clam" of the Gulf) have occupied the ground for any considerable length of time the loose yellow sand has been converted into a dark, sometimes black, sandy soil, containing a large amount of vegetable mold and bearing a vigorous growth of bottom timber, mingled with the live-oak, while the pitch-pine is altogether absent. The soil of these "shell hummocks" is highly productive, and is everywhere occupied either by residences, market gardens, or plantations. Like the shell heaps themselves, it forms only limited patches, but it is by far the best soil of the coast.

THE COAST MARSHES.

The "sand hummocks" of the coast form strips or bands from one-eighth to one-half mile in width, separated from one another by small marshes, formed by short water-courses which empty directly into the Gulf. Beside these, all the larger streams, such as the Pascagoula, Tshula Cahawfa, Biloxi, Wolf, Jourdan, and Pearl, form more or less extensive marshes at their mouths and for some distance inland, the largest bodies being those belonging to the first and last named. The main body of the Pearl river marsh, however, lies on the Louisiana side, leaving on the east side only a narrow strip between Mulatto bayou and the main river south of Pearlington.

The soil of the marshes derived from the short streams heading in the sand hummocks or meadow lands is usually very sandy, so far as it has any solid basis at all. Sometimes the soil is represented only by a semi-fluid, almost gelatinous mass of black, fetid muck, into which a pole may easily be pushed down to a depth of 8 or 10 feet. Such marshes are occupied mainly by the "cutting rush", a sedge grass (*Cyperus*) with triangular stems and formidably sharp, saw-toothed leaves, which the visitor soon learns to hold in awe. Where the soil is more solid, the prevailing growth is the "round rush" (*Scirpus lacustris*), with its round, soft, pithy stem. With it there usually grows the marsh milkweed (*Asclepias paupercula*), the large arrowhead (*Sagittaria lancifolia*), and the pickerel weed (*Pontederia cordata*). In both kinds of marsh we frequently see stunted bushes of bay (*Magnolia glauca*), bay galls (*Laurus Carolinensis*), and candleberry (*Myrica Carolinensis*). Stunted pine, cypress, maple, black gum, etc., are occasionally seen.

In the marshes belonging to the larger streams, such as the Wolf, Pascagoula, and Pearl, there is generally near the main stream a belt of heavy clay soil, covered by from 10 to 18 inches of matted "grass roots". Farther away the soil is usually more sandy, and the "cutting rush" more abundant.

Attempts to reclaim the marshes for cultivation have as yet been made on a small scale only by throwing up the soil from a portion, so as to form ridges above the level of the overflow or to serve as levees around the areas intended to be reclaimed. When freshly dug up all these soils are very fetid. On the whole, they are not very strongly impregnated with salt, and samphire and other salt growth is seen mainly near the beach. It is noteworthy that, notwithstanding this, the region is remarkably healthy, and the presence of the mosquito in large numbers is the only drawback to its pleasantness as a health resort from the cities.

SOILS OF THE PINE FLATS AND COAST REGION.—The soils of the immediate coast and those of the pine flats inland are so intimately correlated that the two are best considered together, the more as the areas covered by the coast soils are very limited.

No. 214. *Soil of pine meadow lands* from R. 7 W., T. 6, south of Little Bluff creek, Jackson county. Perfectly level, timbered with the scattered growth of stunted pine and cypress, and the ground covered with a dense turf of small sedges, cord-rush (*Eriocaulon*), *xyris*, short-leaved sundew (*Drosera brevifolia*), etc. The soil here appears to be uniform to the depth of 12 inches, being gray, very sandy, and unretentive; lower down pale-yellow sand at the time (May), drenched with water.

No. 17. *Soil of "shell hummock"* from the land of Mrs. McRae, at West Pascagoula, Jackson county. Timber, large live-oak, red cedar, magnolia, bay galls (unusually large here), Spanish oak (*Q. falcata*), water oak, holly, dogwood, sweet gum, pitch-pine, wild plum (*Prunus Americana*), ironwood, prickly ash (*Xanthoxylon Carolinianum*), Hercules club (*Aralia spinosa*, commonly called "prickly ash" in the interior of Mississippi), muscadine (*V. rotundifolia*), frost grape (*V. cordifolia*); of smaller shrubs, cassine (*Ilex Cassine*), French mulberry (*Callicarpa Americana*); also very abundantly an *Actinomeris*, (?) called by the Creoles "l'herbe a trois quarts", and considered an indication of an excellent soil. It will be noted that with a few exceptions this growth is characteristic of calcareous soils elsewhere. Soil almost black, very sandy, with shells intermixed.

No. 15. *Subsoil of the above*, taken from 6 to 12 inches depth, somewhat lighter in color, and very sandy.

a It is probably the same as *P. Cubensis*, Griseb.

No. 88. *Soil of shell hummock on Mulatto bayou*, R. 16 W., T. 10, Hancock county, from the sea island cotton plantations. The timber is almost precisely the same as that recorded above as occupying the shell hummock at West Pascagoula, with the addition of a good deal of hickory and of the laurel-leaved oak (*Q. laurifolia*) and sassafras. The soil is very light, and is of a dark "mulatto" or chocolate tint, unvarying for about 20 inches, at which depth there underlies a pale-yellow sand, highly productive, yielding 40 bushels of corn or a bale of cotton per acre, very light and easily worked. Prior to the war this tract was almost exclusively occupied by the culture of long-staple cotton. Its greatest width is about one-third of a mile, and it extends along the bayou with a varying width for 4 or 5 miles. Shell heaps, consisting of oysters and clams, form long levee-like ridges along both the present and older channels. Soil sample taken to 12 inches depth.

No. 90. *Subsoil of the above*, 12 to 20 inches depth.

No. 241. *Soil from the marsh of Pearl river*, Hancock county, taken about 30 yards from the river bank, near Mr. Brown's mill; thrown up from a ditch 3 feet deep, the first 12 inches being a matted mass of grass roots. The chief growth of this marsh along the banks of the river and its bayous is a tall "round rush" (*Scirpus lacustris*) 6 to 10 feet high, with an undergrowth of arrow-head, pickerel weed, and lizard's tail (*Saururus cernuus*). The cutting rush also occurs apparently in the more elevated places, and with it the marsh milkweed. The only shrub to be seen on the green plain, extending westward as far as the eye can reach, is the wax myrtle (*Myrica Carolinensis*), growing to a height of 8 to 14 feet, and at intervals a solitary bush of the bay (*Magnolia glauca*). The soil near the river bank is simply a stiff, bluish-gray clay, apparently with but little vegetable matter. Farther inland it becomes darker, and where the sample was taken it was black when moist and of a slate color when dry. It contains very little sand, cuts with a shining surface, and is variegated with irregular dark-colored veins and specks, which, on exposure to air, become yellow or rust color.

It is stated that this soil when laid dry (which can readily be done, since it forms firm levees) is easily worked and produces fine vegetables, such as pease, beans, cabbage, etc., but is specially adapted to water- and musk-melons. None of these plants showed any disposition to wither, as was the case with the Pascagoula marsh soil. Near Pearlington, where the soil is the same, an experiment was made with rice. The crop was very abundant and of fine quality.

No. 215. *Marsh soil*, thrown up to the depth of about 3 feet, in a small "cutting-rush" marsh adjoining the premises of Alfred Lewis, West Pascagoula, Jackson county. This is one of the small marshes formed by branchlets heading in the meadows or "gallberry flats", or in the sand hummocks. The portion in which the soil was thrown up adjoins the beach. When in its natural condition a pole could be pushed down some 8 feet into it. The soil is almost black when wet, dark gray when dry, and to the eye appears like a mere mixture of sand and marsh muck. In attempting to cultivate this soil Mr. Lewis found that both corn and rice thrive finely up to a certain age, producing a large crop of leaves. When both were about 15 inches high the leaves began to turn yellow, and the corn soon died out altogether; the rice "spindled up" into a weakly stem, some of which even bloomed, but failed to fructify. The application of shell quicklime produced no sensible difference in the result in the season following its application in spring.

No. 220. *Marsh muck*, taken from the same marsh farther inland, dark brown and spongy, with more or less of undecomposed vegetable matter; thin and mushy when fresh, and fetid.

Soils of the coast region.

	Upland or hummock soils.						Marsh soils.	
	Jackson county.			Hancock county.			Jackson county.	
	R. 7 W., T. 7, pine meadow.	R. 6 W., T. 8, S. 7, shell hummock, West Pascagoula.		R. 16 W., T. 10, Sea island cotton land.		R. 16 W., T. 9, S. 20, (?) Pearl river.	R. 6 W., T. 8, S. 7, West Pascagoula.	
	Soil.	Soil.	Subsoil.	Soil.	Subsoil.	Marsh soil.	Marsh soil.	Marsh muck.
	No. 214.	No. 17.	No. 15.	No. 88.	No. 90.	No. 241.	No. 215.	No. 220.
Insoluble matter	95.592	94.208	97.245	93.634	96.370	74.150	70.183	25.225
Soluble silica		0.680	0.512	2.448				
		94.888	97.757	96.082				
Potash	0.061	0.055	0.012	0.045	0.080	1.003	0.559	
Soda	0.050	0.046	Not detr.	0.057	0.045	0.379	0.957	
Lime	0.023	0.223	0.072	0.098	0.115	0.182	0.109	
Magnesia	0.069	0.161	0.060	0.114	0.065	1.004	0.743	8.358
Brown oxide of manganese	0.045	0.016	0.042	0.053	0.035	0.065	0.067	
Peroxide of iron	0.459	0.433	0.404	0.516	0.524	3.350	1.171	
Alumina	0.848	0.585	0.388	0.464	0.322	10.643	5.894	
Phosphoric acid	0.021	0.104	0.148	0.097	0.107	0.188	0.111	
Sulphuric acid	trace.	0.004	0.018	trace.		0.858	0.176	0.347
Water and organic matter	2.277	3.561	1.019	3.018	1.821	8.390	19.826	66.070
Total	99.445	100.016	99.920	100.544	99.484	100.212	99.796	100.000
Hygroscopic moisture absorbed at		2.06 10 C.°	0.98 10 C.°	2.52 22 C.°	2.04 22 C.°	7.94 Air-dried.	15.44 22 C.°	21.49 21 C.°

No. 214, the pine meadow soil, shows throughout such low percentages of the important ingredients of plant-food that its sterility does not appear surprising. Yet, when we compare it with the highly productive shell hummock soils from two widely separated localities, we find that these differ from the other, so far as the mineral ingredients are concerned, in only two material points, viz, amounts of lime and of phosphoric acid, from four to six times greater. (*a*) The shell hummock soils are even poorer in potash than the meadow soil, but doubtless contain a good deal more of true humus, the vegetable matter of the meadow and marsh soils being in a sour and soluble condition, in which it does not serve the nutrition of the ordinary culture plants.

But apart from these important chemical differences there is a most important physical one. The shell hummock soils are several feet deep and are well drained, permitting the roots to penetrate to great depths, and thus to utilize the plant-food of a very large soil mass. In the case of the meadow soil, as has been stated, the subsoil is water-soaked at the depth of 10 to 12 inches, and thus effectually precludes the penetration of roots to any greater depth. Hence we find on it only fibrous-rooted plants or very small tap-rooted ones, and of all these the seeds are exceedingly small, conforming to the very small amount of phosphates available.

Undoubtedly the original material of the shell hummocks was the same as that of the sand hummocks, gallberry flats, and meadows. The change has been brought about by the long-continued action of the disintegrating shells. It is not difficult to see how these acted. While furnishing slight amounts of phosphates and nitrogen compounds directly, the chief effect has been to retain and accumulate near the surface all the plant-food absorbed by successive crops of vegetation by virtue of the effect of lime in rendering humus insoluble and preventing its waste, and with it that of the accompanying available plant-food. In the meadow soils the dark-colored drainage-water speaks plainly enough of the acid condition of the humus, as manifested by the growth of "sour" grasses. A dressing of lime would promptly relieve this condition, as is actually sometimes done for a few years after the burning of the dry grasses (by their ashes); but so long as the land is left undrained the continued formation of more acid in the soil soon destroys this effect.

Drainage first, and then the use of lime, are therefore the first steps to be taken in the reclamation of the ill-drained "meadow" soils wherever the value of land may be such as to justify such treatment of a soil of such slender natural resources. Doubtless the broadcast sowing of lime on meadow pastures would soon create a great improvement, even without drainage, rendering it possible to replace the sedges by sweeter grasses. As to the sand hummocks, which are well drained, but are too poor and unretentive for profitable culture, it would seem probable that they could be made available for market-garden purposes at least by the combined use of dressings of lime and marsh muck; a treatment which would result in the production of a soil similar to the "shell hummocks", produced by the action of the shell lime, which has continued for many centuries. The muck will carry with it both plant-food and the property of retentiveness to the soil, which will thus ultimately be made capable of retaining manure.

As to the marsh soils, it is clear that those occurring along the channels of the larger streams, such as No. 241, require only drainage and aeration to render them profusely productive. They are, in fact, little more than rich, heavy bottom soils, with high percentages of every mineral ingredient of plant-food; but they are in a condition in which they contain compounds positively poisonous to plant growth, such as the soluble salts of iron, and in the case before us of sulphate of magnesia or epsom salt, which has doubtless been derived from the sea-water. From the experience had, it would seem that simple aeration, after leveeing, enables these soils to bear ordinary crops; but it cannot be doubted that even with them the use of some lime to favor the aeration process and to decompose the poisonous epsom salt would be found highly advantageous.

As regards the soil and muck of the "cutting-rush" marsh, as exemplified in Nos. 215 and 220, the best use of the latter would doubtless for the present be the improvement of the sand hummocks near the coast, in conjunction with lime, as above stated. Where such marshes can be drained, such soils as No. 215 would offer considerable inducements for cultivation, since it is not only reasonably rich in plant-food, but is also rather unexpectedly retentive and otherwise qualified for culture by its not inconsiderable percentage of clay. The withering of the crops tried by Mr. Lewis, as above stated, was undoubtedly due to the contact of the roots with the acid, and to them in many respects poisonous, water of the adjoining marsh, charged with soluble iron salts and (as shown by the odor alone) sulphureted hydrogen. It will not do simply to throw up the soil in ridges, but the marsh must cease to exist as such immediately around it.

NATURAL FERTILIZERS OF THE LONG-LEAF PINE REGION.—Apart from the pine straw, which at present is the most generally available material for the production of manure (see page 58, under the head of "Soils of the long-leaf pine region"), and from the marls available to the portion of the region adjacent to the central prairie region, there are within it but few naturally occurring materials of much value as fertilizers. The green and gray clays cropping out in the beds of streams are often taken for marls, and are usually without agricultural value. In a few localities these clays contain enough of lime and other ingredients of plant-food to be useful as fertilizers. Analyses of three such are given on page 71.

a The high lime percentage of No. 17 is probably partly due to shell particles mechanically scattered in the mass, and not wholly to the chemically diffused substance.

MAP
OF
MISSISSIPPI

SHOWING
IN THE DIFFERENT SECTIONS OF THE STATE
THE RELATION BETWEEN THE
AREA CULTIVATED IN COTTON
AND THE TOTAL AREA

BY
E. W. HILGARD
SPECIAL AGENT, 10TH CENSUS

1880.

LEGEND

Percentage of total area planted in Cotton in 1880.

I	0 to 0.1 per cent.
II	0.1 to 1 " "
III	1 to 5 " "
IV	5 to 10 " "
V	10 to 15 " "
VI	15 to 20 " "
VII	20 per cent and above.

Scale
25 0 25 50 75 100 MILES.

Julius Bien & Co lith

It should be recollected that, as stated, lime is notably deficient in all lands bearing the long-leaf pine as their exclusive growth; hence its addition is the most needful improvement, as what other plant-food is contained in the soils will thus be made more available. Of commercial fertilizers bone-meal, which supplies both lime and phosphoric acid, will probably be found the most immediately profitable. Were Pearl and Chickasawhay rivers to be made navigable for flats at least, the lime and marls of the prairie region would become sufficiently accessible for use along these streams. But, above all, those growing cotton should keep in mind that they cannot afford to lose any portion of the plant-food contained in their cotton-seed. All this should be either directly and indirectly, but fully and faithfully, returned to the cotton-fields, for in losing its substance the very life essence of cotton culture is lost.

No. 261. *Red clay marl* from a hilltop on Sec. 1, T. 6, R. 3 E., on the south fork of the Homochitto (Judge Cassady's land), Franklin county. A stiff, dark orange-colored clay, with calcareous concretions (not included in the analysis); once a "prairie spot" covered with strawberry bushes; black soil, now washed away.

No. 293. *Gray clay marl* from a high bluff, on Pearl river, on Secs. 2 and 35, T. 4 and 5, R. 12 E., Marion county. Forms a stratum about 6 feet thick in the face of the bluff some 30 feet above the river level.

No. 267. *Green loam* from Burnett's bluff, on Lower Pearl river, near Spring Cottage post-office, Marion county. Forms a stratum 5 feet thick above low water of the river. A greenish, loose, loamy mass.

The two first are fairly good marls, especially for the sandy lands of the region in which they occur. No. 267 would hardly pay for hauling to any distance, being too poor in lime, but might be available for the somewhat stiff bottom lands of the neighborhood.

	FRANKLIN COUNTY.	MARION COUNTY.		SMITH COUNTY.
	Cassady red clay marl.	Barnes' bluff gray clay marl.	Burnett's bluff green loam.	Long-leaf pine straw.
	No. 261.	No. 293.	No. 267.	
Insoluble matter	49.475	77.438	83.691	65.242
Potash	1.242	0.709	0.827	5.530
Soda	0.152	0.101	0.268	0.416
Lime	13.190	4.800	0.793	13.860
Magnesia	1.825	1.248	1.053	5.208
Brown oxide of manganese	0.266	0.316	0.223	1.681
Peroxide of iron	5.538	2.989	4.394	0.141
Alumina	12.587	6.440	8.347	4.539
Phosphoric acid	0.132	0.111	0.148	1.154
Sulphuric acid	0.033	Trace.	0.022	0.839
Carbonic acid	9.555	3.372	Not determined.	.....
Water	5.875	2.554		
Potassium chloride	.....	.....	.....	1.479
Total	99.870	100.087	99.766	100.089

GENERAL FEATURES OF COTTON PRODUCTION IN THE STATE OF MISSISSIPPI.

The map exhibiting graphically the relation between cotton acreage and the total areas in the several portions of the state shows very striking inequalities of distribution; and this inequality would be even more pronounced if, instead of the acreage, the product in bales of cotton had been made the basis of the delineation.

The broadly obvious fact shown by the map, as well as by the tables, is that by far the greater portion of the area planted in cotton lies in the northern and western part of the state, while in the extreme south there is an area where cotton culture is either very subordinate or practically non-existent. This area continues into the adjacent portion of eastern Louisiana, and it is the region where lumbering, turpentine making, and cattle raising form thus far the predominant industries of the sparse population.

The most abrupt inequalities are met with when traversing the state from east to west about latitude 34° 45′ north. Here we meet no fewer than eight alternate belts of low and high intensity. A glance at the soil map of the state shows that these belts correspond closely with the soil regions there laid down. Southward, the variations become less extreme and the areas of similar intensity broader.

Unlike the case of Louisiana, the decrease of cotton culture in the southeastern part of Mississippi is not accompanied by a corresponding increase of some other staple production. It is primarily due to the inferior quality of the soils in that section, improving steadily, however, as we advance westward to the Mississippi river.

TABLE III.—POPULATION AND COTTON PRODUCTION IN EACH AGRICULTURAL REGION OF THE STATE.

Agricultural region.	Area.	POPULATION.			COTTON PRODUCTION.									
		Total.	White.	Colored.	Acres.	Bales.	Average per acre.				Total in tons.		Percentage of the state's total production.	Cotton acreage per sqr. mile.
							Bales, 475 lb.	Seed cotton.	Lint.	Seed.	Lint.	Seed.		
The State	*Square miles.* 46,340	1,131,597	479,398	652,199	2,106,214	963,111	0.46	*Lbs.* 657	*Lbs.* 219	*Lbs.* 438	228,739	457,478	100.0	45.5
Table-lands	5,620	204,700	79,861	124,839	457,215	202,058	0.44	627	209	418	47,989	95,978	21.0	81.4
Oak and short-leaf pine uplands	6,580	145,964	95,757	50,207	230,090	89,254	0.39	555	185	370	21,198	42,396	9.3	35.0
Northeast prairie region	4,650	184,821	71,757	113,064	404,418	136,027	0.34	486	162	324	32,306	64,612	14.1	87.0
Pontotoc ridge	1,340	39,755	29,343	10,412	61,461	23,768	0.39	555	185	370	5,645	11,290	2.5	45.9
Central prairie	5,020	133,309	49,843	83,466	226,639	89,124	0.39	555	185	370	21,167	42,334	9.3	45.1
Cane hills	2,630	105,784	25,253	80,531	165,226	95,626	0.58	828	276	552	22,711	45,422	9.9	62.8
Mississippi alluvial	7,040	143,443	29,323	114,120	338,822	245,759	0.73	1,041	347	694	58,368	116,736	25.5	48.1
Long-leaf pine, oak, and hickory uplands.	5,810	128,537	66,062	62,475	207,266	77,052	0.37	528	176	352	18,300	36,600	8.0	35.7
Long-leaf pine hills and flats	7,650	45,284	32,199	13,085	15,077	4,443	0.29	414	138	276	1,055	2,110	0.5	2.0

TABLE IV.—COUNTIES IN EACH REGION HAVING THE HIGHEST PRODUCTION.

REGIONS, ACCORDING TO AVERAGE PRODUCT PER ACRE.		COUNTIES HAVING HIGHEST TOTAL PRODUCTION.						COUNTIES HAVING HIGHEST PRODUCT PER ACRE.					
Name.	Average product per acre.	Counties.	Rank in total production in state.	Acres.	Bales.	Product per acre.	Rank in product per acre in state.	Counties.	Rank in total production in state.	Acres.	Bales.	Product per acre.	Rank in product per acre in state.
Mississippi alluvial	0.73	Washington	1	63,409	54,873	0.87	2	Issaquena	22	18,293	16,150	0.88	1
Cane hills	0.58	Warren	13	34,127	22,950	0.67	9	Warren	13	34,127	22,950	0.67	9
Table-lands	0.44	Holmes	5	62,556	30,463	0.49	18	Holmes	5	62,556	30,463	0.49	18
Oak and short-leaf pine uplands	0.39	Attala	23	35,950	15,285	0.43	30	Calhoun	38	19,028	9,536	0.50	16
Pontotoc ridge	0.39	Union	42	21,255	8,259	0.39	37	Tippah	47	18,758	7,424	0.40	33
Central prairie	0.39	Hinds	3	80,013	36,684	0.46	22	Hinds	3	80,013	36,684	0.46	22
Long-leaf pine, oak, and hickory uplands.	0.37	Copiah	12	54,616	23,726	0.43	25	Franklin	45	18,211	8,042	0.44	25
Northeast prairie region	0.34	Noxubee	16	82,483	25,294	0.31	57	Alcorn	46	18,863	7,477	0.40	33
Long-leaf pine hills and flats	0.29	Covington	66	6,968	2,071	0.30	59	Prentiss	48	18,610	7,207	0.39	38
								Marion	68	4,717	1,579	0.33	51

County in the state having the highest total production: Washington, 54,873 bales.
County in the state having the highest average product per acre: Issaquena, 1,254 pounds seed-cotton.
County in the state having the greatest cotton acreage per square mile (see Table I): De Soto, 131.5 acres.

DISTRIBUTION OF COTTON PRODUCTION AMONG THE SEVERAL AGRICULTURAL REGIONS.

Table III shows the total products, in bales of 475 pounds, of each region, as resulting from the summation by counties. The county lines having no relation to the natural divisions, these summations can only be rough approximations; but the form of the census returns does not admit of a complete segregation of the product of each natural division, and the outlines of the several shades on the acreage map are, to a considerable extent, shaped in accordance with information derived partly from the answers to schedules and partly from outside information and personal knowledge of the actual distribution of production. Similar corrections must, of course, be applied in the discussion of the subject.

Perhaps the most unexpected fact to the generality of readers would be the relatively small proportion of the cotton product of the state coming from the lowlands of the Mississippi, for it has been customary to consider the pre-eminence of Mississippi as a cotton-producing state to be due mainly to the "rich lowlands". On the contrary, it appears that only a little over one-quarter (25.5 per cent.) of that product is derived from the Mississippi and Yazoo bottoms, while over 30 per cent. is produced in the yellow loam or oak and short-leaf pine uplands region and table-lands north of the central prairie belt. At the same time, the long-leaf pine region of the south, exceeding the oak uplands region in area by over a thousand square miles, produces only 8.5 per cent. of the total product.

THE YAZOO BOTTOM.—The relatively low total product of the lowlands is at once explained by reference to the column giving the percentage of tilled lands, which is only 12.8 per cent. for the region as a whole, and even

this is too high a figure, from the introduction into the summation of the uplands of Yazoo and Tallahatchie counties, which are well settled. The scanty population and the low percentages of tilled lands in the interior counties, such as Quitman and Sunflower, show that large portions of the bottom are almost without settlements, while the higher percentages of the counties fronting on the Mississippi river are equally eloquent in the opposite direction. In this case the difference is not merely due only to the facilities for shipment offered by the great river, but largely to the greater danger of inundation in the interior and, therefore, lower portions of the bottom plain. Until this danger is measurably removed this state of things is not likely to change materially, and production will remain concentrated on the higher lands fronting the Mississippi, Yazoo, and a few other streams. It has not been practicable to obtain any detailed outlining of the areas of intense production existing on the Yazoo and the Tallahatchie rivers.

Of the tilled area in the great bottom as a whole, nearly 59 per cent. is occupied by cotton; in the counties of Tunica and Sharkey the percentage rises to 76 and 73 respectively. These are the highest figures reported from the state for any region or county, showing the marked preference given to cotton in these lowlands.

YELLOW-LOAM REGION.—The returns from the two divisions of this region show a striking difference in the product, the larger one, exceeding the other by nearly a thousand square miles, yielding only 9.3 per cent. of the state's product, against 20.9 furnished by the other, viz, the table-lands division. Parallel with this is the showing of the respective percentages of tilled lands, viz, 16 of the area of the oak and short-leaf pine region, against 30.7 in the table-lands, or again approximately as 1 to 2. But in the latter region 41.3 per cent. of the tilled lands is given to cotton culture, as against 34.2 in the short-leaf pine country. While in the oak and short-leaf pine region the whites exceed the negro population in the proportion of nearly two to one, the reverse occurs in the table-lands, the whites counting only two to every three negroes. As regards density of population, the two divisions are related nearly as 2 to 3.

In the table-lands the area of highest intensity of production lies in the counties of De Soto and Tate, with cotton acreages respectively of 131.5 and 123.7 per square mile. While this may, in part, be due to proximity to the great cotton mart of Memphis and the excellent facilities for transportation, inspection of the table shows that a special adaptation of the soil must be called in to account for the high production, which, in the case of Tate at least, is to be credited exclusively to the uplands, *i. e.*, outside of the Yazoo bottom. No other portion of the state shows such a combination of high figures, both as regards the density of rural population, the percentage of total area under cultivation, and of tilled lands given to cotton culture, the cotton acreage per square mile, and the product per acre; so that this portion of Mississippi seems to constitute (in common probably with the adjacent portion of Tennessee) the *center of maximum cotton production in the uplands.* In Tate, notwithstanding this high position as a cotton-growing county, the white and colored population are nearly equal in numbers.

In the upland short-leaf pine and oak region a corresponding position may be assigned to Montgomery county, which, however, lies partly within the table-lands region. Excluding it from comparison, Attala and Choctaw would seem to compete for the next rank upon a combination of the several points.

The density of the population in the short-leaf pine division being not quite two-thirds of that in the table-land counties (22.2 to 36.4), and the proportion of the total area under tillage nearly as 1 to 2 (16 to 30.8), it would seem that less land suffices for each inhabitant in the pine division, and the reason for this is obvious upon a reference to Table II; for while in the latter division corn occupies one-tenth more land than cotton, in the table-lands region the proportion is more than reversed, corn being given only three-fourths as much land as cotton, and of course a corresponding amount of provisions must be there purchased from outside sources. Concurrently, we find that in the table-lands division the negroes outnumber the whites in the ratio of 100 to 64, while in the pine country the ratio is 100 to 190.7, or nearly two whites to one negro. In the matter of product per acre, the pine country, of course, falls behind the table-lands (0.39 against 0.44 bale), but the figure is still higher than that of the southern portion of the prairie belt (0.33 bale per acre), where again the negro population is in an overwhelming majority. It is true that in the pine region a large proportion of the tilled lands, especially of those given to cotton, is creek bottom land.

The *Cane-hills region* is best considered in connection with the table-lands, to which it partially belongs, and with which its statistics of production most nearly correspond. It will be noted that, with approximately half the area of the table-lands, the cane-hills region produces also very nearly half the amount of cotton, viz, 9.9 per cent. of the state's total, against 21 in the former region. When, however, we consider that in each of the counties of the group a not inconsiderable proportion of Mississippi alluvium contributes to the results as shown in the tables (such as the average product per acre and the proportion of tilled lands occupied by cotton), it becomes obvious that in the details of production there are not inconsiderable differences. Remembering that these counties belong to the first settled regions of the state, the low percentage of tilled lands in the case of Warren and Wilkinson (15.6 and 14.9), placing them in this respect on a level with such counties as Lauderdale, Newton, and Winston, and below Copiah (25 per cent.), which is by them regarded as a pine-hills country, is very striking. In connection with this, the fact that nearly one-half (47.3 per cent.) of the tilled lands is, on the average, given to cotton, and that the negro population exceeds the white in the proportion of over three to one (80,531 to 25,253 whites), the economic picture presented is somewhat puzzling and not altogether flattering. In the case of Claiborne, Jefferson, and

Wilkinson about half as much as the cotton area is devoted to corn, while in Warren and Adams not as much as one-third of the amount of land given to cotton culture is devoted to the production of corn. The area given to other cultures is insignificant.

It thus appears that, unlike other regions, where in the course of time there comes an adjustment favoring a self-sustaining policy in farming, these counties have either remained fixed in the policy of cotton-growing, regardless of provisions, or have lapsed from a better condition toward this undesirable state of things which involves the importation of the bulk of the necessaries of life.

The country, when "fresh", was occupied by large plantations, and the black deep loam soil, enriched by the cane growth, yielded crops scarcely inferior to those now obtained in the bottom lands. These original plantations have nearly all disappeared, their owners generally removing their working force and appliances to the Tensas bottom, opposite, while mostly retaining their residence in the hills; but their hill lands were to a large extent "turned out", and, as is natural in a hilly country, had their soil washed away to a great extent, deep gullies and ravines forming across the once cultivated fields, making their cultivation progressively more difficult and less profitable. In other words, the plantation system has passed away, leaving large areas apparently barren and wasted; and the small farmers that are to reclaim them by careful culture and thrift have not yet come in to any great extent. Hence one may travel in the uplands of Warren, for example, for miles together without seeing what appears to be a prosperous farm outside of the valleys; the country surrounding Vicksburg thus forming a striking contrast to that near Memphis, where the density of rural population and that of cotton culture jointly reach their maxima within the state.

By reference to the descriptions of the cane-hills region at large and of its individual counties, it will, however, be seen that this state of things is not a necessary consequence of natural conditions, and that its still rich and easily reclaimed soils offer great inducements to industrious small farmers. The satisfactory results of such a system may be best seen in Claiborne county, where the large tilled area is more generally subdivided into small holdings.

NORTHEASTERN PRAIRIE REGION.—The cotton product of this region, forming in the aggregate 16.6 per cent. of the state's total, is quite unevenly distributed among its several portions. The culture is most intense in the southern portion of the prairie region proper, where we have in Lowndes and Noxubee counties the highest percentage of tilled lands (39.5 and 34.9), the largest proportion of the same in cotton (51.2 and 54.4), the highest acreage per square mile (129.3 and 121.3), and the largest number of bales per square mile (43.8 and 37.2). To this is to be added the densest population, viz, 56.5 and 43.9 per square mile, respectively, the figures in the case of Lowndes being disproportionately high on account of including the city of Columbus. It is significant that this predominance of cotton culture is here again associated with the greatest predominance of the black over the white population, being between four and five negroes to one white.

Leaving out of consideration Oktibbeha, a large portion of which lies outside of the prairie belt, we find to the northward a pretty regular decrease of "bales per square mile", and, concurrently, of the percentage of tilled lands and of the proportion of these given to cotton. Parallel with these the proportion between the white and colored population changes, until it is completely inverted in Prentiss, where the whites outnumber the negroes in the ratio of between four and five to one. At the same time the product per acre has risen from 0.31 bale in Noxubee to an average of 0.39 bale in Prentiss.

The three counties embracing the greater portion of the Pontotoc ridge (Tippah, Union, and Pontotoc), furnishing 2.5 per cent. of the state's cotton crop, are a good deal varied in their surface. The flatwoods belt forms a very considerable but very sparingly cultivated portion of their area, to which in Tippah is added the broken and sandy and also very sparsely settled valley of the Hatchie; hence in the latter case the surprisingly low percentage of the tilled lands as compared with the total area, while as a matter of fact the Pontotoc ridge portion of the county is probably among the most densely settled portions of the state. Union, also, has a large slice of thinly-settled and scantily-producing flatwoods, but on the other hand embraces a tract of fertile black prairie country, as well as some of the choicest portions of the "ridge"; hence, of the three counties, it has the largest percentage of lands under cultivation, the largest proportion of these in cotton, the maximum cotton acreage, and the highest number of bales per square mile. It has also the densest population, but the whites outnumber the negroes more than three to one, as in Tippah. Pontotoc stands lowest of the three in most of the points mentioned under the combined influence of the flatwoods belt and of the lower productiveness of a portion of its ridge lands. Unlike the prairie counties, those of the ridge give a large portion of their land to corn and small grain, these being given an area over one-half greater than that assigned to cotton (93,242 acres, against 61,461 in cotton), while in the prairie belt the total of cereal area is about one-tenth less than that given to cotton (365,321, against 404,418).

In other words, the returns show the Pontotoc ridge country to be one of a more or less varied and self-sustaining culture, with a white population of small farmers outnumbering the colored nearly three to one, while in the prairie belt there prevails the old system of cotton plantations purchasing supplies from the outside and employing chiefly negro laborers, who accordingly outnumber the whites nearly two to one (113,064 negroes, against 71,757 whites). Concurrently, the average product per acre is considerably less in the rich prairie belt than in the hill country. The contrasts become much more striking when, as may properly be done, the counties of Prentiss and Alcorn are

either eliminated from the comparison or joined with the ridge counties, to which, in some respects, they more properly belong, being largely upland, and greatly varied in their agricultural features. The average product per acre of the prairie counties is then reduced to 0.33 bale, against nearly 0.40 in the northern counties, where the staple is chiefly produced by white labor.

The flatwoods region cannot be separately considered upon the basis of the census returns, but only upon that of a general knowledge of its agricultural condition and capacities. It is almost throughout very thinly settled, and that by small farmers, whose means do not allow them to purchase lands held in higher estimation. As has been stated in the original description (see Part I), the soil, while not intrinsically poor in the ingredients of plant-food, is difficult of cultivation, being mostly very heavy, and the entire region is ill-drained and liable to remain wet until late in the season. It will require intelligence and thrift to render their cultivation profitable, but this is feasible, as it has been done locally. With systematic drainage of the region will come not only easier tillage and more certain crops, but also improved health. In its southern portion, in Oktibbeha, Noxubee, and Kemper, the character of the soil is less extreme, and settlements are more abundant.

The counties belonging to the *central prairie region*, growing altogether nearly one-tenth of the state's cotton crop, are so much varied in their surface features and soils that few general statements can be made that will hold for all of them. Thus, Madison and Hinds, furnishing two-thirds of the product of the entire central belt, agree in most points with the table-lands section in percentage of area under tillage, the predominance of cotton culture as shown in percentage of tilled lands in cotton, cotton acreage per square mile, etc., as well as in the large predominance of negro population over the white (nearly 3.1); and thus what has been said in the discussion of the table-lands will substantially apply here. In the counties east of Pearl river we at once have a reduction of the percentage of tilled area of one-third of the average on the west side (31.9: 10.6), due to the fact that large portions of these counties belong to the adjacent long- and short-leaf pine regions, while the form of the census returns does not permit the segregation of the product of each division. At the same time, the average proportion between the white and colored population approaches equality, but this average is in part the result of considerable variations in opposite directions. Wherever the rich black prairie lands are available for cotton growing (which is not always the case, on account of "rust", see regional description) the negro population is in the majority, as in northern Rankin, southwestern Scott, and northeastern Jasper. But Smith county, notwithstanding the large part of its area on which prairie soils do occasionally occur, is statistically clearly within the long-leaf pine region, most of the "prairie" soil being unavailable for cotton culture on account of a tendency to "rust". Wayne might be similarly classed but for the fact that practically nearly all its cotton product comes from the northeastern portion within the prairie belt, and in view of this fact the low product per acre (0.26 bale) is somewhat surprising. Here, as well as in Clarke and Smith, a more painstaking system of culture would result in a material improvement of the quantity and quality of the cotton product, for not only are there large tracts of intrinsically very productive soils now almost untouched on account of difficult tillage, but the marls occurring so abundantly in the region allow of indefinite and exceptionally cheap improvement of the soils. (See regional description.)

THE LONG-LEAF PINE REGION, embracing over one-fourth of the area of the state, furnishes only a little over one-twelfth of the total product (8.5 per cent.). Of this contingent, moreover, over 94 per cent. is produced in the northern and western counties of the region, where oaks and short-leaf pine, at least in the bottoms, mingle with the long-leaf species, while the balance is produced scatteringly within the long-leaf pine division proper, where this tree descends even to the sandy bottoms or bordering flats, in which the ti-ti, gallberry, star anise, and similar shrubs are its associates. Outside of these bottoms there is practically, as yet, no cultivation, except along the immediate sea-coast and in the western portion of Covington county, that county having the largest proportion of tilled lands and producing nearly half of the cotton of the group; so that its figures might, with almost equal propriety, place it with the western group of counties, where oaks and hickory accompany the pine. As a whole, the long-leaf pine region is characterized by the sparseness of its population, among which the whites exceed the negroes in the proportion of 13 to 10, by the small average percentage of tilled lands (7.4 per cent. of the area), and the correspondingly small cotton acreage per square mile (16.5), and nearly an equal amount of land given to corn. It is curious that, considering the remoteness of a large portion of the region from markets, so large a share of the cultivated area should be given to cotton. The good roads, so easily maintained on the sandy soils, have their share in encouraging this state of things, hauling being habitually done to great distances. Thus this region would, as a whole, seem to be less nearly self-sustaining than is the short-leaf pine area.

Copiah stands at the head of the western group, having the largest proportion of tilled area (25 per cent.) and the highest aggregate production, exceeding that of Madison (the two counties having nearly the same total area) on a somewhat smaller area given to cotton, and therefore with a higher average product per acre (0.43 bale against 0.38 in Madison); certainly an excellent showing for a "pine-woods" county which has been long settled. Its numerous and well-watered valleys, occupied by small farms largely worked by whites (the latter nearly equaling the negroes in number), appear to prove more than a match for the large upland plantations of the former county, where the negroes outnumber the whites more than three to one. The acreage given to corn also differs by only a few hundred acres, while the corn product of Copiah exceeds that of Madison by over 66,000 bushels. The result of the comparison is certainly a remarkable one, and probably unexpected to both counties concerned.

Proceeding southward from Copiah, we find in Lincoln, Pike, and Franklin counties a rapid falling off of the percentage of lands under tillage (10.5 in the latter county), indicating an increasing restriction of the cultivation to the bottoms of the streams, the surface of the country being rather broken. The percentage rises again in Amite and Lawrence, under the influence of considerable bottom areas, but falls again as we cross Pearl river eastward, in Simpson and Smith, where only 8.4 per cent. of the total area is under tillage. The proportion of the tilled lands given to cotton seems in all these cases to be largely controlled by the facilities for communication with a market, the remoter portions growing more corn in proportion. The high average product per acre, exceeding that of the black prairie region of Lowndes and Monroe in most cases, testifies to the use of bottom lands for cotton. Lauderdale stands somewhat apart from the rest of the group in its statistics as well as in geographical position. Its higher percentage of tilled area (16.2), and the fact that as much as 46 per cent. of that area is given to cotton culture, are doubtless due to its railroad facilities; for the figure given for product per acre (0.29 bale) proves that the soil is not more productive, and that uplands are contributing to the general average. Concurrent with the high proportion of lands devoted to cotton the negro population is seen to exceed the white (11.5 : 10), and the same relation is noticeable in Amite (8.5 : 5.5). In the rest this proportion ranges from near equality to (in the case of Smith) 4 whites to 1 negro.

In the southeastern group of counties, the especial home of the long-leaf pine, pure and simple, the sparseness of the population (5.9 to the square mile), the low percentage of tilled lands (average, 1.8 per cent.), and the low cotton product per acre (0.29 bale), all speak of the comparative poverty of the soil, which in its natural condition is not adapted to the profitable production of the staple. Pasturage and lumbering will be profitable for some time to come. Better tillage of smaller areas and the use of fertilizers have improved similar soil regions farther east, in Georgia and the Carolinas.

No sea-island or long-staple cotton was reported from Mississippi for the census year. Prior to the war it was profitably grown on a limited area near the coast, on the deep, sandy "shell hummock" soils of Mulatto bayou, in Hancock county. In due time this culture will doubtless be renewed, and by an artificial application of the process by which nature and man have combined to form, in course of time, the "shell hummocks", the long-staple cotton may yet occupy an important place in the products of the Gulf-shore region.

RELATIONS OF THE TWO RACES TO COTTON CULTURE AND PRODUCTION.

These have been cursorily alluded to in the discussion of the several regions, but it may be well to summarize the conclusions more definitely here. Broadly speaking, it is obvious that the bulk of the cotton is produced where the bulk of the negro population is found in the state as a whole. A glance at the column giving the proportion of the tilled lands occupied by cotton shows that, on the whole, this percentage is greatest where the negro race predominates most, viz, in the great Yazoo bottom, where, with an average predominance of the negro race over the white in the ratio of nearly four to one (3.9 : 1), we find also the maximum percentage of the tilled lands in cotton (58.9). Still, in detail this general rule does not hold good, for we see in Issaquena the greatest disproportion between the two races (11.1 negroes to 1 white, almost the same as the parish of East Carroll, opposite), yet the proportion of tilled lands in cotton is only 56 per cent., being less than the average, while the maximum percentage of total area in cotton is found in Tunica, where the whites are nearly twice as numerous (5.8 negroes to 1 white). Among the upland regions the greatest overbalancing of the negro race is found in the cane hills (3.2 : 1), with the next greatest percentage of lands in cotton (47.3), and here the greatest percentage of tilled lands in cotton agrees with the greatest overbalancing of the colored race in Wilkinson county (Warren being largely lowland, and containing a large city, cannot enter into the comparison). The northeastern prairie region and the table-lands division of the yellow-loam region show almost the same proportion between the two races (1.58 and 1.56 negroes to 1 white, respectively), while the respective percentages of tilled lands in cotton are 45.3 and 41.3, again showing a slight preponderance of cotton area where the negro population is most predominant. In the case of the prairie region this becomes much more obvious when we segregate the "black prairie counties" of the south from the group formed by Lee, Prentiss, and Alcorn (see discussion of the prairie region). In the southern group, Noxubee, with nearly 4 negroes to 1 white, has also the maximum percentage of tilled lands in cotton (54.4). In the rest of the state, apart from the local influence of great centers, there is a more or less obvious inverse ratio between the predominance of the negro population and the percentage of lands occupied by cotton. But the relation between the product per acre and that predominance is equally marked, and here the ratio is as obviously an inverse one when the natural productive capacities of the several soils occupied is taken into consideration. The best possible comparison is that made above between the northern and the southern groups of the northeastern prairie region, where the best soil under negro predominance, and in the very center of the cotton belt, yields only an average of 0.33 bale per acre, while northward, under the influence of a predominance of the whites and a consequent subdivision into small farms, the product per acre rises to an average of nearly 0.40 bale. Under the same influences the average product of the Pontotoc ridge, with inferior soils on the whole, exceeds by 4 per cent. that of the black prairie region. Similar relations are abundantly exemplified among the counties of the yellow-loam region.

The bottom region forms only an apparent exception; for while its lands under the greatest negro predominance among the regions shows also the highest production per acre, this is manifestly due to the great native fertility of the soil, which, under favorable circumstances, will produce as much as 2 bales per acre. Instead of this, these lands actually yield only an average of 0.73 bale, and the highest product reached, even in the profusely fertile buckshot lands of Issaquena, is 0.88 bale per acre. Here also, with an overwhelming negro predominance, out of over 22,000 acres of land under tillage, only 3,849 are given to corn, although that crop, as will be noted, actually yielded during the census year the surprising average of over 100 bushels per acre. In the face of such advantages, nearly all the subsistence and supplies are purchased from the outside. Whether or not this is due to free choice on the part of the colored race or to the prevailing plantation system is not apparent from the returns; but be that as it may, the concurrence of the two factors is none the less significant. The negro population seeks the rich lands, especially the lowlands, and at present tends to continue there a system of agriculture which involves as direct results indifferent culture, exhaustion of the soil, and a continued indebtedness incurred for the purchase of the prime necessaries of life, which these very soils are so eminently adapted to produce advantageously at home.

AGRICULTURAL METHODS IN THE PRODUCTION OF COTTON.

The view afforded by the schedule replies of the methods and condition of agriculture in the state shows that it is largely in the first and partly in the transition stage, resulting from a partial exhaustion of the soil beginning to direct attention to the best and cheapest methods of resuscitation. The almost universally shallow tillage, the rare use of the subsoil plow, together with the variety of opinions expressed as to the merits whether of deep plowing or subsoiling proper, the turning out of "tired" land, while fresh portions are cleared and brought under the same primitive system of cultivation, and the fact that the use of fertilizers is exceptional, are all characteristic of the advance of the settler into the wilderness, from Alabama and Wisconsin to the Pacific coast. Generally, however, the reduction of the soil's production under this treatment is only temporary, and yields to intelligent culture by the more permanent successor of the pioneer farmer.

RESULTS OF IMPERFECT TILLAGE.—Mississippi has the unenviable privilege of an exception in the latter respect, her copious rainfall and peculiarity of soils having combined to render her uplands, and among them the very best, liable to great and permanent damage from the effects of shallow plowing and "turning-out" of "tired" land. The causes and details of this state of things have been discussed, in treating of the yellow-loam uplands region, from the point of view afforded from personal observations, and are further illustrated by the abstracts of reports received from the counties concerned. But the actual extent of the damage done by this washing and final gullying of the hillside slopes, with the final undercutting into the underlying sands and the bodily descent of the upland soil into the valleys, mingling with a flood of sand, which renders useless alike the hills and the valleys, must be seen to be appreciated. While "horizontalizing" and hillside ditching is now being made in a measure to prevent these inroads, yet the shallow plowing does not give a sufficient depth of tilled soil to hold the heavy downpours of water that occur more or less every year, so that the hillside furrows are broken sideways. The difficulty of making the unintelligent laborers, prevalently employed, follow the prescribed hillside levels, instead of plowing up and down hill, as customary, makes it more difficult to preserve any improvements made in this respect. But however difficult, no more pressing problem than this comes before the cultivators of the uplands of northern and western Mississippi; for, quite apart from such serious and almost irremediable injury as is caused by gullying, there is primarily involved the washing away of the best portion of their surface soil. Even the use of a subsoil plow every alternate year would go far to prevent this grave evil.

ROTATION AND FALLOW.—Next in importance among the means of maintaining productiveness is a proper system of rotation and fallowing, or, what amounts to the same thing, a proper diversity of crops. That this cannot be maintained where half or more of the tilled area is given to cotton is obvious; yet this state of things exists in a large number of counties, as will be noted by reference to Table I, where it will be seen that in very few counties only does cotton occupy less than one-third of the tilled area, the average for the state being 42.7 per cent. While the answers show that a conviction of the benefits of rotation is gaining ground, this is obviously the case mainly in the more remote regions, where circumstances compel a greater diversity of crops. But it is plain that in the great cotton-growing counties the tilled area is practically divided between corn and cotton only; and even this alternation is very commonly only begun and maintained after the cotton product of the land bearing it year after year has seriously diminished. This has been especially the history of the northeastern prairie country, where one bale to the acre was at first the regular crop, which has now diminished to an average of about one-third (0.33). But it is expressly stated by several respondents that this succession is far from satisfactory, and that the intervention of at least one additional crop (field pease) secures far better results. A four-year rotation, including sweet potatoes, is strongly recommended by some; but when we compare the areas given to that crop (one of the common necessaries of life) with that given to other crops it is quite evident that there would not be mouths enough to consume the product of one-fourth of the tilled area. There is a fifth alternative, practicable to any extent, viz, the fallow; but it must be such fallow as tills the land not planted, instead of letting it go to waste by washing, as now

happens when land is "turned out". The great difficulty lies in convincing the negro, and even a portion of the white population, that tillage bestowed on land not planted is not thrown away. When land turned out lies level and "grows up in briers", as is quaintly stated in the answers, it means, of course, that it does not wash away, and from this a benefit is uniformly reported; but when it means only the absence of tillage and the washing away of the soil, joined perhaps to the treading of ranging cattle in wet weather, it is no wonder that "lying out" is not found to benefit the land, as is so frequently stated. Few cotton-growers in the state appreciate adequately the injury done to their fields by the practice of letting the cattle pick up what they can through the winter, the forage thus utilized being dearly paid for by the cloddiness and lack of tilth found in the spring plowing, the difficulties of after-cultivation, and the quick "burning up" of the crop under the influence of dry weather.

FALL PLOWING.—The difference of opinion regarding the utility of fall plowing, with perhaps a leaning against it, is perhaps, in a measure, justified by the necessity existing in any case, of repeated surface tillage. The soil thus receives on the whole a very fair amount of stirring, and to this extent the never-ending fight against "the grass" is a benefit.

WEEDS.—By the wholesale ripening of the weed seeds in the cornfields the fight is made to be a life and death question for the crop whenever a wet season occurs. The most universally troublesome weed—the crab-grass—makes excellent hay. The reason given for letting this matter go by default each season is that *the hands are too busy picking cotton*, which must ever be true so long as two-fifths or more of all tilled land is occupied by that crop. It is clear, then, that so long as this is the case no sound or permanently practicable system of farming can exist. Hay, corn, and bacon will have to be purchased from the outside, and the energies of the cotton-planter must continue to be given to "fighting crab-grass".

PLANTING IN RIDGES.—The universal practice of planting cotton in ridges is intimately connected with shallow tillage. The reason assigned is that when cultivated level cotton is liable to be "drowned out" by heavy rains, and that the greater depth of surface soil so secured is an advantage. The experience of the older states has shown that deep preparation and level cultivation is by far the safer method, for by it security against drought, as well as wet, is gained, and of late the droughts have proved, on the whole, the more fatal to success. In view of the adaptation of the implements now in use to ridge culture, it will probably continue to hold its own for some time, especially where negro labor is in the ascendant. The skill attained in the use of these implements is really remarkable.

FERTILIZATION — USE OF COTTON-SEED.—The answers concerning fertilization are also pregnant with information as to the prevailing ideas and practice. It is only from regions where the soil is naturally of inferior productiveness that we hear of the use of commercial fertilizers; elsewhere they have scarcely been thought of, and even stable manure and cotton-seed, and composts made of them, are used only by "small farmers". Green manuring is chiefly practiced by turning in cow-pease, but large planters only turn in crops of weeds. The discussion as to whether cotton can be profitably grown on a large scale by the aid of fertilizers is still actively going on, the tendency still being to increase production by cultivating more land in the old way, rather than to intensify production on small areas. Cotton-seed is generally recognized as a good fertilizer, and in some regions it is used systematically; but a great deal of it is still lost by being allowed to rot in neglected piles. Some is fed to cattle, whose manure is then scattered in the woods. From Sharkey its use for fuel in making steam for gins is reported. The grievous loss incurred from the wasteful practice of the past is beginning to be appreciated; but now comes the temptation to sell the seed to the oil-mills for cash, with little thought of getting back the seed-cake. As a hopeful symptom, Lowndes and Prentiss report an occasional exchange of the raw cotton-seed for its equivalent, approximately, in seed-cake meal. The seed-cake, or its substance in the guise of the manure of cattle fed with it, should be returned to the soil. (See on this subject the article on "Cotton-seed and its uses" in the general report.) Thus far this essence of fertility is chiefly shipped from the mills to Old and New England.

"INTENSE CULTURE."—The experiments repeatedly made in the eastern cotton states, more especially in Georgia, by Mr. Dickson, and later by Judge Furman, showing plainly and irrefragably the profitableness of intense production on small areas by the use of fertilizers, cannot be too strongly commended to the attention of the cotton-growers of Mississippi. The habit of scattering the energies of the working force over large surfaces, producing only a fraction of a bale per acre, with great risks in case of an unfavorable season, is a proceeding that evidently cannot be long continued, if only on account of its depleting effects on the soil; and it perpetuates the pernicious system of credits and advances upon crops for provisions which could be more cheaply produced at home.

LABOR SYSTEM.—A system of intense culture is incompatible with the now most generally prevailing practice of planting on shares with the laborers or renting land to tenants for a certain portion of the crop. Under either arrangement there is no prospect of the maintenance or improvement of the soil, since the laborer or tenant-at-will is nowise interested in anything except "skinning the soil" to the utmost, and is generally too ill-informed to appreciate the advantages of intense culture, even if he was sure that he would enjoy the results of what improvements he makes. The wage system, placing the plantation under a central, intelligent management, is obviously the only one under which improved methods of agriculture are possible; and even under this system it is not easy to overcome the old slovenly habits and the easy-going ways of the colored race.

GENERAL CONCLUSIONS.—In comparison with the need of greater attention and a steady change in respect to the matters above noted all questions of detail sink into insignificance. Taking the state as a whole, few of the cotton states can compare with Mississippi as to the extent of area occupied by first-class soils, such as those of the Yazoo bottom, table-lands, and prairies, the like of which cannot be found, save in very small bodies, in the Atlantic states. Even of the lands now considered too poor for profitable cotton culture a large proportion only await rational treatment to rise to a level with the good average uplands of Georgia and the Carolinas. The climate is pre-eminently adapted to the culture not only of cotton, but of most of the other products of the warm temperate zone, and in the uplands at least is certainly more conducive to the health of the white race than the prairies of Illinois and Missouri. The rare invasions of the yellow fever, as experience has shown, can be controlled by rational and strict sanitary regulations. The great bottoms are, as yet, during the summer, a safe abiding-place only for the colored race and a small proportion of acclimated whites; but with the exclusion or regulation of overflows, and greater care especially in the matter of the drinking-water used, there will be a great improvement in the sanitary condition of the lowlands, together with possibilities of production, of which the rough, wholesale treatment these lands have thus far experienced can only give a remote idea. It is true that for the census year all replies state that all the cotton has been picked; but it is notorious that many times heretofore, when exceptionally favorable seasons realized the conditions of high and intense culture, the ordinary force of the plantations has been inadequate to pick nearly all the crop, of which, in some cases, as much as one-third has been estimated to have remained in the field on the buckshot lands, the portion actually picked amounting to two (400 pound) bales; so that the product per acre must in these cases have been between 1,100 and 1,200 pounds of lint per acre, or the same result that, in the Georgia experiments, was produced by the highest culture and abundant manuring on worn-out land. The virgin soils of the black prairies of northeastern Mississippi, when first occupied, produced frequently a 400 pound bale and a half; the table-lands of the western part did nearly as well, and, as the replies show, are still credited with the ability to do so, although the statistical evidence shows the rarity of that result at the present time. Since, as a matter of fact, all these lands have merely been "skinned" with tillage a few inches in depth, there can be no question that their resuscitation and restoration to their original production is merely a question of time and good husbandry, and not nearly as much dependent upon actual manuring as is the case in the worn soils of the Atlantic states, whose original store of plant-food was much smaller. There is, then, no natural cause why Mississippi should ever cease to be what she has been for some time past, the banner state for cotton production. Texas, with its immense area, may soon surpass Mississippi in total product by force of numbers, as it were; but it would be difficult to cut out of that state an area equal to that of Mississippi which would equal the latter state as a whole in capacity of production. But it is certain that in order to maintain this pre-eminent position the state must speedily adopt material changes from the old methods of wastefulness, especially as regards the "turning-out" of her "tired" uplands and failure to return the cotton-seed to the cotton-fields, directly or indirectly.

The statistical facts brought out in the preceding tables and their discussion show very clearly some of the leading points to be noted in bringing about this improved state of things. It appears, as a rule, that as yet the regions producing the largest proportion of the cotton product of the state have also the largest negro population. Inspection of the census table giving the size of farms also shows that in such regions the system of large plantations is still in the ascendant, and the system of planting on shares definite or contingent. The effect upon the crop is most noticeable in the columns giving "product per acre", which, other things being equal, seems to be in nearly an inverse ratio to the excess of negroes over whites and to the size of the farms or plantations. Any one familiar with the subject will not need the figures to prove this, but to the world at large they will make the most convincing showing. In the course of the preceding discussion this point of view has been brought forward repeatedly. It is perhaps best exemplified in the comparison between the northern and southern counties of the northeastern prairie region, but with a different form of statistical returns it would be equally apparent in many other cases. When we find that the average product of the Yazoo bottom counties is not quite three-quarters of a bale per acre, instead of an easily possible two bales, as shown in numerous cases of careful culture, the showing becomes quite as cogent in their case as in that of the prairie counties. It is quite clear, then, that a subdivision of the land into smaller holdings, in whose maintenance the owner is personally interested, and, concurrently, the substitution of the wage system for that of shares, at least so far as the negro laborer is concerned, are conditions-precedent of the introduction of a rational and permanently possible agricultural system, not only in Mississippi, but wherever in the cotton states a similar condition of things still prevails; for while the white farmer is far from appreciating, as he should, the advantages of rational agriculture, yet as a matter of fact he is incomparably more accessible to the influence of progress than the negro race, whose excessive conservatism in respect to habits once formed will need the time of several generations to be overcome and replaced by more thrifty methods and ideas.

Analyses of soils, subsoils, and clays of Mississippi.

Number.	Description.	Locality.	County.	Vegetation.	Depth.	Insoluble matter.	Soluble silica.	Insoluble matter and soluble silica.	Potash.	Soda.	Lime.	Magnesia.	Brown oxide of manganese.	Peroxide of iron.	Alumina.	Phosphoric acid.	Sulphuric acid.	Carbonic acid.	Water and organic matter.	Total.	Hygroscopic moisture.	Temperature of absorption C.°	Humus.
	NORTHEASTERN PRAIRIE REGION.																						
	Cretaceous.				*Inches.*																		
175	Prairie soil	Booneville prairie	Tishomingo		10	64.816	3.595	68.411	0.862	0.129	0.987	0.777	0.045	7.651	14.365	0.157	0.010		7.065	100.459	13.07	18	
176	Prairie subsoil	do	do					43.955	0.353	0.124	18.101	0.191	0.076	6.917	5.978	0.229	0.085	11.832	12.159	100.000	12.03	18	
172	Prairie soil	Monroe prairie	Monroe	Black-jack oak, widely scattered	15			78.293	0.333	0.080	1.367	0.369	0.143	14.224		0.104	0.034		5.847	100.788	12.82	19	1.925
173	Prairie underclay	do	do		24 to 36			71.539	0.542	0.230	1.075	0.771	0.046	5.419	13.153	0.051	0.036		6.992	99.854	11.35	9	
125	Cotton-rusting soil	Hollimon's place	Chickasaw					73.602	0.484	0.098	0.986	0.627	0.128	5.510	11.155	0.267	0.027		7.151	100.035	10.30	16	1.418
170	Prairie soil	Noxubee prairie	Noxubee	Scattered post oak and hickory	12	64.644	11.060	75.704	0.366	0.074	1.254	0.716	0.118	4.557	8.918	0.068	trace.		8.466	100.241	14.29	20	
139	Hillside prairie soil	Pettus' place	Kemper		12			67.073	0.699	0.136	1.371	1.003	0.245	6.748	13.068	0.033	0.077		9.453	99.911	11.45	8	1.277
141	Heavy clay soil	do	do			54.565	13.219	67.784	0.431	0.277	0.540	0.836	0.079	7.089	16.071	0.187	0.009		6.922	100.225	13.07	11	0.781
273	Dark loam hummock soil		Tippah	Hickory	5	81.176	5.958	87.134	0.217	0.058	0.350	0.559	0.292	3.421	3.426	0.103	0.016		4.295	99.871	6.86	11	
275	Subsoil		do		5 to 12	78.083	7.965	86.048	0.217	0.057	0.580	0.567	0.127	4.359	4.678	0.096	0.000		3.315	100.050	9.03	11	
164	Pale loam upland soil	Pikeville	Chickasaw	Scarlet, post, and Spanish oaks	10	93.622	1.356	94.978	0.093	0.065	0.069	0.126	0.023	1.090	1.472	0.033	0.005		1.990	99.944	1.80	11	
	Bottom and hummock lands of the northeastern prairie region.																						
177	Heavy clay soil	Coonewah creek	Pontotoc	Willow and water oaks, etc	5	86.160	3.804	89.964	0.207	0.171	0.247	0.263	0.045	1.587	3.023	0.066	0.040		4.761	100.394	3.38	9	
178	Heavy clay subsoil	do	do		5 to 15	90.688	2.742	93.430	0.173	0.151	0.103	0.218	0.058	1.542	2.838	0.115	0.048		1.628	100.304	2.51	9	
	Pontotoc ridge.																						
226	Dark loam soil	Dagget's place	Pontotoc	Black, black-jack, post, and Spanish oaks, hickory, some walnut, sweet and black gum.	10	83.270	5.566	88.836	0.374	0.219	0.281	0.234	0.276	2.359	4.511	0.082	0.017		3.106	100.295	4.08	11	
122	Subsoil	do	do		10 to 18	79.280	8.463	87.743	0.414	0.229	0.221	0.469	0.142	4.525	4.345	0.235	0.066		2.109	100.498	5.60	16	
346	Dark loam soil		Chickasaw	Black oak, hickory, some water oak, etc	9	87.044	3.125	90.169	0.153	0.085	0.168	0.215	0.106	2.758	3.581	0.113	0.018		3.066	100.432	4.06	19	
347	Subsoil		do		9 to 18	70.697	6.569	77.266	0.262	0.105	0.263	0.420	0.134	5.521	11.228	0.094	0.022		4.796	100.111	9.01	19	
	FLATWOODS REGION.																						
220	Heavy clay soil, pale in color.	Flatwoods	Pontotoc	Post oak and pine	12			77.854	0.753	0.106	0.178	0.831	0.167	5.899	10.302	0.052	0.032		3.689	99.863	9.33	22	0.306
288	Clay	do	do			69.099	5.016	74.115	0.737	0.389	0.490	1.787	0.073	7.123	11.322	0.004	0.002		4.429	100.471	19.41	16	
165	Light sandy soil	do	Chickasaw	Post oak chiefly	12			93.575	0.254	0.066	0.082	0.175	0.111	1.445	2.605	trace.	0.008		1.333	99.654	2.05	air-dried	0.891
	Bottom lands of flatwoods region.																						
147	Heavy siliceous soil	White-oak flatwoods	Chickasaw	Post and Spanish oaks and pine	6	89.802	2.656	92.458	0.127	0.100	0.080	0.147	0.087	3.057	1.773	0.105	0.013		1.998	99.945	3.26	21	
144	Heavy siliceous subsoil	do	do		6 to 18	83.040	5.690	88.730	0.171	0.152	0.148	0.119	0.051	3.936	4.627	0.208	0.007		2.230	100.379	7.45	18	
180	Heavy siliceous soil	Potlockney bottom	La Fayette	Chestnut-white and willow oaks, black and sweet gums, hickory, ash, and elm.	8	87.880	1.490	89.370	0.180	0.099	0.156	0.277	0.284	2.725	2.702	0.115	0.014		4.446	100.368	6.81	11	
299	Heavy siliceous subsoil	do	do		8 to 18	88.472	2.168	90.640	0.292	0.083	0.089	0.394	0.108	2.936	3.115	0.075	0.006		2.686	100.424	6.69	11	
369	Heavy siliceous soil	Loosha-Scoona bottom	Calhoun	Oaks, beech, elm, and hornbeam	10	77.539	7.327	84.866	0.494	0.410	0.235	0.442	0.088	2.057	3.886	0.178	0.004		7.839	100.499	6.61	15	
370	Heavy siliceous subsoil	do	do		10 to 18	81.920	7.228	89.148	0.292	0.165	0.122	0.306	0.108	2.579	5.085	0.055	0.005		2.349	100.214	5.58	18	
	YELLOW LOAM REGION.																						
119	Heavy clay upland subsoil, of a pale color.	McLaurin's creek	La Fayette	Post oak, black-jack, and pine	6	92.872	1.632	94.504	0.152	0.058	0.144	0.130	0.065	1.631	1.274	0.040	0.036		2.350	100.384	2.71	16	

374	Heavy clay upland soil, pale in color.	Benela	Calhoun	Pine, Spanish, black and post oaks, hickory, and black gum.	8	91.498	1.722	93.220	0.137	0.054	0.173	0.203	0.066	1.372	1.522	0.088			3.394	100.229	3.36	11	
367	Heavy clay upland subsoil, pale in color.	do	do		8 to 18			83.930	0.355	0.087	0.167	0.502	0.288	4.618	6.948	0.080			3.280	100.255	7.72	11		
160	Subsoil	Noxubee hills	Winston	White and black oaks and hickory	3 to 10	83.399	2.609	86.008	0.198	0.068	0.082	0.218	0.082	3.570	4.770	0.271	0.014		4.873	100.154	10.88	17		
	Oak and short-leaf pine uplands.																							
142	Pale loam upland soil	North of Greensboro' (T. 20, R. 9 E., S. 22).	Sumner	Red oak, chiefly; some post oak and hickory.	6	90.226	2.324	92.550	0.236	0.085	0.092	0.196	0.072	1.839	1.866	0.091	0.007		2.834	99.868	3.57	11		
145	Pale loam upland subsoil	do	do		6 to 15	76.325	7.333	83.658	0.359	0.103	0.087	0.381	0.071	5.151	7.073	0.070	0.008		3.321	100.282	8.59	11		
37	Upland soil	Marion	Lauderdale	Post oak and pine, some hickory, red oak, and black gum.	12	93.702	1.874	95.576	0.095	0.021	0.047	0.115	0.021	0.966	1.031	0.019	0.005		1.651	99.547	1.56	16		
118	Upland subsoil	do	do		12 to 24	83.212	5.386	88.598	0.237	0.082	0.089	0.237	0.037	3.330	4.337	0.061	0.007		2.728	99.743	5.81	16		
71	Dark loam soil	Hamburg hills	Franklin	Black, black-jack, and Spanish oaks, hickory, magnolia, and gum.	7	88.750	1.810	90.560	0.140	0.090	0.070	0.185	0.075	2.405	2.098	0.077	0.005		4.310	100.015	4.40	22		
73	Subsoil	do	do		7 to 20	74.894	9.474	84.368	0.288	0.104	0.127	0.599	0.144	5.672	6.106	0.050	0.006		2.699	100.163	8.81	22		
108	Dark loam upland soil	Brock's plantation	Claiborne	Beech, large Spanish and white oaks, black-jack, holly, etc.	10	78.992	7.430	86.422	0.318	0.087	0.137	0.600	0.072	4.970	5.061	0.025	0.007		2.477	100.176	3.64	18		
112	Subsoil	do	do		10 to 18	78.804	7.910	86.714	0.286	0.084	0.090	0.492	0.022	4.613	5.377	0.042	0.056		2.767	100.543	7.61	18		
	Red lands.																							
246	Red hill soil	Three miles north of Kosciusko.	Attala	White, post, black, and Spanish oaks, hickory, and pine.	12			61.971	0.725	0.297	0.820	1.468	0.129	10.500	17.500	0.018			6.580	100.008	18.59	8		
265	Ferruginous greensand marl.	Shongalo	Carroll					55.705	1.604	0.045	0.166	1.630		34.347		trace	0.129		7.012	100.638				
268	Ferruginous clay, with greensand.	do	do					78.972	0.945	0.401	0.144	1.129	0.177	9.435	4.449	trace	0.001		4.790	100.443				
	Sandy oak uplands.																							
228	Dark loam soil	A. Pegues' place	La Fayette	Black, post, and Spanish oaks, some black-jack and hickory.	5	90.150	1.636	91.786	0.119	0.119	0.147	0.533	0.126	2.532	2.652	0.154	0.007		2.217	100.392	4.69	11		
221	Subsoil	do	do		5 to 18			88.677	0.364	0.135	0.358	0.272	0.450	2.423	4.526	0.045	0.069		3.407	100.726	4.68	10		
346	Dark loam soil	Black-jack ridge	do	Small black-jack oaks and huckleberry bushes.	6			97.092	0.073	0.020	0.142	0.100		0.907	0.640		0.002		0.911	99.887	1.39	14		
	Brown-loam table-lands.																							
216	Dark loam soil	Table-land, Clayton's plantation.	Marshall	Black-jack, post, and Spanish oaks, hickory, and sweet gum.	10			83.347	0.549	0.082	0.245	0.479	0.760	4.798	6.282	0.068	0.062		4.195	100.867	6.84	17	0.787	
235	Subsoil	do	do		10 to 20			83.993	0.700	0.041	0.139	0.597	0.332	3.862	7.729	0.236	0.054		2.716	100.399	7.42	17		
219	do	Ridge, Clayton's plantation.	do		10 to 20	70.53	12.30	82.830	0.630	0.090	0.270	0.450	0.060	5.110	8.090	0.210	0.020		3.140	100.900				
53	Virgin soil	Richland	Holmes	Large post and Spanish oaks	8			89.609	0.304	0.054	0.250	0.307	0.374	2.136	3.554	0.074	0.018		3.557	100.237	4.70	17		
56	Virgin subsoil	do	do		8 to 36			85.462	0.702	0.175	0.392	0.756	0.256	4.237	5.787	0.037	0.049		2.245	100.098	5.84	9		
55	Cultivated soil	do	do		6	92.254	1.891	94.145	0.129	0.043	0.159	0.251	0.141	1.627	1.703	0.071	0.012		2.019	100.300	2.43	11		
298	Loam subsoil	Catching's plantation	Hinds	Black-jack, post, and Spanish oaks	9 to 10			80.788	0.634	0.185	0.266	1.029	0.159	4.927	8.940	0.151	0.076		3.239	100.394	8.54	17		
348	Upland dark loam soil	Dixon's plantation	do	Black, black-jack, post, and Spanish oaks, hickory, walnut, and mulberry.	8	92.198	0.548	92.746	0.417	0.042	0.156	0.140	0.087	1.393	3.157	0.038	0.019		2.364	100.559	4.26	9		
349	Upland dark loam subsoil	do	do		8 to 20	74.179	10.617	84.796	0.519	0.131	0.204	0.626	0.039	4.100	6.747	0.050	0.029		3.039	100.280	7.23	10		
232	Loam soil	Watson's plantation	Claiborne	White and black oaks, beech, hickory, sweet and black gums, sassafras, and elm.	8			87.573	0.458	0.124	0.244	0.545	0.205	3.231	4.842	0.105	0.028		3.073	100.428	5.18	21	0.718	
233	Loam subsoil	do	do		8 to 20			79.477	0.741	0.248	0.238	0.830	0.346	5.635	8.849	0.092	trace		3.496	99.952	9.09	8		
156	Big Black hummock soil		Choctaw	Beech, hickory, elm, and ash	12	85.692	3.642	89.334	0.172	0.084	0.093	0.250	0.450	2.873	3.470	0.175	0.007		2.969	99.877	4.65	11		
58	do		Madison	Post, willow, and black-jack oaks	6			90.847	0.341	0.044	0.163	0.153	0.231	1.014	2.102	0.079	0.028		1.892	96.894	1.20	8		
57	Big Black hummock subsoil.		do		6 to 12	88.342	4.984	93.326	0.142	0.063	0.063	0.151	0.034	1.668	2.980	0.064	0.005		1.760	100.256	4.34	22		
48	White post-oak hummock soil.	Vaiden's plantation	Carroll	A few post oaks	12			89.391	0.192	0.080	0.075	0.067	0.117	1.214	4.373	0.054	0.046		4.093	99.702	4.66	11		
52	White post-oak hummock subsoil.	do	do			86.080	4.150	90.230	0.212	0.076	0.059	0.238	0.127	3.921	3.260	0.076	0.008		2.573	100.780	5.11	21		
50	White hummock soil	Yockanookana	Leake	Hickory, white, and Spanish oaks, elm, beech, and pine.	12			93.223	0.207	0.042	0.132	0.104	0.122	0.932	3.036	0.041	0.026		2.230	100.095	3.25	6	0.637	
	Bottom lands of the yellow loam region.																							
365	Siliceous soil	Tallahatchie bottom	Panola	Sweet-gum, large tulip trees, hickory, ash, white oak, walnut, etc.	12	81.506	5.094	86.600	0.788	0.234	0.265	0.328	0.113	2.575	6.087	0.125	0.035		3.601	100.751	6.12	11		
135	Soil	Besachitto bottom	Choctaw	Beech, ash, hickory, white and willow oaks, sweet gum, holly, etc.		88.154	2.630	90.784	0.228	0.038	0.076	0.237	0.142	1.871	2.968	0.083	0.009		3.639	100.075	5.52	13		
	CANE HILLS.																							
113	Sandy upland soil	Magnolia hills	Claiborne	Magnolia, and cane	10	86.304	4.694	90.998	0.230	0.042	0.279	0.293	0.137	2.236	3.245	0.128	0.013		2.941	100.542	3.36			
114	Sandy upland subsoil	do	do		10 to 24	72.348	9.490	81.838	0.445	0.078	0.381	0.705	0.051	4.930	7.894	0.082	0.038		3.319	99.761	7.53	21		

Analyses of soils, subsoils, and clays of Mississippi—Continued.

Number.	Description.	Locality.	County.	Vegetation.	Depth.	Insoluble matter.	Soluble silica.	Insoluble matter and soluble silica.	Potash.	Soda.	Lime.	Magnesia.	Brown oxide of manganese.	Peroxide of iron.	Alumina.	Phosphoric acid.	Sulphuric acid.	Carbonic acid.	Water and organic matter.	Total.	Hygroscopic moisture.	Temperature of absorption C.°	Humus.
	CANE HILLS—continued.				*Inches.*																		
237	Loess	Near J. Watson's	Claiborne	Oaks and poplar				75.344	0.511	0.115	5.921	3.278	0.252	3.272	2.823	0.143	0.060	6.729	1.231	99.679	4.12	20	
116	Upland loess	Magnolia hills	do			64.593	6.446	71.039	0.360	0.199	7.572	4.507	0.146	2.947	2.512	0.138	0.149	0.004	0.654	100.227	2.74	26	
117	White hummock soil	Bayou Pierre	do	Water and post oaks, black gum, etc.	9	92.637	2.562	95.199	0.133	0.020	0.101	0.167	0.125	1.004	1.393	0.067	0.045		2.092	100.346	2.25	14	
115	White hummock subsoil	do	do		9 to 18	96.108	1.171	97.279	0.119	0.081	0.338	0.095	0.074	0.785	0.150	0.126	0.054		1.116	100.217	1.60	12	
110	Brown loam soil	Cole's creek, near Fayette.	Jefferson	Sweet gum, sycamore, walnut, locust, oak, and cane.	12	73.856	10.127	83.983	0.240	0.324	0.140	0.355	0.362	3.135	6.238	0.056	0.036		5.532	100.401	6.65	12	
109	Brown loam subsoil	do	do			81.287	3.500	84.787	0.164	0.100	0.084	0.704	0.136	5.393	5.168	0.040	0.011		3.338	99.925	9.70	12	
	Bottom lands of cane hills.																						
68	Sandy soil	Middle Homochitto creek bottom.	Franklin	Magnolia, beech, oak, gum, poplar, and maple.	12			92.164	0.148	0.044	0.122	0.212	0.284	1.183	3.219	0.079	0.045		2.697	100.197	4.05	8	
64	Subsoil	do	do		12 to 32	88.780	3.190	91.970	0.140	0.067	0.034	0.280	0.084	2.058	2.780	0.035	0.006		1.847	99.301	4.55	21	
66	Dark soil	West Amite bottom	do	do	12			87.543	0.486	0.054	0.215	0.354	0.690	5.528	2.407	0.100	0.048		3.507	100.932	5.52	6	
67	White soil	do	do	Pine, oaks, gum, hickory, and sweet gum.	10			91.334	0.270	0.103	0.134	0.137	0.141	1.241	3.878	0.149	0.022		2.961	100.370	2.83	20	0.717
70	White subsoil	do	do		10 to 20	90.490	3.382	93.872	0.150	0.045	0.055	0.120	0.085	1.771	2.542	0.048	0.005		1.628	100.321	3.77	22	
	MISSISSIPPI ALLUVIAL REGION.																						
395	Light bottom soil	Dogwood ridge	Coahoma	Dogwood, sweet gum, holly, ash, and sassafras.	4	83.886	7.022	90.908	0.392	0.086	0.259	0.596	0.086	2.691	3.593	0.142	0.010		2.007	100.770	3.95	10	
396	Light-colored buckshot clay.	do	do	do	8	75.513	10.895	86.408	0.606	0.146	0.386	0.972	0.133	2.804	4.457	0.278	0.007		4.401	100.598	6.04	12	
354	Light bottom soil	Tallahatchie	Tallahatchie			87.146	4.798	91.944	0.301	0.084	0.301	0.385	0.158	2.120	2.151	0.112	0.005		2.644	100.205	4.79	22	
376	Light front-land soil	Indian bayou	Sunflower	Sweet gum, oak, hickory, holly, and dogwood.	5	87.898	4.036	91.934	0.226	0.116	0.153	0.256	0.048	1.848	2.565	0.162	0.042		3.013	100.363	4.07	14	0.880
377	Subsoil	do	do		5 to 18	87.898	3.816	91.714	0.305	0.079	0.147	0.392	0.050	2.312	2.998	0.283			1.499	99.779	5.68	16	
394	Light front-land soil	Sunflower river	Issaquena	Sweet gum, maple, oak, elm, and sassafras.	12	71.164	13.506	84.670	0.401	0.191	0.406	0.696	0.011	3.845	6.889	0.165	0.016		2.748	100.038	7.39	15	
390	Heavy clay buckshot soil	Deer creek	do	Sweet gum, hackberry, locust, pecan, oak, and cane.	12	51.063	20.704	71.767	1.104	0.325	1.349	1.665	0.119	5.818	10.539	0.304	0.024		7.369	100.383	14.31	15	
	CENTRAL PRAIRIE REGION (Tertiary).																						
188	Black prairie loam soil	Parker's place	Rankin	Sweet gum, wild cherry, plum, and mulberry.	12	69.949	4.455	74.404	0.904	0.244	1.040	0.910	0.120	4.768	7.246	0.466	0.159		10.739	101.000	16.22	14	1.317
210	Post-oak prairie soil	Crook's place	Smith	Small sweet gum and ash				80.264	0.573	0.114	0.966	0.528	0.292	10.361		0.128	0.035		6.738	100.000	11.14	20	
203	Ridge prairie soil	Bowland's creek	do					51.749	0.534	0.220	0.484	1.005	0.098	23.786	10.854	0.151	0.022		11.385	100.288	19.73	17	
207	Ridge prairie subsoil	do	do			42.523	6.597	49.120	0.288	0.385	0.786	1.621	0.035	20.790	17.680	0.050	0.021		9.966	100.742	22.13	19	
199	Prairie soil	Leaf river	Jasper	Locust, crab-apple, etc	12			63.435	0.796	0.127	1.815	1.112	0.479	6.996	15.895	0.232	0.085	9.028		100.000	20.92	22	1.669
195	do	Suanlovey creek bottom	do	Sweet gum, ash, elm, cottonwood, oaks, and maple.		67.562	9.926	77.488	0.384	0.059	1.728	0.881	0.128	3.899	7.680	0.104	0.005		7.772	100.128	13.78	16	
44	Upland prairie soil	Trotter's plantation	Clarke	Some crab-apple and haw	15	43.615	16.095	59.710	0.686	0.237	2.017	1.327	0.152	7.341	17.829	0.115	0.112		10.726	100.252	18.08	9	
40	Bald prairie soil		do			31.504	7.826	39.330	0.589	0.223	22.570	1.094	0.111	4.094	7.446	0.102	0.246	17.411	6.779	99.995	12.10	11	
363	Gypseous underclay	Nichols' place	Smith					43.529	0.638	0.136	14.867	1.004	0.238	17.035		0.139	7.764	7.466	7.174	100.000	16.71	20	
	b. Hog-wallow and gypseous prairies.																						
187	Gypseous prairie soil	McRae's prairie	Rankin					82.558	0.339	0.023	0.432	0.513	0.092	3.084	7.424	0.076	0.058		5.922	99.921	5.43	air-dried	
401	Gypseous prairie underclay	do	do					67.027	0.518	0.414	5.695	1.233	0.509	4.344	10.751		5.751	1.018	2.740	100.000			

242	Hog-wallow prairie soil	Tallahala creek	Jasper	Post and Spanish oaks, and pine	6			76.756	0.525	0.190	0.424	0.674	0.559	4.121	10.059	0.063	0.059		5.733	99.165	6.83	air-dried	0.782
38	Hog-wallow upland soil	Trotter's plantation	Clarke	Pine, post oak, black-jack, and hickory	8	76.518	9.710	86.228	0.363	0.199	0.133	0.274	0.040	3.951	6.367	0.039	0.018		2.806	100.418	6.40	11	
33	Hog-wallow upland subsoil	do	do		8 to 18			70.982	0.309	0.127	0.168	0.149	0.074	23.040		0.100	0.050		5.148	100.147	15.80	18	
	LONG-LEAF PINE REGION.																								
	Pine hills.																								
205	Pale loam soil	Pine ridge	Simpson	Post, Spanish, and scarlet oaks, pine, and some hickory	6	92.626	2.024	94.650	0.074	0.048	0.061	0.112	0.117	1.263	1.475	0.069	0.004		2.075	99.948	2.19	22	
192	Subsoil	do	do		6 to 15	86.756	4.778	91.534	0.169	0.034	0.038	0.229	0.114	2.219	3.600	0.041	0.004		1.645	99.627	4.04	22	
206	Pale loam soil	Pine hills	Smith	Pine, black-jack, and hickory	5			93.257	0.259	0.065	0.129	0.180	0.146	1.251	2.356	0.030	0.024		2.330	100.027	2.48	19	0.548
209	Under-subsoil	do	do		12 to 18			83.030	0.485	0.061	0.078	0.519	0.153	4.145	8.893	0.022	0.021		3.117	100.519	7.69	19	
292	Red loam subsoil	White sand creek	Lawrence		8 to 18	81.229	6.689	87.918	0.269	0.105	0.059	0.243	0.046	3.647	5.114	0.101	0.138		2.681	100.321	6.68	18	
249	Underclay	Bogue Chitto	Pike	Oak and hickory	10 to 18	87.144	3.824	90.968	0.140	0.075	0.059	0.145	0.080	2.744	3.705	0.065	0.306		2.191	100.478	2.20	18	
218	Pale loam soil	Summit station	do	Pine, post, black, and Spanish oaks, and black-jack	9			89.801	0.218	0.076	0.034	0.306	0.072	2.402	3.783	0.038	0.036		3.446	100.212	4.11	21	
222	Subsoil	do	do		9 to 20			77.931	0.266	0.072	0.152	0.352	0.095	5.456	11.870	0.043	0.035		3.261	99.533	10.00	21	
	Bottom and hummock lands of long-leaf pine region.																								
361	White hummock soil	Bayou Pierre	Copiah	Chiefly beech				86.169	0.253	0.050	0.121	0.180	0.245	2.700	6.301	0.100	trace.		4.177	100.296	5.30	19	
360	White hummock subsoil	do	do					88.511	0.333	0.067	0.125	0.277	0.342	2.369	6.106	0.087	0.049		2.516	100.782	5.23	10	
343	White hummock soil	Bahala second bottom	do		10	81.570	4.003	85.573	0.499	9.257	0.090	0.546	0.041	3.233	6.182	0.047	0.035		3.788	100.291	6.74	8	
344	Subsoil	do	do		10 to 20	81.420	3.925	85.345	0.357	0.208	0.129	0.377	0.089	3.409	6.885	0.091	0.009		3.354	100.253	6.18	4	
80	Light-colored soil	Bogue Chitto second bottom	Pike	(As in No. 68)	12	85.376	3.802	89.178	0.136	0.060	0.090	0.188	0.150	1.821	3.497	0.063			4.571	99.754	4.72	18	
194	do	Okahay bottom	Smith	Oaks, hickory, beech, and gum		84.699	3.037	87.736	0.149	0.078	0.418	0.099	0.262	2.107	2.107	0.149	0.007		6.619	99.731	6.61	22	
11	do	Buckatunna bottom	Wayne	Pine and sweet gum	10	71.332	9.321	80.653	0.211	0.139	0.157	0.489	0.216	4.580	8.526	0.132	trace.		7.372	102.475	9.01	10	
19	Soil	Chickasawhay bottom	Greene	Ash, elm, oak, gum, and magnolia		91.816	1.724	93.540	0.122	0.076	0.091	0.142	0.035	1.210	1.373	0.060	0.005		3.307	99.961	4.29	22	
8	Prairie bottom soil	Pascagoula	Jackson	Oak, gum, holly, and magnolia	9	71.069	8.729	79.798	0.312	0.057	0.082	0.321	0.140	4.638	6.858	0.042	0.008		7.904	100.160	11.96	22	
181	Hummock soil	Pearl river	Lawrence	Sweet and black gums, water and willow oaks.	6	94.384	1.738	96.122	0.107	0.053	0.060	0.060	0.066	0.612	0.818	0.014	0.006		2.182	100.100	2.35	19	
182	Hummock subsoil	do	do		6 to 18	89.008	4.494	93.502	0.155	0.077	0.058	0.167	0.077	1.660	2.187	0.130	0.006		1.723	99.742	4.15	19	
61	Hummock soil	do	Marion	Oaks, sweet gum, and pine	6	87.520	2.696	90.216	0.124	0.068	0.113	0.141	0.124	1.830	3.326	0.069	0.016		4.251	100.278	4.41	21	
62	Hummock subsoil	do	do		6 to 20	85.354	4.824	90.178	0.169	0.076	0.054	0.212	0.065	2.774	4.134	0.059	0.005		2.320	100.046	5.67		
60	Hummock soil	Pearl river bottom	do	Sweet gum, hickory, and oaks	10	87.024	0.802	87.826	0.174	0.069	0.078	0.278	0.078	2.511	2.674	0.146	0.008		5.941	99.783	8.49	23	
63	Hummock subsoil	do	do		10 to 20	85.212	3.992	89.204	0.212	0.051	0.071	0.167	0.090	3.021	4.084	0.100	0.006		3.563	100.569	9.60	22	
18	Light hummock soil	Pascagoula river	Jackson	White and water oaks, magnolia, holly, and ironwood.	10	94.200	0.741	94.941	0.115	0.025	0.076	0.081	0.029	0.604	1.158	0.066	trace.		2.777	99.892	2.14	22	
25	Subsoil	do	do		10 to 20	90.336	1.850	92.186	0.173	0.035	0.132	0.153	0.683	1.373	1.941	0.057	trace.		4.496	100.629	4.15	22	
	Pine flats and coast lands.																								
214	Sandy soil	Pine meadow	Jackson	Pine and cypress	12			95.592	0.061	0.050	0.023	0.069	0.045	0.459	0.848	0.021	trace.		2.277	99.445			
17	Sandy shell hummock soil	West Pascagoula	do	Live and water oaks, cedar, magnolia, holly, dogwood, and sweet gum.	6	94.208	0.680	94.888	0.055	0.046	0.223	0.101	0.016	0.433	0.585	0.164	0.004		3.561	100.016	2.06	10	
15	Subsoil	do	do		6 to 12	97.245	0.512	97.757	0.012		0.072	0.060	0.042	0.404	0.388	0.148	0.018		1.019	99.920	0.98	10	
88	Sandy sea island cotton soil.	Mulatto bayou	Hancock	As above, with hickory and sassafras	12	93.634	2.448	96.082	0.045	0.057	0.098	0.114	0.053	0.516	0.464	0.097			3.018	100.544	2.52	22	
90	Sandy sea island cotton subsoil.	do	do		12 to 20			96.370	0.080	0.045	0.115	0.065	0.035	0.524	0.322	0.107			1.821	99.484	2.04	22	
241	Marsh soil	Pearl river marsh	do	Marsh				74.150	1.003	0.379	0.182	1.004	0.065	3.350	10.643	0.188	0.858		8.390	100.212	7.94	air-dried	
215	do	West Pascagoula marsh	Jackson	do				70.183	0.559	0.957	0.109	0.743	0.067	1.171	5.894	0.111	0.176		19.826	99.796	15.44	22	
220	Marsh muck	do	do	do				25.225				8.358					0.347		66.070	100.000	21.49	21	