REPORT

ON THE

COTTON PRODUCTION OF THE STATE OF FLORIDA,

WITH AN ACCOUNT OF

THE GENERAL AGRICULTURAL FEATURES OF THE STATE.

BY

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LETTERS OF TRANSMITTAL.

DEPARTMENT OF THE INTERIOR,
CENSUS OFFICE,
Berkeley, California, October 31, 1881.

Hon. FRANCIS A. WALKER, *Superintendent of Census.*

DEAR SIR: I have the honor to transmit herewith a report on the cotton production and agricultural features of the state of Florida, by Dr. Eugene A. Smith, special agent in charge of the subject for the states of Alabama and Florida.

In view of the very imperfect and fragmentary data regarding the natural features of Florida thus far accessible to the public, and of the growing interest in the inducements offered to the immigrant by this semi-tropical region, it has been thought desirable to accord to it a somewhat more detailed consideration than would be called for in the case of the states whose accessibility by railroads and comparatively dense population have made their general features more familiar. Since, moreover, the personal explorations of Dr. Smith have resulted in very important additions to our knowledge of the geological structure of the state which has been to a great extent misunderstood, this portion of the subject has likewise received more scope than will be given it in the case of the states in which geological surveys have heretofore been made and reported on.

A map showing the several agricultural regions, and one showing the acreage in cotton, accompany the report.

Very respectfully, your obedient servant,

EUG. W. HILGARD,
Special Agent in charge of Cotton Production.

UNIVERSITY OF ALABAMA,
Tuscaloosa, October 15, 1881.

Dr. EUGENE W. HILGARD,
Special Agent Tenth Census, in charge of Cotton Production.

DEAR SIR: I have the honor to submit herewith my report upon cotton production in the state of Florida, in the form of tabular statements of the enumeration results, together with a general account of the physical geography, geology, and agricultural features of the state.

To this are added special agricultural descriptions of the counties, in which it has been attempted to present the most important features of each in such a form as to be of service to the general reader as well as to the immigrant.

In the general arrangement of the subject-matter I have followed the plan adopted by yourself in the report on Louisiana, viz:

1. Tabulated results of the enumeration, showing acreage and production of the leading crops.
2. An outline of the physical geography and geology of the state.

In view of the circumstance that so little has been published on Florida geology, I have, at your suggestion, prepared a measurably complete *résumé* of what has hitherto been done in this field, together with a synopsis of the results obtained by me during the summer of 1880 while engaged in the collection of statistics for the present report.

3. A description of the agricultural subdivisions or regions, with analyses of characteristic soils, etc., and their discussions. With one or two exceptions these analyses were made for the Census Office under my immediate supervision.

4. A general account of cotton production in Florida, with comparisons of the long and short staple varieties and discussions of the enumeration results which relate to the production of cotton. The tabulated results of the enumeration are given in this connection, showing population and cotton production in each agricultural region of the state, "banner counties" as regards production and product per acre in each agricultural region, and area, population, and cotton production of the several counties, arranged according to agricultural regions.

5. Descriptions of the counties, grouped according to the regions to which they belong.

The lines between the agricultural regions, while sharply defined on the map, are necessarily more or less shadowy in reality, and it is in many cases a mere matter of choice or convenience whether a county is to be assigned to one or the other of the divisions. Still I have endeavored, in grouping the counties, to apply as consistently as possible the principles according to which the classification into agricultural regions was made.

Each description is preceded by statistics of area, population, cotton production, production of other leading crops, and estimates of the areas of each agricultural division. These latter figures have been obtained by map measurements, but they can make no claim to be more than close approximations. To this the inaccuracies of the state maps, and particularly the uncertainty as to the exact limits of the agricultural regions, have contributed.

To the description is appended, in every case where the schedules have been returned, an abstract of the answers to the schedule questions relating to the several soils and their cotton production, and to the direction, mode, and cost of shipment.

6. Abstracts of the answers to the schedule questions, covering the details of cultivation and preparation for market, diseases and insect enemies of the plant, labor, and system of farming are next given, arranged according to topics.

In collecting the data for this report I visited the following counties during the summer of 1880: Holmes, Gadsden, Leon, Wakulla, Jefferson, Madison, Suwannee, Columbia, Baker, Bradford, Nassau, Duval, Saint John's, Alachua, Marion, Sumter, and Orange.(a)

From the tables it will be seen that the counties above named produce the greater part of the cotton crop of the state. For this reason, and for lack of time, the remaining counties were not personally visited, and information concerning them has necessarily been derived from other sources, which are substantially the following:

The *schedule answers* returned from seventeen of the counties, abstracts of which, with due credit, are to be found in their proper places.

The publications of the *Bureau of Immigration*, under the present commissioner, Dr. French, and under his predecessor. In these pamphlets is condensed much valuable information concerning the soils, climate, and productions of the state, and free use has been made of both.

A View of West Florida, by Colonel John Lee Williams, published in 1827, and *An Account of the Territory of Florida*, by the same author, published in 1837. These books are models of clear, concise, and accurate description, and I acknowledge my great indebtedness to them throughout. With their aid I have been able to give a tolerably complete account of those parts of the state not personally examined. Some of the descriptions have been literally transcribed.

From the *judges of probate* of several counties I have obtained valuable notes on special subjects, and to Mr. Samuel Fairbanks, of the Bureau of Immigration; to Mr. J. V. Burke, of Marianna; to Mr. Jesse Wood, of Mount Pleasant; to Dr. E. B. Miles, of Fort Mason, and to many of the correspondents from whom reports were received, I am under great obligations, both for descriptions of parts of counties and for oft-repeated courtesies.

Very respectfully, your obedient servant,

EUGENE A. SMITH.

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a The geological results of this excursion were published in a paper "On the Geology of Florida" in the *American Journal of Science* for April, 1881.

TABULATED RESULTS OF THE ENUMERATION.

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

Counties.	Area in square miles.	POPULATION.						TILLED LANDS.			COTTON PRODUCTION.					Cotton, acreage per capita.	Cotton, acreage per square mile.
		Total.	Male.	Female.	White.	Colored.	Per square mile.	Acres.	Percentage of, in cotton.	Percentage of county area.	Acres.	Bales, 475 lbs.	Average per acre.				
													Bales.	Seed cotton.	Lint.		
OAK, HICKORY, AND PINE UPLAND REGION.																	
*Short-staple cotton.**														*Lbs.*	*Lbs.*		
Jackson	1,000	14,372	7,132	7,240	5,637	8,735	14.37	34,738	31.77	13.20	26,920	9,144	0.23	324	108	1.87	26.92
Gadsden	540	12,169	5,926	6,243	4,114	8,055	22.54	65,304	29.81	18.90	19,464	4,696	0.24	345	115	1.60	36.04
Leon	900	19,662	9,570	10,092	2,822	16,840	21.85	104,857	41.00	18.20	42,988	9,562	0.22	318	106	2.19	47.76
Jefferson	560	16,065	7,929	8,136	3,397	12,668	28.69	104,350	35.94	29.10	37,500	10,308	0.28	399	133	2.33	66.96
Madison	850	14,798	7,224	7,574	5,609	9,189	17.41	83,962	34.52	15.40	28,982	7,054	0.24	348	116	1.96	34.10
Total	3,850	77,066	37,781	39,285	21,579	55,487	20.02	443,211	35.16	18.00	155,854	37,824	0.24	345	115	2.02	40.48
LONG-LEAF PINE REGION.																	
*Short-staple cotton.**																	
Escambia	720	12,156	5,945	6,211	6,854	5,302	16.88	1,298	1.93	0.30	25	10	0.40	570	190	.....	0.03
Santa Rosa	1,260	6,645	3,318	3,327	4,773	1,872	5.27	1,804	0.94	0.20	17	5	0.29	420	140	.....	0.01
Walton	1,360	4,201	2,072	2,129	3,685	516	3.09	9,373	15.33	1.10	1,437	382	0.27	378	126	0.34	1.06
Washington	1,330	4,089	2,089	2,000	3,171	918	3.07	12,003	15.56	1.40	1,877	602	0.32	456	152	0.46	1.41
Holmes	540	2,170	1,058	1,112	2,043	127	4.02	12,662	8.98	3.70	1,137	273	0.24	342	114	0.52	2.11
Calhoun	1,160	1,580	795	785	1,184	396	1.36	3,453	20.88	0.50	721	172	0.24	339	113	0.46	0.62
Liberty	800	1,362	681	681	814	548	1.70	3,630	20.22	0.70	734	197	0.27	381	127	0.54	0.92
Total short-staple cotton	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5,948	1,641	0.28	393	131	.....	.....
Sea-island or long-staple cotton.†																	
Wakulla	580	2,723	1,325	1,398	1,563	1,160	4.69	13,678	16.90	3.70	2,311	561	0.24	340	85	0.85	3.98
Taylor	1,080	2,279	1,186	1,093	2,114	165	2.11	8,742	22.80	1.30	1,993	418	0.21	292	73	0.87	1.85
Suwannee	660	7,161	3,756	3,405	4,021	3,140	10.85	37,590	19.30	8.90	7,288	1,177	0.16	228	57	1.02	11.04
Hamilton	540	6,790	3,403	3,387	4,472	2,318	12.57	39,731	29.40	11.50	11,680	1,908	0.16	228	57	1.72	21.63
Columbia	860	9,589	4,855	4,734	4,820	4,769	11.15	45,750	28.72	8.30	13,142	1,992	0.15	212	53	1.37	15.28
Baker	500	2,303	1,210	1,093	1,660	643	4.61	4,898	22.60	1.50	1,107	215	0.19	272	68	0.48	2.21
Bradford	550	6,112	3,117	2,995	4,822	1,290	11.11	22,440	26.01	6.40	5,836	1,094	0.19	248	62	0.95	10.61
Nassau	640	6,635	3,486	3,149	3,075	3,560	10.37	4,554	4.28	1.10	195	53	0.27	380	95	0.03	0.30
Duval	900	19,431	9,719	9,712	8,580	10,851	21.59	5,959	0.96	1.00	57	23	0.40	564	141	.....	0.06
Saint John's	1,000	4,535	2,275	2,260	3,170	1,365	4.54	2,841	0.28	0.40	8	6	0.75	1,052	263	.....	0.01
Clay	640	2,838	1,462	1,376	2,265	573	4.43	4,060	11.21	1.00	456	96	0.21	296	74	0.16	0.71
Putnam	860	6,261	3,306	2,955	3,845	2,416	7.28	11,788	11.50	2.10	1,356	347	0.26	360	90	0.22	1.58
Alachua	1,260	16,462	8,490	7,972	6,440	10,016	13.07	49,731	29.45	6.20	14,646	2,519	0.17	240	60	0.89	11.62
Lafayette	940	2,441	1,298	1,143	2,268	173	2.60	7,962	5.93	1.30	472	107	0.23	316	79	0.19	0.50
Levy	940	5,767	3,081	2,686	3,732	2,035	6.14	15,645	23.43	2.60	3,665	1,251	0.34	476	119	0.64	3.99
Marion	1,680	13,046	6,580	6,466	4,741	8,305	7.77	50,160	26.53	4.70	13,305	2,426	0.18	256	64	1.02	7.92
Volusia	1,340	3,294	1,796	1,498	2,756	538	2.46	4,044	8.16	0.50	330	62	0.19	264	66	0.10	0.25
Orange	2,250	6,618	3,863	2,755	5,595	1,023	2.94	11,762	6.95	0.80	818	143	0.17	244	61	0.12	0.36
Sumter	1,380	4,686	2,405	2,101	3,501	1,185	3.40	14,550	17.37	1.60	2,527	419	0.17	232	58	0.54	1.83
Hernando	1,700	4,248	2,246	2,002	3,319	929	2.50	14,691	10.61	1.40	1,558	468	0.30	420	105	0.37	0.92
Hillsborough	1,300	5,814	2,987	2,827	4,809	915	4.47	11,261	4.94	1.40	556	150	0.27	376	94	0.10	0.43
Polk	2,060	3,181	1,663	1,518	3,033	148	1.54	8,688	5.54	0.70	481	95	0.20	276	69	0.15	0.23
Total for region	30,330	174,417	89,557	84,860	107,221	67,196	5.66	434,826	20.64	2.20	89,735	17,171	0.19	.....	.....	0.51	2.91
Total long-staple cotton	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	83,787	15,530	0.19	260	65	.....	.....
PITCH-PINE, TREELESS, AND ALLUVIAL REGION.																	
Sea-island or long-staple cotton.†																	
Franklin	690	1,791	907	884	1,199	592	2.60	521	.....	0.10	.....	.....	.....	.....	.....	.....	.....
Manatee	4,680	3,544	1,856	1,688	3,378	166	0.76	5,257	.....	0.20	.....	.....	.....	.....	.....	.....	.....
Monroe	2,600	10,940	5,371	5,569	7,659	3,281	4.21	1,705	.....	0.10	.....	.....	.....	.....	.....	.....	.....
Dade	7,200	257	153	104	190	67	0.04	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Brevard	4,390	1,478	819	659	1,379	99	0.34	1,952	0.31	0.10	6	2	0.33	464	116	.....	.....
Total	19,560	18,010	9,106	8,904	13,805	4,205	0.92	9,435	0.06	0.10	6	2	0.33	464	116	.....	.....
Total for State	54,240	269,493	136,444	133,049	142,605	126,888	4.97	887,472	27.07	2.60	245,595	54,997	0.22	*348	*116	0.91	4.53
	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	†264	†88	.....	.....

* Bales=475 pounds. Three pounds of seed-cotton to one pound of lint. †Bales=350 pounds. Four pounds of seed-cotton to one pound of lint.

TABLE II.—ACREAGE AND PRODUCTION OF THE LEADING CROPS IN EACH AGRICULTURAL REGION.

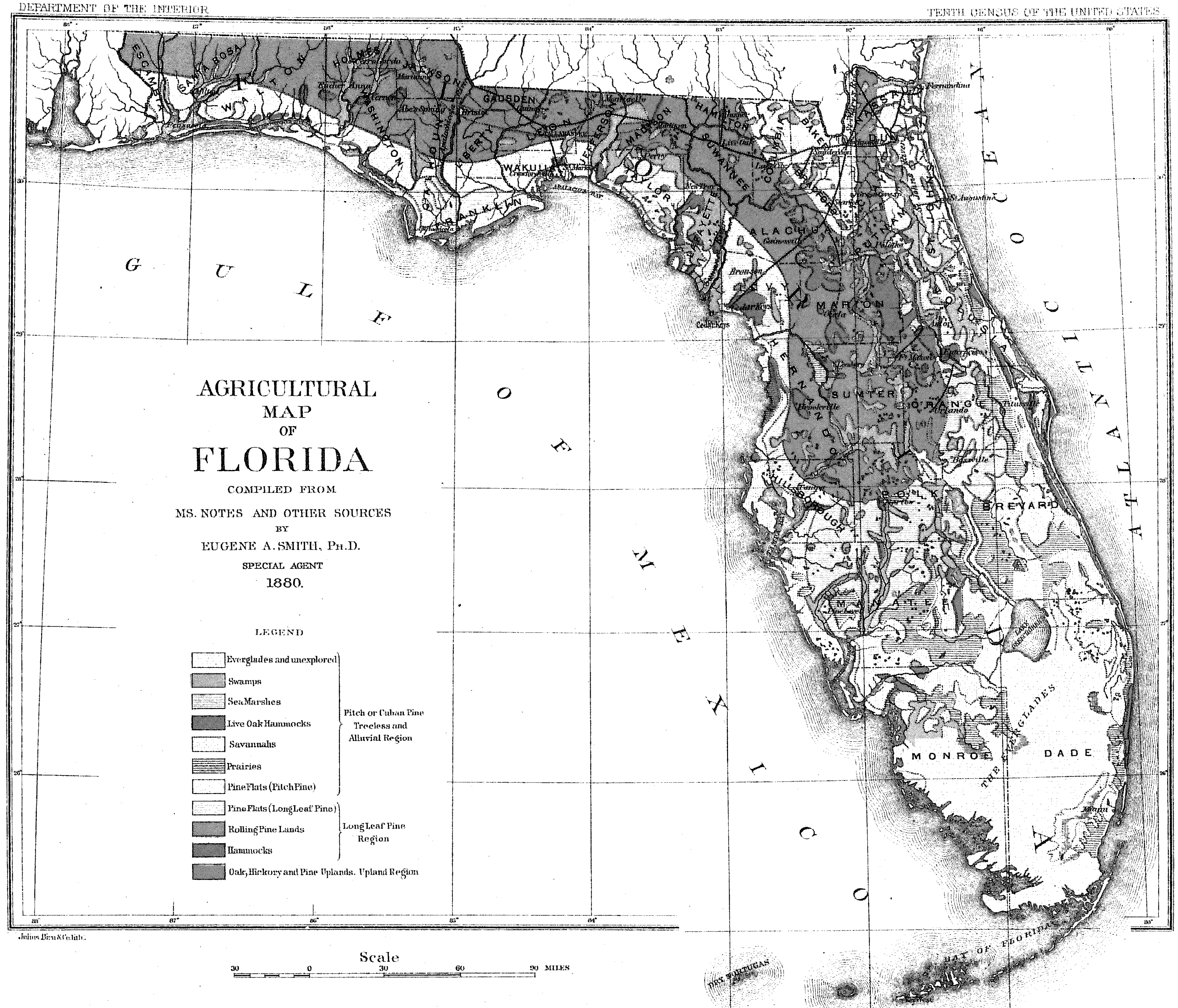
Counties.	COTTON.		CORN.		OATS.		RICE.		SWEET POTATOES.		SUGAR-CANE.		
	Acres.	Bales.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Pounds.	Acres.	Bushels.	Acres.	Hogsheads of sugar.	Gallons of molasses.
OAK, HICKORY, AND PINE UPLAND REGION.													
Jackson	26,920	6,144	33,780	234,425	6,174	50,021	88	37,833	1,022	82,399	566	11	85,045
Gadsden	19,464	4,696	25,753	183,539	2,853	26,286	139	78,183	898	70,956	443	18	72,114
Leon	42,988	9,562	43,745	345,381	3,193	45,768	41	22,250	2,024	116,383	844	23	71,830
Jefferson	37,500	10,368	39,059	350,148	3,949	48,357	22	11,129	987	89,287	537	63	66,527
Madison	28,982	7,054	33,493	285,281	5,894	64,130	77	23,307	889	86,815	573	66	70,741
Total	155,854	37,824	175,830	1,398,774	22,063	235,102	367	172,702	6,420	445,840	2,963	181	375,257
LONG-LEAF PINE REGION.													
Escambia	25	10	602	6,423	132	1,541	68	24,820	164	15,405	12	.....	1,167
Santa Rosa	17	5	1,135	9,850	60	495	169	98,823	158	15,298	43	2	2,968
Walton	1,437	382	6,025	50,275	1,091	9,703	120	84,289	304	29,533	153	20	19,828
Washington	1,877	602	5,809	47,167	565	6,574	84	66,735	325	32,070	131	.....	31,556
Holmes	1,137	273	4,273	31,479	761	5,780	120	79,740	135	21,683	74	2	12,270
Calhoun	721	172	1,643	17,303	391	4,340	75	23,120	173	17,820	52	2	11,310
Liberty	734	197	2,202	16,285	621	5,756	71	24,825	128	12,034	59	.....	10,891
Wakulla	2,311	561	6,871	50,140	554	6,207	37	26,000	134	19,991	108	.....	24,559
Taylor	1,993	418	5,224	40,051	835	6,940	40	16,860	224	22,959	124	6	19,202
Suwannee	7,288	1,177	12,410	99,855	2,132	18,634	154	56,206	484	40,592	238	121	26,622
Hamilton	11,680	1,908	14,991	110,503	2,570	21,413	225	126,464	379	33,402	222	76	26,854
Columbia	13,142	1,992	18,685	172,795	4,016	38,389	317	132,974	687	68,080	297	111	27,074
Baker	1,107	215	2,388	22,838	484	2,584	59	30,785	208	18,726	48	13	4,842
Bradford	5,836	1,094	9,511	91,305	2,119	17,829	143	65,212	388	48,117	200	40	35,572
Nassau	195	53	2,559	23,449	294	2,535	14	8,564	282	21,190	64	6	9,650
Duval	57	23	1,939	17,030	46	617	92	43,885	476	30,921	121	32	13,221
Saint John's	8	6	1,282	13,997	52	481	16	4,410	273	29,259	149	37	13,930
Clay	456	96	1,885	16,850	214	2,509	45	28,209	146	14,505	74	51	8,320
Putnam	1,356	347	2,675	29,019	566	5,757	12	5,803	407	40,413	109	38	10,781
Alachua	14,646	2,519	19,246	221,869	1,006	10,787	73	27,740	845	90,200	361	59	42,939
Lafayette	472	107	3,420	33,420	351	2,969	.....	.....	103	11,854	56	14	6,542
Levy	3,665	1,251	7,250	73,899	2,096	19,782	.....	.....	365	47,357	202	4	50,426
Marion	13,305	2,426	16,641	186,917	1,793	15,629	71	19,632	1,803	96,322	274	75	33,802
Volusia	330	62	1,250	12,672	40	375	2	600	508	31,391	57	19	5,796
Orange	818	143	2,763	26,727	140	1,412	8	7,040	663	65,198	202	64	19,428
Sumter	2,527	419	6,909	68,972	627	5,572	.....	.....	398	34,171	237	38	34,790
Hernando	1,558	468	10,883	146,008	1,371	15,969	88	61,547	619	120,448	383	61	64,171
Hillsborough	556	150	4,968	48,719	98	775	23	13,279	583	68,410	238	36	35,366
Polk	481	95	5,593	52,073	269	1,556	20	14,000	484	51,820	154	46	8,694
Total	89,735	17,171	181,032	1,740,890	25,894	232,850	2,146	1,001 502	11,906	1,149,268	4,502	973	612,661
CUBAN PINE, TREELESS, AND ALLUVIAL REGION.													
Franklin	.....	.....	145	1,761	.....	.....	.....	.....	197	15,040	81	.....	13,250
Manatee	.....	.....	2,668	19,978	.....	.....	22	14,539	436	53,515	124	85	5,325
Monroe	.....	.....	64	645	.....	.....	3	1,200	48	3,445	26	10	2,258
Dade	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Brevard	6	2	555	6,186	5	100	13	14,074	160	20,505	152	24	21,117
Total	6	2	3,432	28,570	5	100	38	30,413	841	92,505	383	119	41,950
Total for State	245,595	54,997	360,294	3,174,234	47,962	468,112	2,551	1,294,677	19,167	1,687,613	7,938	1,273	1,029,868

PART I.

PHYSICO-GEOGRAPHICAL AND AGRICULTURAL FEATURES

OF THE

STATE OF FLORIDA.


AGRICULTURAL
MAP
OF
FLORIDA
COMPILED FROM
MS. NOTES AND OTHER SOURCES
BY
EUGENE A. SMITH, PH.D.
SPECIAL AGENT
1880.
LEGEND
Everglades and unexplored
Swamps
Sea Marshes
Live Oak Hammocks
Savannahs
Prairies
Pine Flats (Pitch Pine)
Pitch or Cuban Pine Treeless and Alluvial Region
Pine Flats (Long Leaf Pine)
Rolling Pine Lands
Hammocks
Long Leaf Pine Region
Oak, Hickory and Pine Uplands. Upland Region
GULF OF MEXICO
ATLANTIC OCEAN
Scale
30 0 30 60 90 MILES
Julius Bien & Co. lith.

GENERAL FEATURES OF THE STATE OF FLORIDA.

PHYSICAL GEOGRAPHY.

Florida, the southernmost state of the United States, lies between the parallels of 24° 30′ and 31° north latitude and the eightieth and eighty-eighth meridians west from Greenwich. Its total gross area, as determined by the latest measurements, is 58,680 square miles. The greater part of this area (about 35,000 square miles) is a peninsula, about 350 miles long, with an average width of 100 miles, separating the waters of the Atlantic ocean from those of the Gulf of Mexico.

The rest of the state, known as eastern (from the Atlantic to the Suwannee river), middle (from the Suwannee to the Apalachicola river), and western Florida (from the Apalachicola to Perdido river), nearly 24,000 square miles, is embraced in a strip 320 miles long and about 75 miles wide, lying immediately south of the lines of Georgia and Alabama.

Roughly speaking, about one-half the area of eastern, middle, and western Florida and from one-fourth to one-third of the peninsula are uplands of various kinds; the rest lowlands, including the level flatlands near the coasts, the Everglades, savannas, etc.

CLIMATE.—The climate is greatly influenced by the Atlantic ocean and the Gulf of Mexico. Extremes of heat and cold are rare, the temperature in winter seldom falling much below 32°, and in summer seldom rising above 90°. The average temperature for the summer is 78°, for the winter 60°. The daily ocean breezes temper the heat of summer, the breeze from the Atlantic lasting during the day, while the Gulf breeze sets in about nightfall.

From the Smithsonian records from 1844 to 1867, kept by Dr. A. S. Baldwin, the following mean temperatures for each month of the year at Jacksonville have been taken:

	Deg.		Deg.		Deg.
January	55	May	76	September	78
February	58	June	80	October	70
March	64	July	82	November	62
April	70	August	82	December	52

The hottest months are June, July, and August, and the coldest December, January, and February, the uniformity being shown by the small difference (30°) between the coldest and the hottest months.

The mean temperature at Saint Augustine, derived from twenty years' observations, is: For spring, 68.54°; for summer, 80.27°; for autumn, 71.73°; for winter, 58.08°.

For Tampa the observations of twenty-five years give the following mean temperatures: For spring, 72.06°; for summer, 80.2°; for autumn, 73.08°; for winter, 62.85°.

The mean temperature at Key West, calculated from fourteen years' observations, is: For spring, 75.79°; for summer, 82.51°; for autumn, 78.23°; for winter, 69.58°.

The average rainfall at Jacksonville (mean of sixteen years) is 50.29 inches, the largest quantity falling in August and September, the least in November. The frequent showers in early spring, during the planting season, are highly favorable to the germination and growth of the seeds planted. Droughts and excessive rains over any large extent of territory are rare.

DRAINAGE.—*Rivers.*—The principal streams of Florida are the Apalachicola, the Suwannee, the Saint Mary's, Saint John's, Kissimee, and Indian rivers, the last named being merely an arm of the sea running parallel with the eastern coast. The Saint John's and the Kissimee in some parts of their courses consist of a chain of lakes connected by the water-courses, the former, rising in the region surrounding the Everglades, flowing northward, and the latter flowing southward toward the Everglades, the two in part of their courses flowing approximately parallel to each other, but in opposite directions, and at no great distance (20 to 30 miles) apart.

According to statements based upon surveys recently made, the waters of the Everglades are elevated 22 or 23 feet above the sea, and the level of lake Harney, on the upper Saint John's, is 9 feet above tide. These figures, if correct, would make the waters of the Kissimee some 14 feet above those of the Saint John's.

The Kissimee, with its lakes, affords the channel by which the elevated ridge of the peninsula from Orange county southward is drained into the Everglades, the Ocklawaha and its lakes draining the same elevated country from Orange county northward. A characteristic feature of the drainage of Florida is the sinking of the streams into subterranean passages and their reappearance as "big springs". The natural bridges thus formed are sometimes narrow and sometimes are several miles across.

Lakes.—In the number and variety of its lakes Florida is distinguished among the states. These lakes vary in size from mere ponds to vast sheets of water like lake Okeechobee, which has an area of more than 500 square miles. In some instances they are apparently fed from underground sources and form the headwaters of streams; in other cases the streams flow through them, which thus appear as mere local widenings of the channels; and in still other cases lakes which receive the drainage of large areas by means of rivers have no visible outlet, the waters being removed by evaporation or by subterranean outlets. The waters of lake Okeechobee are apparently generally connected with those of the Everglades, which are carried off to the sea by a number of channels.

It is impossible to form an estimate of the number of lakes, large and small, with which the scenery of Florida is diversified, for in some parts of the state one may travel for days at a time without being out of sight of these sheets of water. In those sections where the lakes are most abundant they receive the drainage over large areas, and the water-courses are subterranean.

Everglades.—This remarkable feature of Florida has been described as a shallow lake of vast extent, filled with aquatic grasses and other similar vegetation, giving it the appearance of a vast wet meadow. This wet meadow, or shallow lake, is dotted with islands of from one acre to a hundred acres in extent, which rise a few feet above the level of the waters, and are covered with a growth of live and water oaks, cabbage palmetto, and other timber.

The Everglades occupy a depression in the limestone of the country, and are surrounded by a rocky rim, skirted (toward the glades) by a belt of rather low prairie or savanna land.

The headwaters of most of the streams of southern Florida are found in the Everglades, and lake Okeechobee, which seems to be merely an open lagoon, receives the waters of at least one large stream, the Kissimee river. The waters of this lake appear to diffuse through the Everglades, whence they are drained off east, south, and southwest through the various streams mentioned below. The level of the waters is given at 22 to 23½ feet above the sea. Further details will be found below in the general account of the agricultural features and under Dade county.

ELEVATION ABOVE THE SEA.—The ancient maps and accounts of travelers represent the interior of Florida as mountainous; later, the prevailing belief represented the state as comparatively low and flat throughout, while the truth lies between these two extremes.

The upper half of what are known as middle and western Florida consists of uplands, which are entirely similar to the corresponding uplands of Georgia and Alabama. Some parts of these uplands are broken or hilly, and the elevation above the sea cannot be far from 300 feet. Toward the Gulf and the Atlantic there is a gradual slope, and within 10 miles of the coast the elevation is scarcely more than 10 feet above tide.

From the Georgia line, in the vicinity of Okeefenokee swamp, southward down the peninsula, there is an elevated belt of land, known, in part of its course at least, as Trail ridge. This elevated land is known to extend as far south as Polk county, and its height above the sea is between 200 and 300 feet. Between this main ridge and the Gulf there is another ridge, known as the Sand hills, 120 feet and more in elevation.

In Hernando county are high hummock lands of considerable elevation, and Mount Lee, near the head of Homosassa river, is said to be 214 feet high.

The lower part of the state, from Polk county southward, is generally low, comparatively level, and with an elevation probably not greater than 30 or 40 feet. The immediate coast in some localities has an elevation of 15 feet, which is looked upon by some as evidence of upheaval in recent times, and by others as the result of the action of the waves alone.

The altitudes as determined by railroad surveys are difficult to obtain, having been in most cases lost in the transfers of the properties. The tables on page 9 were furnished by the kindness of Major P. W. O. Koerner, engineer:

I.—TRANSIT RAILROAD

Names.	Distances from Fernandina.	Altitude above low tide in the Atlantic.	Remarks.
	Miles.	*Feet.*	
Fernandina	*0	0	Back tide-water.
Boggy river	*20	.....	
Callahan	27	30	
Dutton	36	45	
Baldwin	47	47	
Maxville	56	57	Foot of Trail ridge.
Summit of Trail ridge	61	210	
Western foot of Trail ridge	62½	180	
Lawtey	66	140	
Starke	73	150	
Santa Fé (lake outlet)	79	137	
Waldo	84	150	
Hatchet creek	91	(about) 100	
Gainesville (court-house)	95	128	
Arredondo	100 (?)	70	
Archer	107	70	
Sand Hills (summit)	.....	120	
Bronson	127	27	
Otter creek (Gulf hummock)	134	19	
Rosewood	144	10	
Cedar Keys	154	0	

*27 feet highest elevation between these points.

II.—PENINSULA RAILROAD.

	Names.	Elevation above low tide in the Atlantic.	Remarks.
		Feet.	
Topographical features near line of road.	Santa Fé lake	137	
	Pithlachooke lake	85	
	Payne's prairie	68	Rim of prairie about 100 feet higher.
Stations	Lochloosa lake and Orange lake	52	
	Silver spring	39	
	Hawthorne	150	
	Lochloosa	60	
	Ocala (court-house square)	100	
	Ridge one mile south of Ocala (hummock)	160	

Average elevation of the country between Ocala and Orange lake, 80 feet.

III.—FLORIDA SOUTHERN RAILROAD.

Elevations of stations on Florida Southern railway

[Obtained from Engineer Miller.]

	Feet.
Saint John's river at Palatka	0
Palatka	15
Francis	70
MacWilliams	80
Blue pond	110
Johnson	100
McMeekin	105
Hawthorne	136
Scott place	86
Junction	90
Prairie creek	53
Alachua	88
Gainesville	168

GEOLOGY.

1.—STRUCTURAL AND STRATIGRAPHICAL.—The remark of one of the leading geologists of America that Florida has been universally misunderstood is true as regards both the topography and the geological structure of the state. To these erroneous impressions several circumstances have largely contributed. The photographic and other pictures of Florida have generally been selected, with a view of presenting the state in its semi-tropical aspects, and since Florida in the interior and in the highlands exhibits nothing characteristic by which it is distinguishable from the adjacent parts of contiguous states the most widely circulated views are those of scenes along the banks of the rivers or of the numerous and beautiful lakes of the state. The lack of railroads has restricted tourists and other visitors generally to a few great highways of travel, such as the Saint John's, Ocklawaha, and Indian rivers, and for this reason the geological observations hitherto published have been made usually either along the coasts or along the banks of the rivers mentioned.

In view of the prevailing misconceptions concerning Florida, it has been thought desirable to give here a summary as complete as possible of the published accounts of the geology of the state.

OBSERVATIONS MADE PREVIOUS TO 1880.—As early as 1776 Bartram, who traveled in the peninsula as far south as the present Alachua county, speaks of the limestone outcropping through the sands in many places. He also mentions limestone as forming the basins of some lakes and of large boiling springs, but makes no statement regarding the geological age of the rock.

Colonel John Lee Williams, in his *View of West Florida*, published in 1827, and later in his *Territory of Florida*, published in 1837, gives accurate accounts of the topography and rock structure of various parts of the state. The prevalence of a limestone as underlying rock throughout the entire state is there frequently mentioned, and many of its characteristic varieties are carefully described, though no attempt is made to fix its geological position.

Later, in 1838, Major Whiting mentions the fact that the rocks found *in situ* in Florida are all calcareous, and speaks of a flinty limestone in the interior, and of its connection with the many "surth-holes" and big springs.

In 1846 Lieutenant Allen makes mention of a limestone occurring at Tampa and at various points in the interior, where it forms the sides and basins of many of the lakes. He makes a careful distinction between this and a much more recent limestone occurring along the coast.

In the same year T. A. Conrad collected and described fossils from this older Tampa limestone, and settled definitely its age as Upper Eocene. He also speaks of a limestone as prevailing in the interior, which he thinks will prove to be of the same age.

Professor J. W. Bailey discovered near Tampa, and between Gainesville and Palatka, infusorial strata, which, together with their fossil contents, were described in the *American Journal of Science* and elsewhere. These deposits he considered to be Eocene, from their association with rocks containing shells of that age.

In 1850 Professor Tuomey, of the University of Alabama, visited the Gulf coast of Florida. He confirmed the statement of Conrad respecting the age of the Tampa limestone, and said that the same rock extended probably as far south as Charlotte harbor.

In 1854 W. J. Burnett corrects the prevailing opinion relative to the flatness of Florida by showing from altitudes obtained by surveys that there are points in the peninsula 237 feet above the Atlantic, and that 15 or 20 miles west of the Saint John's river there are elevations of 150 to 200 feet. He considered the peninsula to be of comparatively recent origin, except an elevated ridge extending from Georgia southward to a line joining cape Canaveral with Tampa; but he does not express any more definite opinion as to the age of this ridge.

Professors L. Agassiz and John Le Conte, as results of their explorations of the Florida coast in 1851, conclude that the greater part of the peninsula is of comparatively recent origin, and the latter author, in 1857, published his theory relating to the agency of the Gulf Stream in forming the submarine banks upon which the corals could grow, which were so instrumental in extending the peninsula southward. Professor Le Conte considered as problematical the existence of Tertiary limestone at Tampa, as established by Conrad and Tuomey, but, assuming that the limestone does actually occur there, he thinks it probable that all of Florida south of the line from Tampa to Saint Augustine was formed by successive additions to the land in the manner described by him, and that this extension took place in comparatively recent times.

In 1857 Professor John Le Conte procured from Silver Spring, near Ocala, some fossils which were subsequently recognized to be of Eocene age, as is recorded in the *American Journal of Science* for January, 1861, pages 1–12.

Since the researches of Professors Agassiz and Le Conte were published, the older and correct observations of Conrad, Tuomey, Bailey, and others appear to have been completely overlooked, and upon the latest geological map of the United States Florida is represented as Quaternary throughout.

OBSERVATIONS MADE IN 1880 (*a*).—While collecting material for the present report during the summer of 1880 I had the opportunity of making observations upon the geological structure of Florida from Jackson county, on the west, to Orlando, in Orange county, and the country rock everywhere between these two limits was found to be the Vicksburg or Upper Eocene limestone, with the exception of the recent or post-Tertiary coral limestone formations near the coasts and a limestone of Miocene age at Rock Spring, near Apopka city, east of the lake of the same name, in Orange county. (*b*)

West of Jackson county to the Perdido river the country was not personally visited, but from the position of the Vicksburg limestone in the adjoining counties of Alabama it seems almost certain that the whole of west Florida, with the probable exception of a strip near the Gulf coast, is underlaid by the same rock.

On the Gulf shore, between the mouth of the Perdido river and Apalachee bay, the immediate coast is sandy and the underlying rocks are hidden from view; but a few miles in the interior the presence of fresh-water mollusks in the streams, and the vegetation along their banks, give certain evidence of the existence of calcareous rocks below. From Appalachee bay to the mouth of the Suwannee river the coast is formed of limestone, which extends out to sea for several miles in shoal water.

South of the Suwannee the rugged coast is still formed of this rock, and is bordered with rocky islands or keys. At about the twenty-seventh parallel the calcareous rock above mentioned begins to be covered with the structures of the coral polyp, and down this coast and around on the eastern shore as far as the Soldier's key the coral formation is prominent on all the Florida keys (Williams).

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a See "On the Geology of Florida", by Eugene A. Smith, *American Journal of Science*, April, 1881.

b Though not yet observed, it is quite probable that limestone of this age will be found in other localities, occupying a similar position between the Eocene limestone on the west and the more recent post-Pliocene deposits near the Atlantic coast.

GEOLOGICAL MAP OF FLORIDA

BY

EUGENE A. SMITH,
1881.

Legend.

I *Vicksburg Limestone (Upper Eocene.)*

II *Vicksburg Limestone, Identified by Fossils.*

III *Miocene Limestone. Identified by Fossils.*

IV *Post Pliocene.*

V *Undetermined. Probably Miocene in part.*

THE BATHYMETRIC LINES ARE FROM PROF. J. E. HILGARD'S MAP OF THE GULF.

Scale.

30 0 30 60 90 Miles

GULF OF MEXICO

ATLANTIC OCEAN

100 Fathoms

500

1000

1500

50 Fathoms

100 Fathoms

Along the Atlantic coast the shore is sandy, but the calcareous rock outcropping a short distance back from the coast has been examined by Conrad and other observers and shown to be post-Pliocene.

Overlying the calcareous rocks throughout the state are beds of clay loam, sand, and in places pebbles of Champlain or stratified drift age. The more recent formations (near the eastern coast, especially) have also a covering of sand, which may be of more recent age.

The observations upon which these conclusions are based are given in detail in the article on the geology of Florida, alluded to above, and are briefly as follows:

In Jackson county, near Campbellton, and east of Marianna, limestone containing *Orbitoides Mantelli, Pecten Poulsoni,* and other characteristic fossils outcrops over considerable areas, and its presence below the surface-covering of drift is inferred from the occurrence of ponds, lakes, and "big springs" in nearly all parts of the county, but especially in the eastern, in the drainage area of the Chattahoochee.

In Gadsden, Leon, Jefferson, and Madison counties thick beds of the stratified drift and loam overlie the limestone, which, in consequence, does not come to the surface, except toward the river and along the water-courses.

In all these counties, however, the numerous lakes, of all sizes, which lend such charm to the scenery, the sink-holes into which the waters of large streams are ingulfed, to make their appearance again at a distance as boiling springs, are evidences of the existence of calcareous rocks below the surface, and the age of these rocks has been determined by the fossils which have been collected at several points where the limestone appears at the surface. (*a*)

In Alachua, Marion, and Sumter counties the Orbitoidal or Vicksburg limestone appears to be everywhere the underlying rock, sometimes hidden by overlying sands, but often outcropping over extensive areas. In the vicinity of Gainesville this rock is a mass of shells, in which *Orbitoides Mantelli* is most prominent.

Between Gainesville and Palatka are the infusorial strata observed by Professor J. W. Bailey, and by him considered to be of Eocene age, from their association with rocks containing shells of that age.

At Ocala the limestone outcrops in numerous localities, and the fossils are characteristic.

At Silver Spring, 6 miles east of Ocala, Eocene fossils were collected, as seen above, by Professor John Le Conte in 1857, and specimens of the limestone collected by myself in 1880, and submitted to Professor Heilprin, contained *Orbitoides Mantelli* Morton and *O. supera* Conrad, to the exclusion of other forms, except polyzoan.

In Hillsborough county the Upper Eocene limestone has long since been identified by Conrad, who, in 1846, described the organic remains collected by him in the vicinity of Tampa bay. The existence of the same rock in the other counties of middle Florida and on the peninsula, as far south as Orange county at least, is *inferred* from its observed occurrence in the localities mentioned.

In Orange county, about 10 miles east of lake Apopka, at Rock spring, there is a bluff of limestone some 10 feet in height, from which I was able to collect some fossils. These were submitted to Professor Heilprin, who determined among them the following species: *Pecten Madisonius, Venus alveata, *Cardita granulata, *Cariditamera arata, Mytilocoucha incurva.* The species marked thus (*) are also Pliocene, and from the circumstance that no Vicksburg species are associated with the Miocene shells above enumerated Professor Heilprin concludes that the Rock Spring limestone is Miocene.

The age of the limestone of the coasts and keys has been settled as post-Pliocene, probably beyond doubt, by the observation of many men of science.

CONCLUSIONS.

From the observations of others, as quoted above, and from my own, I have been brought to the following conclusions regarding the past geological history of Florida:

1. Since no rocks have been found in Florida older than the Vicksburg limestone, it follows that until the end of the Eocene period this part of our country had not yet been added to the firm land of the continent, but was still submerged.

2. During the period of disturbance which followed the deposition of the Vicksburg limestone (Upper Eocene) Florida was elevated nearly to its present height above sea-level, which elevation was maintained without material interruption until the Champlain period. Proofs of this statement may be found in the universal occurrence of the Vicksburg limestone as the country rock throughout the entire state, except perhaps in the southern part of the peninsula.

3. In this upward movement the axis of elevation did not coincide in position with the present main dividing ridge (north and south) of the peninsula, but lay considerably to the westward, probably occupying approximately the position of the present western coast. (*b*) In other words, during the Middle and Upper Tertiary periods the Florida peninsula was much broader than it is now toward the west; and while the eastern coast had nearly its present position, the western lay probably 100, and in places perhaps 150, miles beyond its present place. Western Florida was also affected by this movement, and remained above sea-level during the same periods. Reasons for this conclusion are found in the total absence along the Gulf shores of western Florida and the peninsula of all strata between the Vicksburg limestone and the post-Pliocene, while the peculiar beds of the Grand Gulf group of Hilgard overlie the Vicksburg limestone on the Gulf borders of Mississippi, Louisiana, and Texas, and a marine Miocene limestone of the usual Atlantic-coast character overlies the same rock on the eastern side of the peninsula. This conclusion, reached, as is seen above, from purely geological considerations, finds a support amounting almost to demonstration in the position of the 100-fathom line off the Florida coasts, as shown on the accompanying map. It will be seen there that the submerged portion of the peninsula (within 100 fathoms) on the west is as wide as the present land surface, while on the east it is only a narrow strip. That sediments were deposited during the Middle and Upper Tertiary periods off the Gulf coasts of Florida, as well as of the other states mentioned, is of course self-evident, and their absence along the coast at Tampa and elsewhere can be explained only upon the supposition that the coast-line at that time was west of its present position, and that the deposits then made off that old coast are now submerged beneath the waters of the Gulf.

It may be objected that the absence of these deposits on the western coast is apparent, and not real; that they have simply escaped notice; but it seems hardly probable that two such close observers as Conrad and Tuomey should have overlooked them, if they occur, at least from Tampa southward. The negative evidence derived from the observations of Conrad and Tuomey is confirmed by the writings of Colonel J. Lee Williams, who, as early as 1827, in describing the coast between Saint Mark's river and the Suwannee, says that it is formed of a soft calcareous rock, with an imperfect flint embedded in it, and where the softer parts of the rock have been dissolved away these nuclei of flint are left, forming extensive and very rugged reefs. The same author states that at about the twenty-seventh degree of latitude the coral polyp begins to cover this calcareous rock, and thence southward the recent coral formation covers universally

a In Wakulla county and the southern part of Leon these outcrops are numerous, and specimens collected near Saint Mark's, and submitted to Mr. Angelo Heilprin, were pronounced by him to be of Vicksburg age, *Orbitoides Mantelli* being a characteristic fossil.

b This assumes approximate uniformity of slope on each side of the main line of elevation. Under any other supposition, the facts would apparently require an elevation of the peninsula after the Vicksburg period much above its present height and a depression during the Miocene period at least 30 feet below the present level.

the rock above described, which he believes to be the base or substratum of the peninsula and of the keys. Colonel Williams here makes a clear distinction between the limestone which forms the Gulf coast, and, as he believes, also the base of the peninsula and keys, and the newer coral formations which rest directly upon it below the twenty-seventh parallel.

4. After the Miocene (or possibly after the Pliocene) period there was again an elevation (*a*) of Florida, as is shown by the presence of a Miocene limestone on the eastern slope of the peninsula, some distance (not less than 30 feet) above present sea-level. The absence along the Gulf coasts of Miocene and later Tertiary deposits, either of marine (limestone) or of brackish- or fresh-water (Grand Gulf) origin, has already been accounted for above. During this period, between the end of the Vicksburg and the close of the Tertiary, the Florida peninsula, with at least twice its present size, was subjected to subaerial erosion, which marked its surface with hills and valleys. The distribution of the high hummocks along the present peninsula is explained below as dependent upon the position of the elevated points of this old Tertiary peninsula, and the greater prevalence of high hummocks on the western side of the water-shed between the Gulf and the Atlantic, and the occurrence of coast hummocks (Gulf hummocks) exclusively on the western or Gulf coast, seem to be strictly in accordance with the preceding conclusions.

Professor J. E. Hilgard, in an article on the "Basin of the Gulf of Mexico", published in the *American Journal of Science*, III, vol. 21, page 291, writes as follows: "The 100-fathom curve represents very closely the general continental line; the *massiv* of the peninsulas of Florida and Yucatan have more than twice their present apparent width. * * * * Very steep slopes lead from this submerged plateau to an area of 55,000 square miles * * * * at the great depth of over 12,000 feet. There are three ranges on the Florida and Yucatan slopes, extending in the aggregate to more than 600 miles, along which the descent, between 500 and 1,500 fathoms, or 6,000 feet, is within a breadth of from 6 to 15 miles. No such steep slopes and correspondingly elevated plateaus appear to exist on the unsubmerged surface of the earth. The suggestion occurs that while the latter have suffered atmospheric erosion, the submerged surfaces have not sensibly changed from the positions determined by the mechanical shaping of the earth's crust." (*b*)

5. We have evidence in the distribution of the beds of the Champlain period (stratified drift or orange sand) that Florida and parts of adjacent states were during this time submerged sufficiently to allow the deposition over them of a mass of pebbles, sand, and clay, varying in thickness from a few feet to 200. The conditions under which these beds were deposited have been ably discussed by E. W. Hilgard in the *American Journal of Science*, and in his Mississippi and Louisiana reports. Of these conditions I shall speak of one only. From the peculiar mode of stratification of most of these beds it is concluded, with reason, that they were sediments from rapidly-flowing, ever-varying currents. In the northern part of the state the beds of red and yellow loam lie directly upon the stratified drift. These beds of loam are devoid of stratified structure as well as of fossils, and were probably deposited from slowly-running or nearly stagnant waters. The direct superposition of the loam upon the stratified drift throughout Florida, Alabama, and the greater part of Mississippi and Louisiana, and the fact that there is, with the exception presently to be noted, rarely if ever any sharp line of demarkation between the two—the upper beds of the drift passing by imperceptible gradations into the loam—point strongly to a community of origin, and appear to indicate that the loam is the last of the sediments made by the floods of the drift. Along the Mississippi river the two are separated by the Port Hudson and Löss deposits, both having more or less local characters, the Löss being distinctly a river-bank and the Port Hudson a river or gulf swamp deposit. We can imagine that after the great rush of waters which deposited most of the pebbles and other coarse materials of our drift there followed, over the larger part at least of the Gulf states, a gradual checking of the currents, and consequent deposition of the finer yellow loam, while along the axis of the Mississippi, where, as Hilgard has shown, the extremes of oscillation were experienced, this gradual change from swiftly-flowing to nearly stagnant waters might have been interrupted by such subordinated and local oscillations as would have caused the formation of deposits like the Port Hudson and the Löss.

6. Following the submergence during the Champlain period was a re-elevation, which brought up the peninsula with approximately its present configuration. (*c*)

Evidences on this point are to be found in the post-Pliocene formations described by Conrad, Tuomey, and others as bordering, more or less uniformly, the eastern, southern, and western shores, and forming the keys.

7. In the height of these post-Pliocene deposits above the present sea-level Conrad and Tuomey see proofs of the elevation of the peninsula and keys (10 or 15 feet) in still more recent times, while, on the other hand, Professors Agassiz and Le Conte give a different explanation. To quote the words of the latter author: "Neither the mainland nor the keys are anywhere higher than may be accounted for by the action of the waves, viz: from 10 to 15 feet."

8. Since the elevation of Florida to its present position atmospheric agencies have been at work scouring its surface and producing those inequalities which constitute its present scenery. In some places the removal by these agencies of the later Champlain beds has exposed the elevated points of the old limestone peninsula, or special lines of drainage have cut down to the general level of this rock, which, in either case, by its action upon the soil, has produced hummocks. The circulation of the atmospheric waters below the surface has caused the formation of caverns and underground channels in the limestone, and has thus given rise to many of the characteristic features of the Florida landscape, as sinks, ponds, lakes, "blue springs," etc.

9. In view of the absence of marine formations of the Middle and Upper Tertiary age along the Gulf coasts of Mississippi, Louisiana, and Texas, and to account for the formation of the beds of the Grand Gulf group, without remains of marine life, which overlie the Eocene of those coasts, Professor E. W. Hilgard has been brought to the conclusion that during a part or the whole of the interval between the Vicksburg and Champlain periods the Gulf was by some means partially or wholly isolated from the Atlantic, and thus converted into a fresh- or brackish-water basin, and he also further suggested that this was brought about by a land connection between Florida and Yucatan.

The facts lately brought to light by Dr. Loughridge and myself, taken in connection with the soundings in the Gulf made under the auspices of the coast survey, point to a more probable explanation of the means by which the partial freshening of the waters of the Gulf was effected.

Professor Hilgard writes as follows:

"The inference is irresistible that the upward movement of the Tertiary period continued up to the end of the Glacial epoch. * * * It is clear, also, that even a minimum elevation of 450 feet, so far proven, would convert the Gulf border to the edge of the 100-fathom

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a On this point compare foot-note under 3, above.

b It is proper to state that the article of Professor Hilgard on the Gulf basin and my own on the geology of Florida appeared simultaneously in the *American Journal of Science*, so that the conclusions in each were independently reached.

c We can only speculate as to when and how the change from the broad peninsula of the Middle and later Tertiary periods to the present narrow form took place. Two possibilities suggest themselves, viz: 1. At the beginning of the Champlain period a more profound depression of the western as compared with the eastern half of the broad Tertiary peninsula; or, 2. At the end of the period of submergence the shifting of the main axis of elevation eastward would have brought about this result.

line into a region of shallows, whose waters would be kept perceptibly freshened by the continental drainage, especially in the axis of the Mississippi valley, even in the present condition of the straits of Yucatan and Florida. If, however, we suppose the bottom of the latter to have participated in the elevation to a greater or less extent, sensibly lessening the oceanic circulation, the freshening of the border waters may readily be supposed to have been such as to render very precarious the existence of either a marine or a fresh-water fauna, thus accounting for the remarkable dearth of fossil forms in the Grand Gulf strata." (*a*)

The facts with regard to the distribution of the rocks of Florida are presented on the accompanying map. (The bathymetric lines are taken from Professor J. E. Hilgard's map.

Those points where the existence of the Vicksburg limestone has been determined beyond doubt by fossils collected and identified are indicated upon the map by appropriate marking, explained in the legend. This formation was first recognized, at Tampa and near the mouth of the Manatee river, by Conrad; between Gainesville and Palatka, by Professor J. W. Bailey; at Silver Spring, by Professor John Le Conte; and at the other localities marked, by myself. The locality of the Miocene limestone was first observed by myself, and the post-Pliocene age of the coasts and keys has been determined at many points by Conrad, Tuomey, Agassiz, Le Conte, and others.

Between the post-Pliocene on the eastern coast and the Eocene of the interior a space is left blank, as *undetermined*, except in one place, Rock Spring, where the Miocene limestone was noticed. In this area other occurrences of Miocene beds will probably be found.

2.—PHYSIOGRAPHICAL GEOLOGY.—Since the surface configuration, soils, and other features of Florida are in great part dependent upon the mutual relations of the two principal formations above named, viz, the Upper Eocene or Vicksburg limestone, which forms the substratum through most of the state, and the stratified drift and loam, which form the surface materials, it will be well to give more in detail the chief character of each.

The limestone.—This rock, which has been shown to be of Upper Eocene or Vicksburg age by the fossils collected at widely distant localities, presents the following principal varieties:

1st. A white pulverulent mass of carbonate of lime, without recognizable fossils, except a few silicified tubes of as yet undetermined affinities. This natural marl, mingling with the sands near the coast, forms the well-known "Gulf hummocks". In these the soil appears to a casual observer to be composed almost entirely of white sand, and the vigorous growth supported by it seems at first unaccountable.

The composition of this substance is shown by the following analysis:

Pulverulent limestone from Wakulla county.

Insoluble matter	35.555	39.011
Silica soluble in soda carbonate	3.456	
Potash		0.372
Soda		0.338
Lime		30.986
Magnesia		0.424
Brown oxide of manganese		0.134
Peroxide of iron		0.534
Alumina		1.196
Phosphoric acid		0.014
Sulphuric acid		0.331
Carbonic acid		24.253
Water and inorganic matter		3.074
Total		100.667

2d. An earthy, very slightly fossiliferous, much disintegrated limestone, which appears to form always the substratum of the "high hummocks" of the interior. This rock is of a yellowish to white color, somewhat granular, and in disintegrating breaks up into small, rounded, pebbly masses. Disseminated through the soil, it imparts to it a great degree of fertility, as is shown by its heavy growth of live oak, water oak, Spanish oak, and other hard woods, and also by the large crops produced upon the land when cleared and cultivated. It seems probable that this variety may be found as substratum of part of the "Gulf hummocks" also.

3d. A porous, friable mass, made up almost entirely of the shells of *Orbitoides Mantelli*, *O. floridana*, and similar species, with here and there shells of other genera, all characteristic of the Upper Eocene or Vicksburg stage of the Tertiary.

4th. A light-colored, tolerably soft, porous rock, which has been quarried for building purposes, but which, on analysis, proves to be much more valuable as a source of phosphoric acid. This material was first brought into notice by Dr. C. A. Simmons, of Hawthorne, Florida, who forwarded specimens to Dr. George W. Hawes.

An analysis (see page 14), carried out by the direction of Dr. Hawes, revealed the true character of the rock, which contains in some cases as much as 16 per cent. of phosphoric acid.

a "Later Tertiary of the Gulf of Mexico", by Eugene W. Hilgard, *American Journal of Science*, III, vol. xxii, p. 64.

Phosphatic rock, Hawthorne, Alachua county.

Silica	46.83
Alumina	19.61
Ferric oxide	1.64
Lime	2.75
Magnesia	0.27
Phosphoric acid	16.02
Water	14.28
Total	101.40

The mean of two other analyses of specimens from the same locality is given below in the table of analyses.

As yet, the amount of this material available is not known, but specimens have been received from localities a mile apart.

This variety of the rock and the two preceding, when freshly quarried, are quite soft and easily cut with a saw, and on this account they are almost universally used where they occur (in Mississippi, Alabama, and Florida) in the construction of chimneys. For this purpose the rock is cut into blocks of suitable size, which harden upon exposure to the atmosphere, and where somewhat protected the chimneys thus made are durable. Objection to it as building material is its porosity, for it absorbs water readily, and this in freezing causes the stone to crumble. Notwithstanding this objection, the oldest chimneys throughout the region of this limestone are constructed of it, and they show, as a general thing, no greater evidences of decay than do the brick chimneys.

5th. A highly fossiliferous variety, composed chiefly of shells of Orbitoides, is often quite hard, and produces very little effect upon the soil, for it often outcrops through the most barren sands of the pine woods.

6th. Another hard, compact variety has very few fossils, and is impregnated with silica, which often takes the form of nodules of flint or hornstone. Major Whiting, above quoted, speaks of bowlders of silica occurring in the limestone from which the Indians manufactured their flints; and Professor Bailey found between Gainesville and Palatka nodules of flint, from which he prepared thin sections for the microscope, and in these he discovered many forms of infusoria. The flint is quite prevalent also along the Gulf coast below the mouth of Suwannee river.

7th. Lastly, Colonel Williams notes the occurrence of crystalline limestone in Hamilton county, near the Suwannee river, and on the Econfina, in Washington county.

The stratified drift and loam.—These two formations, while quite distinct in portions of Mississippi, where they were first accurately described, are in Florida so closely associated as to justify their treatment together. The thickness of these beds is quite variable (from a few feet up to at least 100), and, as they have been deposited upon an eroded surface of the underlying limestone, great variations in the thickness may be noticed in comparatively limited areas. The most abundant material of the drift is a siliceous sand, often colored by hydrated ferric oxide. The depth of color decreases, as a rule, southward, and on the peninsula proper white or very light-colored sands greatly predominate. In the upper counties, adjoining Alabama and Georgia, various shades of yellow and red are characteristic.

Next in importance are beds of rounded, water-worn pebbles of quartz, rarely as large as a walnut, and usually much smaller. These pebbles are more numerous and larger northward and along the lines of certain water-courses, such as the Apalachicola. Upon the peninsula they have been observed only in a few instances, and then are small in size (no larger than peas) and comparatively few in number. Beds of clay are of local occurrence, and are not abundant.

The upper beds of the stratified drift are frequently seen to grade off almost imperceptibly into a reddish or yellowish clay loam, having often a thickness of 15 to 20 feet, and showing no traces of stratification or of fossils. This loam forms the subsoils and frequently the soils of the oak uplands, and is confined to the northern part of the state, thinning out and disappearing within 10 or 15 miles of the coast. The principal occurrence of the loam is in the contiguous parts of middle and western Florida, on both sides of the Apalachicola river.

While a distinguishing feature of the loam is the absence of all traces of stratification, the drift is equally characterized by the great irregularity of its lines of stratification. Rarely can the same stratum be traced continuously for any great distance, and the materials change greatly within comparatively limited areas.

Topography as influenced by the quality and thickness of the superficial beds overlying the limestone.—The several materials of the drift and loam offer varying degrees of resistance to denudation. When clays and loams predominate, rain-water penetrates very slightly, being mostly shed from the surface, and, collecting into rills, rivulets, and torrents, it produces that endless variety of topography characteristic of clayey lands everywhere. For this reason the oak-upland region of Florida shows a greater variety of scenery than the rest of the state. On the other hand, where sands predominate, as, for instance, southward upon the peninsula, the rains are quickly absorbed and dispersed below the surface, thus producing very little erosion, and causing the formation of those gentle undulations which characterize the sandy lands.

Throughout Florida the underlying limestone has been dissolved away in the most irregular manner by the atmospheric agencies, and is everywhere traversed by caverns, the outcropping rock presenting the most fantastic

shapes. The sinking in of the roofs of such caverns causes depressions of greater or less extent, which assume a character dependent in great measure upon the nature and thickness of the superficial beds; for where these are of considerable thickness, and are comparatively impervious, as is the case with the clays and loams of the oak-upland region, water collects in the depressions, forming the lakes which are so numerous in the uplands. Occasionally, but not very often in this part of the state, these sinks are drained by underground channels.

In some parts of the peninsula, where the surface-beds are mostly sandy but of great thickness, lakes, ponds, and swamps, caused by the water collecting and standing in the depressions, are as numerous and as characteristic as in the upland region, and this is notably the case along the water-shed between the Atlantic and the Gulf; but, as a rule, in the lower part of the state the surface-beds are both sandy and of no great thickness, and the rain-water soon soaks through them to the underlying limestone. Where this is cavernous, as is usually the case upon the higher lands, the water passes by an underground channel to the larger streams or to the sea; or, after a subterranean course of greater or less length, it reappears at the surface as a "boiling spring" or a "blue spring", flowing thence by a short open "run" to the nearest large water-course or to the sea. A large proportion of the tributaries of the Saint John's, the Ocklawaha, the Suwannee, and other rivers are fed by such springs. An inspection of the map, especially along the Gulf coast, will show a great number of "rivers" which are merely the runs from limestone springs.

Where the limestone is more compact, or where the subterranean channels in the rock are from any cause obstructed, the water collects in the depressions, forming ponds and lakes as before. This is especially the case in those low-lying and flat lands which have not sufficient natural slope to secure proper drainage by means of streams. Large areas in many parts of Florida are nearly destitute of running water, in place of which are ponds and lakes.

The water of some of the limestone springs above mentioned is impregnated with sulphureted hydrogen, which is very evident to the taste, as well as perceptible by the sense of smell upon approaching. From accounts of various travelers, these sulphur springs are quite generally distributed throughout the state.

By reason of the great thickness of the surface-beds in the oak-upland region, and also along the water-shed of the peninsula, the underlying limestone seldom appears at the surface, and exerts, in consequence, comparatively little influence upon either soils or topography, except in the formation of the lakes. Southward, however, in many parts of the peninsula, from its proximity to the surface, the limestone, in its reaction upon the overlying sandy soils, is directly concerned in the formation of the "high hummocks", "prairies," and other agricultural features.

AGRICULTURAL FEATURES.

The agricultural relations of Florida may conveniently be considered under the following general subdivisions or regions:

I.—Oak, Hickory, and Pine Upland Region, subdivided into—
1. The red lime-lands.
2. The brown loam uplands, with oak, hickory, and short-leaf pine.
3. The long-leaf pine ridge lands.

II.—Long-leaf Pine Region, with its subdivisions:
1. Pine lands.
   - *a.* Rolling pine lands.
     - First class.
     - Second class.
     - Third class.
   - *b.* Pine flats (Flatwoods).
     - Second class.
     - Third class.
2. Hummock Lands.
   - *a.* High hummocks.
   - *b.* Low hummocks.
   - *c.* Gulf hummocks.

III.—Pitch pine, Treeless, and Alluvial Region.
1. Flatwoods (with pitch pine).
2. Swamp lands.
3. Prairies and savannas.
4. Everglades.
5. Marshes.

DESCRIPTION OF THE AGRICULTURAL REGIONS.

I.—The Oak, Hickory, and Pine Upland Region.

General features and subdivisions.—The uplands have a substratum of clay, or rather of clay loam, commencing usually about 20 miles from the coast and rising gradually toward the Georgia and Alabama lines. Throughout the uplands the red and yellow colors of the clayey subsoil are characteristic, the soil varying from a brown or chocolate-colored loam to a pale yellow and gray, the latter more or less sandy.

Strictly speaking, the upland region, with clayey subsoils, would comprise most of the northern tier of counties of middle and western Florida from Columbia county to the Perdido river; but east of Madison county and west of Jackson the distinctive features of the uplands are lost, being merged into those of the pine lands. For this reason the uplands on the map are restricted to an area averaging 25 miles in width from the Georgia and Alabama lines, and extending from the central part of Madison county, on the east, to central Jackson, on the west. The area thus included, together with several small upland tracts in Calhoun and Washington counties, is about 2,300 square miles.

It is to be understood that, while the clayey subsoils and other features of the uplands are not wholly wanting beyond these limits, they are of local occurrence, and cease to be characteristic. There are three principal soil varieties, which, with their intermixtures, represent the agricultural character of this subdivision. These are:

1. The red lime-lands.
2. The brown loam lands, with oak and hickory and short-leaf pine.
3. The long-leaf pine ridge lands.

Relative position and origin of these varieties.—The facts concerning the distribution of these soil varieties, together with the obvious inference regarding their formation, are briefly these:

Within the area of the uplands the red lime-lands have been observed only at the lowest levels, the upland pine woods occupying the high table-lands and the dividing ridges, while the oak and hickory or brown loam uplands are found intermediate between the two. The topography varies similarly, the red lands being gently undulating or nearly level, the pine lands the same, while the oak uplands, with their hills and valleys, present a variety in scenery exceptional in Florida. The soils vary from the sandy soil of the pine lands through the sandy loam of the oak uplands to the loamy calcareous clays of the red lands. From these circumstances it may be inferred that the pine uplands and table lands have suffered least from erosion. The sandiness of their surface soils is probably due to the fact that, through the scarcity of lime, the rains which for ages have fallen upon these areas have gradually caused the the finer clayey portions of the soil to sink deep below the surface, or floated them off, leaving the sandier material. Upon the slopes, or wherever the erosive power of water has been active, this tendency of the soil to become more sandy is counteracted by the continual removal of the sandy surface and exposure of the underlying clayey loam. The topography determined thus by erosion becomes more varied in such localities. And lastly, along the margin and in the vicinity of the water-courses comparatively level land is again reached. The drainage having cut down into the calcareous rocks which form the substratum of the entire state, the presence of lime in the soil, by rendering the clay flocculent, prevents it being carried down by rains, and keeps it at the surface, where its influence is seen and felt.

Areas.—The estimated area of the red lime-lands is 150 square miles, that of the brown loam uplands 1,190 square miles, and that of the pine ridge lands 960 square miles. This estimate includes also the occurrences of the soils in question outside of the limits of the uplands, as shown on the map: *e. g.*, in Walton, Washington, Calhoun, and Liberty counties.

1.—*Red lime-lands.*

It is only in Jackson county that lands of this character have been observed in large bodies. They characterize the country from Campbellton, or, rather, from Big creek, in Geneva county, Alabama, to Marianna, and thence eastward as far as the Big spring, 6 miles from Marianna, and northeastward in the direction of Greenwood, nearly to the Chattahoochee river; an area of from 6 to 10 miles wide, east and west, by 18 to 25 long, north and south, and estimated at about 150 square miles. This area occupies the valleys formed by the Chipola river and its tributaries from the latitude of Marianna northward. A small area of similar soil occurs in the Euchee valley, in Walton county, and near the headwaters of Alaqua creek, in the same county. Near Vernon, in Washington county, the soil, though limy, is not so characteristically red. In all these spots white limestone of Vicksburg age lies near the surface (1 to 8 feet), but often outcrops, and to this admixture of lime is probably due most of the exceptional fertility of the soil.

The face of the country is tolerably level or gently undulating, with no considerable inequalities, and is not much elevated above the water-courses. The lands are generally cleared and in cultivation, and the farms were once large and flourishing, as is indicated by the white frame houses and tastefully laid-out yards, which in a few instances are still kept up, but since the war have mostly been allowed to fall into decay. The greater part of the population consists of negroes, as is the case also in the adjoining states wherever rich farming lands occur. The soil varies from a heavy red clayey loam to a grayish sandy loam where it borders the pine lands, and a brown sandy loam adjoining the oak uplands. The subsoil is a red clay, sometimes bluish, and this is underlaid at a depth of 1 to 8 feet by the calcareous rocks above mentioned.

The white limestone which is found through all this area varies in character from a soft, white, friable rock, made up almost entirely of shells, such as *Orbitoides Mantelli*, *Nummulites floridana*, through a white chalky substance, apparently devoid of fossils, (*a*) to a hard cherty limestone with flinty concretions. Although this rock in its several varieties is found in nearly all parts of Florida, often very near the surface, and sometimes even outcropping over considerable areas, yet this particular kind of red soil occurs only in the northern and western parts of the state. This circumstance may be due to the fact that the soil, which is here marled by the underlying limestone, is itself a tolerably fertile loam. In other localities east and south where the limestone approaches the surface the soil is more sandy, and it is probable that the differences observed in the characters of the hummocks of the peninsula and the red lime-lands of this part of the state (both of which owe their existence to the influence of the limestone) may be traced to differences originally existing in the soils themselves. Similar red soils have been observed in parts of Alabama and Mississippi.

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a Occasionally this rock is in composition nearer a sandstone, having only 2 to 3 per cent. of lime.

The prevailing growth upon these red lime-lands consists of several species of oaks, such as red, post, Spanish, and black oaks, some hickory and short-leaf pine upon the uplands, and willow and water oaks, spruce pine (*P. glabra*), beech, sweet gum, poplar (*liriodendron*), etc., in the bottoms. The typical red soil belongs rather to the lowlands than to the uplands.

With changes in the quality of the soil are associated changes in the timber; for with increasing sandiness the long-leaf pine associates itself with the trees above named, and such trees as the beech, the poplar, the willow, and water oaks disappear.

The composition of soils of this character is fairly shown by the following analysis of a soil taken from the lowlands bordering on Spring creek near Campbellton. The yield in seed-cotton of the fresh land is estimated to average about 1,500 pounds per acre:

No. 1. *Red loam soil* from lowlands of Spring creek.—Growth, hickory, sweet gum, post, red, and Spanish oaks, with short-leaf pine; color, reddish brown. The sample was taken to the depth of 10 inches.

Red loam soil (lime-lands), Jackson county.

	No. 1.	
Insoluble matter	84.240	
Soluble silica	3.250	87.490
Potash		0.072
Soda		0.019
Lime		0.266
Magnesia		0.105
Brown oxide of manganese		0.077
Peroxide of iron		1.456
Alumina		6.885
Phosphoric acid		0.222
Sulphuric acid		0.033
Water and organic matter		4.053
Total		100.678
Hygroscopic moisture		4.291
absorbed at		21 C.°

This analysis shows a deficiency of potash, but the soil is nevertheless thrifty, because of the lime, which is present in considerable quantity, and an adequate supply of phosphoric acid. The red soils of Murder creek, near Evergreen, Alabama, are of a similar nature.

2.—*Brown loam lands, with oak, hickory, and short-leaf pine.*

The rolling and sometimes hilly country included under this head is in general aspect and in timber entirely similar to the corresponding areas in Georgia and Alabama. The elevation of these uplands varies between 75 and 200 feet above the main water-courses, the latter figure being probably much nearer the average. Geologically considered, they are formed by beds of varying thickness of stratified drift or orange sand (sometimes 75 to 100 feet), with a capping of red or yellow loam 5 to 20 feet thick, both overlying limestone of the Vicksburg age.(*a*) A characteristic of most of the better class of these upland soils is the deep red or orange color of the subsoil, due to the presence of hydrated ferric oxide. The subsoils in composition vary from tolerably stiff loamy clays to rather sandy loams, and the sandiness generally increases southward.

The largest continuous body of the oak and hickory uplands with clay-loam subsoils is found along the Georgia line in middle Florida, and includes Gadsden, northern Leon, northern Jefferson, and northwestern Madison counties, and in western Florida, including the northeastern part of Jackson county. These are the limits marked off on the map, in addition to which are small tracts in the other counties named below, and the area included is about 1,190 square miles. Beyond these limits small bodies of this kind of land, interspersed with predominating pine lands, and therefore represented as pine lands on the map, occur in eastern Florida, in parts of Hamilton, northern Suwannee, and northern Columbia; in western Florida in parts of Jackson, Washington, Holmes, Walton, and Santa Rosa; and on the peninsula in Hernando and Hillsborough counties. It is impossible, in the present state of our knowledge, to give a trustworthy estimate of the area thus represented. These areas are more conveniently considered separately.

Western Florida.—The oak uplands in this part of the state are not seen in any considerable bodies west of Jackson county, though small areas occur in Washington and Walton counties, as mentioned below. In Jackson county they divide the area rather unequally (as may be seen in the heading) with the red lime-lands above

a Occasionally the term "hummock" is applied to all classes of land (including these uplands) which support a growth of hard woods. In this report the word hummock is used with the restriction given below under the appropriate heading.

mentioned and the pine woods to be described below. The soil here is a sandy loam of a gray to brown color, resting upon a subsoil of stiff red loam, passing downward into red and orange-colored sands, intermixed occasionally with pebbles. The pebbles are found on both sides of the Chattahoochee and Apalachicola rivers for 15 or 20 miles, and mark with some precision the ancient bed occupied by the river during the period following the deposition of the drift, at which time it seems to have been one of the main water-courses leading to the Gulf.

In the eastern part of Washington county, and embracing part of northwestern Calhoun, a number of hills, including Orange and Hickory hills, possess a soil of this character.

In Walton county the Alaqua country is apparently of similar nature. Euchee valley, like some other good farming land southeast of Euchee Anna, appears from accounts to have a red clayey subsoil, and belongs rather to the preceding division of red lime-lands. The rest of western Florida is pine woods, in part pine uplands and in part rather low pine barrens.

Middle Florida.—In this area, as above defined, the oak uplands form from one-fifth to three-fourths of the tillable land. The country is broken and hilly, and the bright red or yellow color of the subsoil is sufficiently characteristic. The soil is usually a reddish brown to gray loam, becoming in places very sandy. The depth of soil to a change of tint is from 2 to 6 inches. As the lands lie generally very favorably with respect to drainage and the like, they are usually deemed the best farming areas of the state. The timber comprises the usual varieties of upland oaks, such as post, red, and Spanish, with black-jack on the poorer spots and hickory, short-leaf pine, with sweet gum, along the slopes and in the valleys. Most of the trees are draped with long moss (*Tillandsia usneoides*, L.). As this class of soil grades into the sandier varieties, so the short-leaf pine and upland oaks are gradually replaced by long-leaf pine and black-jack, there being all gradations between the pure oak and hickory uplands and the genuine pine woods.

Eastern Florida and the Peninsula.—In eastern Hamilton, Suwannee, and Columbia counties there are small areas of these uplands, but it is impossible to locate them definitely. Long-leaf pine is the prevailing growth over the greater part of these counties, and they are therefore best considered in connection with the pine ridge lands of this division or the long-leaf pine region below. In Hernando, and perhaps in Hillsborough county also, the high rolling lands, with reddish or yellowish loam subsoil, are probably of this character; but my information on this point is not definite. These soils are usually well drained and easily tilled in all seasons, and are about equally well adapted to all the southern crops, such as cotton, corn, oats, sugar-cane, and sweet potatoes, being perhaps more particularly suited to the upland cotton, which is cultivated upon from 50 to 60 per cent. of all the cleared land of this character. The yield in seed-cotton of the average upland loam soils is usually estimated at about 1,000 pounds on the fresh land. As representing the composition of a characteristic soil of this class the following analysis may be taken:

No. 2. *Upland brown loam soil*, from 6 miles northeast of Tallahassee, Leon county.—Depth, 9 inches; vegetation, post, red, and Spanish oaks, short-leaf pine, hickory, and sweet gum; color of the soil, brown.

Brown-loam upland soil, Leon county.

	No. 2.	
Insoluble matter	86.460	89.100
Soluble silica	2.640	
Potash		0.065
Soda		0.013
Lime		0.248
Magnesia		0.023
Brown oxide of manganese		0.024
Peroxide of iron		1.491
Alumina		3.977
Phosphoric acid		0.323
Sulphuric acid		0.011
Water and organic matter		3.982
Total		99.252
Hygroscopic moisture		4.159
absorbed at		21.1 C.°

This soil, like the preceding red-lime soil, is deficient in potash, though otherwise a fair soil, the high percentages of lime and phosphoric acid in both rendering them thrifty.

Throughout the region of the oak uplands two well-defined classes of low hummocks are recognized, and named, according to the prevailing material, sand hummocks and clay hummocks. These are usually associated closely with some water-course, and are, especially in the case of the sand hummocks, due to washings from the uplands. These will be mentioned more in detail under Gadsden county.

3.—*Long-leaf pine ridge lands.*

In this subdivision are included all those high pine lands which usually skirt the oak uplands, or which rather occupy the ridges separating the oak upland areas from each other. A classification of these lands into first, second, and third quality is in common use among the farmers. The soils are sandy loams, mixed with more or less of vegetable matter; the subsoils sandy, but underlaid by yellow or red clay loam, at depths varying from two or three to several feet. The largest continuous area of this kind is associated with the oak and hickory uplands above mentioned in Gadsden, Leon, Jefferson, and western Madison counties, in middle Florida, and in Jackson, northern Calhoun, Washington, and Walton counties, west of the Apalachicola.

In eastern Florida and in other parts of western Florida most of the pine lands are to be classed rather with the long-leaf pine region, as below defined.

As stated above, the oak uplands and pine ridges are estimated as dividing about equally (960 square miles of pine ridge lands, 1,190 oak uplands) the whole upland region. The surface configuration of this class of land is varied. In Gadsden county there is a large body of high, level table-land, with small inequalities of surface, except where it breaks off toward the water-courses. This table-land soil would probably be rated as second class, and while too unproductive for ordinary crops without manures, it has lately been coming steadily into favor, as it has been found that with the moderate use of commercial fertilizers it produces quite well, is easily tilled, and is very safe.

Through Holmes, Calhoun, northern Washington and Walton, Santa Rosa, and Escambia counties the pine lands are high and rolling, and mostly of second and third quality, with smaller bodies of first-class land. It is more convenient to treat these in connection with the long-leaf pine region, though they partly belong here. In these counties, as also in Jackson, the third-class lands have usually a scrubby growth of pine and high-ground willow oak (*Q. cinerea*), turkey oak (*Q. catesbœi*), and shrub oak (*Q. pumila*). To these are added, with gradual improvement of the soil, black-jack, post, and other species of oak, with short-leaf pine, forming a gradual transition into the oak uplands. On the other hand, the pine ridge lands grade off imperceptibly into the low pine barrens, with cypress swamps and undergrowth of saw palmetto.

The distinction here made between the upland and the low pine lands is based upon the existence in the first case of underlying beds of red and yellow sandy and clayey loams and their absence in the latter case, rather than on any marked difference in the general character of the land and the vegetation; for whether upland or lowland the same characters of surface soil will be productive of about the same class of pine woods. The pine uplands or ridge lands vary greatly in their productiveness. The third-class lands do not pay for cultivation; the second class are scarcely cultivated without manure; but the average yield of the first-class lands may be put at 500 pounds, though in many cases the yield is given at 1,000 pounds of seed-cotton to the acre. Sea-island cotton succeeds well on this soil. The table-lands of Gadsden county may be considered as fairly representative of the second-class pine lands, and, while they are scarcely ever cultivated (in cotton) without the use of fertilizers, with fertilizers very fair returns are always reached. The following analysis shows the character of this kind of soil:

No. 8. *Table-land soil*, Mount Pleasant, Gadsden county (S. 5, T. 3, R. 5 W.).—The color remains without change to a depth of 6 inches, below which it passes into that of the subsoil, which is a yellowish sand, with a slight intermixture of yellowish clay. The clayeyness increases downward, and at a depth of 2 to 6 feet it becomes a hard yellow clay, with brownish, sometimes black (iron) pebbles in places. Depth at which sample was taken, 9 inches; natural growth, long-leaf pine, round and narrow leaf black-jack, red and post oaks, some hickory, with undergrowth of oak runners, low bush whortleberries, devil's shoestring (*Tephrosia Virginia*), wild oats, vanilla, and other weeds, and wire-grass.

Pine upland soil, table-land, Gadsden county.

	No. 8.	
Insoluble matter	93.362	95.083
Soluble silica	1.721	
Potash		0.045
Soda		0.018
Lime		0.064
Magnesia		0.065
Brown oxide of manganese		0.220
Peroxide of iron		0.941
Alumina		1.339
Phosphoric acid		0.066
Sulphuric acid		0.091
Water and organic matter		2.422
Total		100.294
Hygroscopic moisture		1.830
absorbed at		21.1 C.°

As will be seen, this is essentially a poor soil, being notably deficient not only in potash, but also in lime, phosphoric acid, and magnesia. Its lack of retentiveness of moisture is also to be remarked. The under subsoil of clay loam, however, causes it to retain and profit by all the artificial fertilizers which may be applied, and hence, with small outlay for these aids, fair crops may always be expected. The sea-island variety of cotton grows well upon this soil, which seems, moreover, to be specially suited to grape culture.

II.—Long-leaf Pine Region.

General features and classification.—In the most general terms the soil varieties occurring within the limits of the long-leaf pine region may be grouped under the three heads of pine lands, hummocks, and swamps.

In those parts of Florida where the long-leaf pine forms the principal timber there are three kinds of pine lands, which, in their extremes, may easily be recognized. These are the long-leaf pine uplands or ridge lands, the rolling pine lands, and the pine flats or "flatwoods". The first of these is associated with the oak uplands above mentioned, occupying usually the ridges and plateaus intersecting the same. The sandy top soil of these elevated places, formed in the manner already described, is underlaid with beds of red and yellow clayey sands and loams of notable thickness. These are the pine uplands which have already been described.

In the second and third kinds of pine lands the subsoil is never a red clay, but is at best a light-yellow sandy loam, grading into light-colored sand or sandy clay, the whole resting upon the Tertiary limestone of the state, which can be found at varying depths below the surface.

The pine lands of the upper counties of middle Florida, adjoining the Georgia line, and of the eastern counties of western Florida belong generally to the first kind, as they are more or less closely associated with the oak uplands, and have red or yellow clayey loam subsoils. Eastward and westward, however, from these uplands, and adjoining the Georgia and Alabama lines, the underlying red and yellow loams either thin out or change so much in character as to give to the pine lands of these sections most of the features of the long-leaf pine region proper, which includes the rolling pine lands and the pine flats of the above division. It is in many cases a mere matter of choice or of convenience to which of these divisions a particular tract of pine lands shall be assigned, and they have been restricted to the limits above given, while the great bulk of them have, for convenience of treatment, been reserved for description under the present heading.

The pine lands adjoining the Alabama and Georgia lines as far east as the middle of Hamilton county, and occupying, with an exception presently to be noted, the central portion of the peninsula as far south as the middle of Polk county, are gently undulating and sufficiently elevated to secure good drainage. These constitute the rolling pine lands of this division, and correspond to the lime-sink and wire-grass division of Georgia and Alabama.

South of the Okeefenokee swamp, in Columbia, Baker, Bradford, and Clay counties, and skirting the rolling pine lands east, south, and west toward the coast, are level, generally badly-drained bodies of poor land, known as pine flats, or flatwoods.

The area first mentioned, that south of Okeefenokee swamp, has considerable elevation above the sea (at least 200 feet); the other pine flats are seldom more than 40 feet above tide, sloping gradually down to 15 or 20 feet elevation. Near the coast, and especially south of latitude 27°, the Cuban or pitch pine (*P. Cubensis* Grisebach, *P. Elliottii* Engelmann) partly or wholly replaces the long-leaf species (*P. australis*).

The estimated area of the long-leaf pine region, exclusive of the pine ridge lands of the preceding section, but including the flatwoods and hummocks, is 28,650 square miles.

The rolling pine lands are of all three qualities; the flatwoods are mostly third-class lands, sometimes second class, but never first. Throughout the long-leaf pine region are interspersed subordinated areas of hummock lands, as described below.

To complete the enumeration of the soil varieties occurring in the long-leaf pine region it would be necessary to include swamp lands and prairies; but as these are more conveniently treated in the next division, a mere mention of them will suffice here.

Wherever the underlying limestone of the country has only a thin coating of the surface materials lime-sinks and outcroppings of the rock itself are of frequent occurrence. Around the borders of the sinks the jagged edges of the limestone are usually exposed. These sinks have sometimes an underground outlet, by which waters collecting in them are drained away, and as the soil-covering is usually thin they are often destitute of timber, but are covered with a dense carpet of grasses, constituting prairies, and, when somewhat wet, savannas. The sinks in the limestone, when without outlet, are soon filled with water, thus forming lakes or ponds, according to size. Payne's prairie, formerly also called the Alachua savanna, is at the present time a lake, the change from prairie to lake having been caused by the obstruction of the underground outlet.

The subterranean streams, as above stated, often come to light in big springs, which are usually at no great distance from some water-course or the sea, with which they are connected by a short open run. This position of the springs near the coast or near water-courses is obviously determined by the greater amount of erosion in such localities.

1.—*Pine lands.*

a. Rolling pine lands.—As has already been stated, the pine lands belonging to this division are rolling or gently undulating, and are sufficiently elevated to secure good drainage. The counties and parts of counties included under this division are Escambia, Santa Rosa, Walton, Holmes, Washington, Jackson, Calhoun, Liberty, Madison, Hamilton, Suwannee, Columbia, Nassau, Duval, Clay, Putnam, Alachua, Marion, Hernando, Hillsborough, Sumter, Orange, and Polk; in general terms, embracing those pine lands lying adjacent to Alabama and Georgia (except the oak uplands, already described, and the flatwoods area south of Okeefenokee swamp), and occupying the central part of the peninsula to the southern limits above given. The whole area thus included may be put at 15,120 square miles. The map shows the distribution.

Irrespective of the topographical character of the country (whether rolling lands or flatwoods), the classification of the pine lands in common use among the farmers of the state, and for that reason adopted in this report, is into first, second, and third class.

These three qualities of pine land appear to depend in great measure upon the admixture of varying quantities of loam with the prevailing sandy soils. Of the distribution of these varieties not much can be said definitely. In general, however, the third-class soils form the surface of most of the barren ridges, separating more fertile areas.

First-class pine-land soil.—This is a dark-colored sandy loam, usually underlaid with a stiff loam, approaching a clay. In the upland region, already described, the underlying loam of the pine lands is quite stiff, clayey, and usually of a tolerably deep red color. In the long-leaf pine region proper it has a much higher percentage of sand, and lacks the red color almost entirely, having at most a shade of yellow.

The surface of the country is usually gently rolling, and has considerable elevation above sea-level. The natural growth is long-leaf pine, with Spanish and red oaks and hickories.

The soil is well adapted to the cultivation of sea-island cotton, and when fresh will yield, under favorable circumstances, from 500 to 700 pounds of seed-cotton to the acre. A soil collected in Marion county, of which an analysis is subjoined, is a good type of this class.

No. 6. *Oak, hickory, and pine lands soil.*—Depth, 10 inches; vegetation, red oaks, hickory, and long-leaf pine, and wire-grass; locality, 9 miles north of Ocala, Marion county.

First-class pine-land soil.

	No. 6.	
Insoluble matter	94.460	96.125
Soluble silica	1.665	
Potash		0.189
Soda		0.038
Lime		0.072
Magnesia		0.039
Brown oxide of manganese		0.055
Peroxide of iron		0.321
Alumina		0.915
Phosphoric acid		0.110
Sulphuric acid		0.091
Water and organic matter		1.884
Total		99.839
Hygroscopic moisture		2.138
absorbed at		26.1 C.°

Second-class pine-land soil.—This, like the first, has a clayey or loamy substratum. It is usually, however, a little more sandy and somewhat less productive. These lands are sometimes high and rolling, sometimes nearly level, interspersed with areas of swampy land, and this appears often to be the case upon or near the dividing ridge above spoken of. The natural timber is chiefly long-leaf pine, to which are added occasionally high-ground willow oak (*Q. cinerea* Mich.), black-jack, and post oaks.

I subjoin an analysis of a soil of this kind taken from the vicinity of Lake City. In this neighborhood the lands are comparatively level, and swampy tracts alternate with pine lands. The elevation above the sea is considerable, this being upon the water-shed. The average yield of seed-cotton (long staple) is about 350 pounds. As was stated above with reference to similar soils upon the uplands, these are not commonly planted in cotton without manure.

No. 7. *Gray sandy pine-woods soil* from 5 miles north of Lake City, Columbia County.—Depth, 10 inches; vegetation, long-leaf pine and wire-grass.

Second-class pine-land soil.

	No. 7.
Insoluble matter	95.630 } 96.509
Soluble silica	0.879 }
Potash	0.117
Soda	0.064
Lime	0.058
Magnesia	0.042
Brown oxide of manganese	0.049
Peroxide of iron	0.224
Alumina	0.478
Phosphoric acid	0.092
Sulphuric acid	0.058
Water and organic matter	1.807
Total	99.493
Hygroscopic moisture	1.643
absorbed at	24.5 C.°

A comparison of these two analyses will show at once the relations of the two classes of soil. With nearly equal amounts of insoluble matter, the first is richer in potash, phosphoric acid, and lime, and its larger content of iron and alumina and greater capacity for absorption of moisture make it superior in physical condition, as well as in chemical composition. Neither, however, is a high-grade soil, the deficiency in lime and potash being most marked.

Third-class pine-land soil.—The sandy ridges which traverse this region have both soil and subsoil very sandy. The natural growth is indicative of the poverty of the soil, and consists of long-leaf pine, mostly small and worthless for timber, shrubby oaks (*Quercus pumila*, *Q. cinerea*, *Q. falcata*, *Q. ferruginea*, *Q. virens*, *Q. Catesbæi*), occasionally small hickories, sour-wood (*Andromeda*), and whortleberries (*Vaccinium*). These barren ridges alternate with the better qualities of pine lands. The name "pine barren" is applied to third-class lands.

b. Pine flats, or flatwoods.—In the direction of the coast the rolling pine lands are bordered with a margin of greater or less width of low, flat, badly-drained lands, which become water-soaked in wet weather. For this reason they are seldom cultivated, but, as grass flourishes upon them, they are usually well suited for pastures. These flats embrace parts of the following counties: Escambia, Santa Rosa, Walton, Washington, Calhoun, Liberty, Wakulla, Jefferson, Taylor, Lafayette, Levy, Hernando, Hillsborough, Polk, Manatee, Orange, Brevard, Volusia, Putnam, Saint John's, Clay, Duval, and Nassau, aggregating about 11,250 square miles. Beside this belt, there is upon the elevated land of the peninsula, on the divide between the waters of the Atlantic and the Gulf, a similar tract of flat, wet land, differing from that of the coast principally in its greater elevation. Parts of the counties of Columbia, Baker, Bradford, Putnam, Clay, Duval, and Nassau are of this character, and this area includes about 2,280 square miles, the whole area of the long-leaf pine flatwoods being 13,530 square miles.

In the flatwoods second- and third-class pine soils are only represented, with which, along the coast, are associated Gulf hummocks, and in all parts areas of swamp land.

The more or less sandy soil of the flatwoods is usually underlaid by a clayey substratum or a densely-packed sand, which is impervious, and this, together with the low position and level surface, prevents proper drainage, and produces a water-soaked soil that cannot be profitably cultivated. For similar reasons, swamps are everywhere associated with the flatwoods. The principal growth is long-leaf pine, black-jack oak, saw palmetto (*Sabal serrulata*), and gallberry (*Prinos glabra*). In this division the pine lands are mostly of third class, there being very little of the second class.

Barrens.—Throughout the long-leaf pine region the poorer classes of land are termed pine barrens. The growth upon these is mostly long-leaf pine and black-jack, with shrubby oaks of other species. In the flat pine barrens saw palmetto and gallberry bushes are common.

While the undergrowth of shrubs in the barrens is sometimes scarce, and often wanting entirely, the herbaceous undergrowth is rich and varied, embracing nearly half the flora of the state. In most pine barrens slight sinks or basins in the surface, which are filled with water in wet seasons and are moist at all times, are of frequent occurrence, and these places have a large and characteristic flora.

Scenery and vegetation of the long-leaf pine region.—The most prominent characteristics of this region as regards surface configuration and natural growth have already been enumerated under the several divisions. Wire-grass (species of *Aristida*, chiefly *A. stricta*) grows upon nearly all the varieties of pine land, and in some places it forms almost the entire undergrowth.

Where the shrubby undergrowth is scanty or wanting, one can see for great distances between the straight trunks of the pines, and over the gently undulating surface a wagon may be driven for miles in any direction without need of following any beaten track.

The following are a few of the most characteristic plants of these open pine lands: *Actinomeris nudicaulis*, *A. pauciflora*, *Baldwinia uniflora*, *Berlandiera tomentosa*, *B. subacaulis*, *Eriogonum tomentosum*, *Asimina pygmæa*.

Along the margins of ponds or wet places in the barrens are to be found many plants which are, to a certain extent, peculiar to such localities; as *Drosera capillaris*; species of *Sarracenia*, as *S. Psittacina*, *S. Drummondii*, etc.; *Utricularia* of several species, as *U. purpurea*, *U. cornuta*, *Pinguicula lutea*.

One who has never traveled through the pine barrens can have little idea of the impression of utter desolation which they leave upon the mind. Nothing is to be seen in any direction but the tall, straight columns of the pine, with here and there a pond or lakelet. It need hardly be said that human habitations upon these typical pine barrens are few and of the rudest character, generally mere cabins, which barely afford shelter from the weather.

2.—*Hummock lands.*

Origin and distribution of these varieties.—It has already been stated in the general geological description that the variety in the topography and the soils of Florida depends upon the mutual relations of the limestone, which makes the substratum of the entire state, and the surface-beds of sand and loam which have been drifted over it.

The limestone formation presents throughout the state the same varieties described in some detail above. It can be easily shown that before the beds of drifted material had been deposited the surface of the limestone had already been subjected to a great amount of erosion, and great inequalities had thus been produced, so that the superficial beds were deposited upon a very uneven hill-and-valley surface. The thickness of these later beds was, therefore, from the first quite variable. Adding to this the fact that since the emergence of the peninsula these surface-beds have themselves been subjected to erosion in conformity with existing systems of drainage, many points in the topographical and other physical features of southern and middle Florida are readily explained. An examination of the map will show that the water-shed between the Atlantic and the Gulf is an irregular line running from Okeefenokee swamp, in Georgia, southeastward, and in general parallel with the axis of the peninsula.

From figures obtained by railroad and other surveys, the average altitude of this divide as far south as Orange county cannot be much less than from 200 to 250 feet.

It will also be seen that upon this divide are numerous ponds and lakes, forming, in many instances, the headwaters of streams running off on each side to the sea. The beds of drift are here found in greatest thickness (having been least removed by erosion), and the underlying limestone seldom makes its appearance at the surface. The sinks and depressions in this rock are shown in the basin-shaped depressions in the overlying sands, and most of these basins, being filled with water, appear as ponds or lakes.

On either side of this water-shed erosion has removed the sands and partially exposed the underlying limestone, and wherever this rock, in its disintegration, affects the overlying sands and soils hummocks are produced, which are nothing but the soils marled by the decomposing country rock. (*a*)

It has been stated above that previous to the deposition of the drift the limestone itself had suffered from denudation, its surface having been worn into hills and valleys. This circumstance explains the apparently irregular distribution of the high hummocks, which, according to the present view, mark the places where the elevated points of the ancient Tertiary peninsula (*b*) are brought to the surface by removal of the sands, and thus affect the overlying soil. Along the drainage slopes also of the larger lakes and the various water-courses the underlying limestone is exposed by denudation, and its reaction upon the soil produces the low hummocks. And finally, along the Gulf slope itself, where general drainage has uncovered the limestone, spots of hummock land—the Gulf hummocks—are formed, which are disconnected from any definite water-course.

It will thus be seen that the distribution of the hummock lands (using the term in the restricted sense just given) depends upon two principal factors: 1st, the configuration of the underlying limestone, with its worn surface, its elevations and depressions; and, 2d, the position of existing lines or channels of drainage. The latter can easily be traced out, but to determine accurately the former is no easy task, and only a few general remarks upon this head can at present be advanced.

In general it appears that on the western or Gulf side of the water-shed the ancient limestone suffered more from denudation than on the eastern, and that in more recent times the drifted materials have also been more generally washed away on that side, leaving the great bulk of hummock lands, both high and low, on the western half of the peninsula. This is in accordance with the conclusions already reached concerning the geological history of the peninsula. (*c*)

It is impossible to give more than an approximate estimate of the aggregate area of the various hummock lands of the state for two reasons: First, the hummocks are irregularly distributed in tracts which vary greatly in extent; and secondly, the term hummock has been applied to several widely distinct varieties of land.

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a The brown loam uplands are sometimes called hummocks because they support a growth chiefly of hard woods.

b See above, under heading "Geology".

c See "Notes on the Geology of Florida", by Eugene A. Smith, published in Silliman's *Journal* for April, 1881, and also above, under general heading, "Geology."

Limiting the term as defined above in the general part, the area of the several kinds of hummocks associated with the pine region, and excluding the so-called hummocks of the upland region, may be given at from 2,500 to 3,000 square miles.

a. High hummocks.—Throughout this agricultural division of the state (long-leaf pine region) there are areas of what is called high hummock land, in contradistinction to the low hummock land of the streams and water-courses. This land supports a vigorous growth of "hard woods", such as live and other oaks, hickory, magnolia, bay, sweet bay, long-leaf pine, cabbage palmetto, cedar, elm, and linden.

The color of the soil varies from brownish red to nearly black; is always more or less sandy, and its thickness varies from 8 to 12 inches, the subsoil being sometimes sandy also, but oftener a marl or limestone. Earthy disintegrated limestone of Eocene age underlies invariably, so far as observations go, the whole of these hummocks. Usually fragments of the rock are to be found mingled with the surface soil, and nearly always with the subsoil.

The yield of long-staple seed-cotton per acre may be put, on an average, at 500 to 700 pounds for fresh land.

The general principles which bear upon the mode of formation and distribution of hummock lands have been mentioned above, and from this it will be seen that the distribution of the high hummocks through the prevailing pine lands, depending as it does upon the local character of the underlying limestone and upon the degree of its intermixture with the surface soil, cannot be laid down with any degree of accuracy upon a map without close and detailed surveys of the whole country.

A few of the largest and best known areas of such hummock lands may be mentioned.

In Lafayette county are Cooke's and Old Town hummocks, and in Marion county, near Ocala, begins a strip of hummock land which stretches away toward the southwest, through Sumter, into Hernando county. In the latter county there are two of the largest bodies of hummock land in the state, known as the Annutalaga and the Choccochattie hummocks. Further details concerning these will be found in the county descriptions.

A specimen of soil from the hummock near Ocala was collected for analysis, and it may be looked upon as a representative of this class.

No. 5. *High-hummock soil*, from 1 mile south of Ocala, Marion county.—The soil is of grayish "pepper-and-salt" color. Depth, 10 inches; vegetation, live oak, white and water oaks, hickory, bay, sweet and sour gum, magnolia.

High-hummock soil, Ocala, Marion county.

	No. 5.	
Insoluble matter	90.585	91.965
Soluble silica	1.380	
Potash		0.112
Soda		0.035
Lime		0.185
Magnesia		0.033
Brown oxide of manganese		0.027
Peroxide of iron		2.048
Alumina		2.494
Phosphoric acid		0.110
Sulphuric acid		0.054
Water and organic matter		3.583
Total		100.646
Hygroscopic moisture		4.210
absorbed at		26.6 C.°

A noticeable feature of this soil is the large percentage of lime, iron, alumina, and organic matter which it contains, as compared with other Florida soils from the long-leaf pine region.

b. Low hummocks.—Along the margins of many of the lakes and streams of the long-leaf pine region, and in some of the low, swampy areas not connected with any running water or lake, are the low hummocks, with cypress, cabbage palmetto, saw palmetto, hickory, live oak, water oak, bay, evergreen, etc. These hummocks appear to be generally rather more sandy in character of soil and subsoil than the high hummocks, and the admixture of lime is less obvious, especially on what are called the light-gray hummock lands. There seems, however, to be very little reason to doubt that it is the influence of the underlying limestone, felt through the intervening beds, which gives to the soils of all the hummocks their greater degree of fertility.

The yield of the light-gray sandy hummock land may be put at about 400 pounds of seed-cotton (sea island) to the acre when the land is fresh.

The following may be taken as showing the composition of the light-gray hummock lands:

No. 4. *Light hummock soil*, Leesburg, Sumter county.—Color, light gray, "pepper-and-salt;" depth, 8 inches; vegetation, hickory, live oak, water oak, red bay (*Persea Carolinensis*), evergreen, and saw palmetto.

Low-hummock soil, Leesburg, Sumter county.

	No. 4.	
Insoluble matter	97.350	97.564
Soluble silica	0.214	
Potash		0.052
Soda		0.015
Lime		0.077
Magnesia		0.019
Brown oxide of manganese		0.032
Peroxide of iron		0.214
Alumina		0.628
Phosphoric acid		0.079
Sulphuric acid		0.053
Water and organic matter		1.675
Total		100.408
Hygroscopic moisture		1.199
absorbed at		23.8 C.°

c. Gulf hummocks.—Along the Gulf coast, especially from Wakulla county down to Hillsborough, there are frequent spots, sometimes quite extensive, where the Tertiary limestone lies near the surface, and its reaction upon the sandy soils brings about the modification known as Gulf-hummock land. This land will yield a bale of lint (sea-island cotton) to the acre in some localities; the average, however, would probably be less. The growth is the usual hummock growth given above. The color of the soil in some localities in Wakulla county is light gray, nearly white, looking very much like white sand. In this place the limestone is a white pulverulent mass, with shells, and has the following composition:

Marl from Wakulla county.

Insoluble matter	35.555	39.011
Soluble silica	3.456	
Potash		0.372
Soda		0.338
Lime		30.086
Magnesia		0.424
Brown oxide of manganese		0.134
Peroxide of iron		0.534
Alumina		1.196
Phosphoric acid		0.014
Sulphuric acid		0.331
Carbonic acid		24.253
Combined water		1.159
Moisture driven off at 100°		1.015
Total		100.667

The intermingling of this substance with the sandy soils gives to this hummock its high degree of fertility. No analyses have yet been made of any Gulf-hummock soil.

III.—Pitch pine, Treeless, and Alluvial Region.

Under this head are included flatwoods (pitch pine), swamps, prairies and savannas, everglades, and marshes.

The grouping of so many seemingly diverse things in one division is justified by the following circumstances: They are all, with the exceptions presently to be noted, closely associated geographically, together forming the whole of the peninsula south of the line joining cape Canaveral with the head of Charlotte harbor.

The pitch pine grows all along the Gulf coast, and has been designated as *Pinus Elliottii* Engelmann, in the northern portion of its area of occurrence, while southward it is named *Pinus Cubensis* Grisebach, by Professor Sargent, who considers it identical with the Cuban pine. The coast marshes and swamps also are not confined to the lower end of the peninsula, the treeless portions being practically mere modifications of one and the same thing, brought about by varying degrees of moisture and by changes from salt to fresh water. Thus, a savanna may be-

looked upon either as a fresh-water marsh or a wet prairie, or as a part of the Everglades not submerged. Finally, for the special purposes of this report, they may be well classed together, since none of them are of any importance in the cultivation of cotton. Only two bales are reported from the whole territory.

Where the lands of this division are under cultivation at all they are devoted to corn, sweet potatoes, and sugar-cane, and especially to tropical fruits; but by far the greater proportion of them, even where not submerged, is practically uncultivated. They constitute now, and are likely long to remain, the great natural pasture-grounds of the state.

The timbered portions of the above group, viz, the swamps and pine flats, as well as part of the sea marshes, are not confined to the extremity of the peninsula, as the map will show.

General description.—The relations between the flat lands of the coasts and the uplands, and a comparison between the Gulf and Atlantic coasts, have been very clearly stated by Colonel J. L. Williams in his account on Florida, already referred to, and no apology is needed for reproducing his descriptions here:

> The Gulf coast from the mouth of the Perdido river to cape San Blas is formed of white sand, mixed with some calcareous particles of broken shells, and the cabbage-palmetto region extends often quite to the sea-shore. Occasional live-oak hummocks are met with along this part of this coast. From cape San Blas to Apalachee bay the sand becomes of a yellowish brown color, and extensive salt marshes alternate with the sand-hills.
>
> From the Apalachee or Saint Mark's river to the Suwannee, a distance of 80 miles, a soft calcareous rock forms the sea-coast. It is uniformly covered with coarse grass and rushes, which extend from the woody coast several miles out to sea. This limestone forms the base of the peninsula and of the Florida keys; but in the Apalachee bay it is sheltered from the storms, and is very shoal, so that at low tide the sea appears like a green meadow 5 or 6 miles from the coast. This rock resembles chalk, and is generally of an ash color; some of it, however, is quite white, and is used for chalk. A kind of imperfect flint is embedded in it, in form of a shelly nucleus. It becomes hard on exposure to air. The flint is of a light-gray color, full of holes, which are filled with the calcareous matter. It breaks with a conchoidal fracture, gives fire freely with steel, is quite opaque, but is void of the greasy feel which is peculiar to pure flint. On points of the coast where the waves have washed the calcareous matter away these flinty nuclei form extensive and very rugged reefs. Along the shores of Apalachee bay the forests rarely approach within 3 or 4 miles of the tide. On the marshes, however, there are frequent keys, which rise like small islands, covered with live oak, cedar, and tall cabbage palmetto. These are most frequent where streams of water enter the bay. The high grounds bordering the marshes are usually rocky, but are covered with a great variety of heavy timber.
>
> A ridge of lime rock runs parallel with the coast, and 8 or 9 miles distant (inland) it does not rise much above the surface, but causes falls in all the streams between the Saint Mark's and the Suwannee. For a distance of 15 or 20 miles from the coast this rock is but slightly covered with sand; small streams are rather scarce and sink-holes are frequent, in which the water is rather cool, but, like the rivers, highly tinctured with lime. This tract of flat country is generally covered with yellow or long-leaf pine timber, under which grasses grow luxuriantly, and it is a good grazing country. From this level tract of pine land the country rises over gentle swells, underlaid with red and white clay, into the uplands, covered with brown-loam soil, and crowned with wide-spreading oaks and tall hickories, mixed with liriodendron, magnolia, and gum. The uplands rarely approach to within 18 miles of the coast. In places the flatwoods form indentations extending many miles further inland.
>
> South of the Suwannee the shore and the keys present a bare rock, with small trees of cabbage palmetto and cedar growing in the crevices as far as the Anclote keys. Beyond these the sea beats heavily on the shore, and makes a rough coast as far south as cape Roman. The pine barrens here usually extend to the rocky shore. About the twenty-seventh degree the coral formations begin to cover the calcareous rock above mentioned. From Sarasota key down the coast, and around on the eastern shore as far as the Soldier's key, this coral formation is prominent on all the Florida keys. Key Biscayne is sandy, as is the coast north of it as far as Jupiter inlet. Thence the *coquina* rock lines the coast as high as Anastasia island, in front of Saint Augustine; here it ceases, and no sign of this formation is seen north of this inlet. Coral formations are seen in Indian river even as high as Halifax river, but in no proportion to those of the western coast. North of Saint Augustine the whole coast is formed of white siliceous sand as far as the Saint Mary's.

We resume now the description of the flat lands:

> The flat lands, reaching down to the coast as far south as the Suwannee river, have already been described above. Below the Suwannee the Wacasassee river empties its waters behind the Cedar keys through a low, marshy coast. The country then rises through rich Gulf hummocks into a series of sandy ridges, occasionally broken by masses of limestone, to the Alachua country, a name originally applied to a rich tract of land 30 or 40 miles in extent, but wholly undefined as regards boundary. This name has since been given to a county which embraces the original Alachua. This part of the country is diversified with savannas, lakes, ridges of hummocks, and plains of pine barrens. The soil is equally various. Some of the savannas are large and covered with a tall grass, and an adjoining ridge of sand-hills will remind one of the sea-coast, the hummocks presenting groves of live oak, exactly similar to the shores of the Gulf, which are, however, 25 to 30 miles distant. South of this, toward the Withlacoochee, the land falls off in the direction of the coast in gentle swells of pine land.
>
> On every part of the country watered by the Withlacoochee the lands are diversified with rich hummocks, dense swamps, pine flats, wet savannas, and extensive grassy ponds. South of the Withlacoochee, and near the sea-coast, is an extensive tract of rich swamp land, 8 or 10 miles in length and from 3 to 4 in breadth. From Tampa bay to Peace creek the country is, in general, flat and rather poor as far south as Charlotte harbor.
>
> About the twenty-seventh degree of latitude the vegetation begins to change rapidly. Oaks and yellow (long-leaf) pines become rare, and at length disappear altogether. The howey (a species of fig), caccaloba or sea-grape, and gum elemi take their place on the sea-coast, and p tch pine takes the place of the yellow pine in the interior.
>
> On the eastern or Atlantic side of the peninsula the flat lands are in general rather wider than on the Gulf side. They are mostly flat pine lands, diversified with streams of good water. There is little difference, either in soil or productions, from the Saint Mary's to Mosquito inlet. The sea-coast is covered with the palmetto. Two or three miles from the sea-shore there is a strip from 1 to 4 miles wide covered with excellent land, bordering on the lagoons that stretch parallel with the shore. West of that are flat pine lands. South of Mosquito inlet and of Volusia, on the Saint John's, the country changes rapidly. Vast grass meadows and savannas, diversified with clusters of cabbage palms and live oaks, are separated by strips of pine land and hummocks of wild orange, and verges fast toward a tropical complexion, which increases as you approach cape Florida.

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The interior of the peninsula south of the twenty-seventh degree of latitude is even yet imperfectly known. In soil and productions it varies considerably from the northern part of the state.

The shores and islands of the south are uniformly covered with mangrove bushes; these, as the cape (Florida) is approached, become forests of tall trees. This timber extends as far into the country as the salt water. The back country presents a singular alternation of savannas, hummocks, lagoons, and grass ponds, called all together the Everglades. They are drained north, east, and west by a great number of streams, more particularly mentioned elsewhere. There is a curious contrast between the calm and gentle swells of the Gulf of Mexico and the furious surf that eternally lashes the Atlantic coast. The tide in the Gulf rises only 2½ feet, but on the Atlantic it rises more than 6 feet.

In the Gulf, on the western side of the peninsula, the soundings range from 7 to 14 fathoms at 20 miles from the coast; on the Atlantic, the same distance from the shore, in many places soundings are lost. The eddies of the Gulf Stream throw upon the eastern coast such a quantity of broken shells, called coquina, that from Saint Augustine to Key Largo the mouths of all the rivers are dammed up and their waters thrown back on the country. Such are the waters of Indian river, as well as of Hillsborough, Halifax, and Matanzas. These are shut out from the sea by banks of shells and sand from 15 to 30 feet high. The waters thus barred out from the ocean unite laterally and form extensive lagoons, peculiarly calculated for inland navigation. When the waters of these lagoons are greatly swelled by rains in the upper country they burst their shelly barriers and open a deep channel into the ocean, through which the waters are soon drained, and the waves again commence a natural dam to close the inlet. As soon as the shells are cast upon the shore the rains dissolve the calcareous matter, crystallization commences between the fragments, and the rudiments of a rock are formed.

The coquina formation extends from Anastasia island south beyond Indian river, but is scarcely ever more than 6 miles wide, and generally not more than 2. We think the formation began at the south; the rocks there appear much older than at Saint Augustine. Very small quantities of shell are thrown on the coast at cape Canaveral, while at Saint Augustine they are abundant. The strata are horizontal and of varying thickness. They have been quarried to the depth of 20 feet, but we have not been able to learn how much further they descend into the earth.

Areas.—This agricultural division embraces an area of about 23,290 square miles, of which 4,850 square miles are swamp lands, 5,840 square miles are coast marshes and flat lands, timbered with pitch pine, and 12,600 square miles are prairies, savannas, and everglades. The area of the Everglades, as estimated from the most reliable data available, may be put at 6,400 square miles.

1. *Flatwoods (pitch or Cuban pine).*—South of latitude 27°, as we have seen in the above extract from Williams' book, the pitch pine replaces in part or wholly the long-leaf species. Through the courtesy of Professor C. S. Sargent I am enabled to give other localities of this tree north of that parallel along the coast. From the map it will be seen that the flat lands along the coast from the Perdido river to Apalachee bay have as timber chiefly this pine. The same remark applies to the eastern or Atlantic coast from the Saint Mary's river to the end of the peninsula, and from Hernando county southward on the Gulf side. In Manatee and Brevard counties the flatwoods, which, alternating with prairies and savannas, make up the country, are timbered with pitch pine, and wherever the prairies, savannas, and marshes prevail this tree is characteristic. The area is little cultivated, being used almost exclusively as grazing grounds for vast herds of cattle.

2. *Swamps.*—These are of three kinds:

a. Those formed along the banks of rivers and other bodies of water by inundation. These are the richest and most extensive. Between them and the stream is usually a ridge of dry land, a sort of natural levee, formed of the coarsest part of the alluvial sediments, which is deposited immediately after leaving the current. This ridge prevents the waters from draining off as the river subsides. Swamps are usually densely covered with heavy timber, and this timber is tangled with innumerable vines, which renders them almost impenetrable (Williams). Of this kind are the swamps skirting the Saint John's, the Ocklawaha, and other rivers. Where high enough, these lands have occasionally been cleared and cultivated in corn and sugar-cane, to which they seem to be best suited. It has been demonstrated that they will yield four hogsheads of sugar to the acre. Large bodies of swamp lands are met with in central and southern Florida, embracing, according to estimate, over a million acres. Drainage is necessary in most cases to prepare them for cultivation.

b. The pine-barren swamps. These are natural basins, containing the waters of the surrounding country (Williams). The growth upon them is principally cypress trees and knees. Pine-barren swamps are frequently associated with the flatwoods above mentioned. While this kind of swamp and the flatwoods are often formed in the lowlands near the Gulf or the Atlantic, they together form quite an extensive area upon the dividing ridge, and at an elevation of from 150 to 200 feet above tide. The Okeefenokee swamp, in Georgia, the southern limit of which is in Baker county, Florida, is upon the high land; and southward down the peninsula, still upon the dividing ridge, are large bodies of swamp land of this character in Baker, Columbia, Bradford, Clay, and Putnam counties. (See map.) The basins occupied by these swamps appear in most cases to be caused by sinks in the underlying limestone.

It has been stated above that where a moderately thin coating of surface materials covers the country limestone the depressions or sinks in this rock are shown at the surface as hummocks, prairies, savannas, or lakes, according to the degrees of moisture or the quantity of water filling them. On the other hand, where the sand and soil over the limestone are of not inconsiderable thickness, such depressions are marked above by low hummocks, swamps, and lakes. And similarly, whether a water-course shall be skirted with a belt of hummock or of swamp land seems in great measure to depend upon the depth of sand and soil overlying the limestone and upon the degree of drainage; for where the influence of the limestone or marl is felt in the soil, and where surface waters are tolerably well drained off, hummocks result.

c Galls or sour-lands are spongy tracts, where the water continually ooze through the soil and finally collect in streams and pass off. They are the coldest soils, and the waters rising through them are frequently impregnated with sulphur and iron. When their foundation is alluvial matter, it is usually very thin, like quagmire, and the land may be shaken for acres in extent. When the base is sand, it is a lively quicksand, very dangerous for cattle.

These galls are usually covered with titi (*Cliftonia ligustrina*), loblolly bay, and others, vacciniums and vines (Williams).

In some of the swamps of southern Florida, and probably of other parts of the state also, beds of marine shells of recent species, and in some instances large bones, have been found at small depths below the surface soil. Of the character of these bones I can say nothing from personal knowledge, but I obtained large shells of a species of *strombus* or conch from a swamp near Sanford, Orange county.

3. *Prairies and savannas.*—On the peninsula, and especially in the lower part, where the limestone is close to the surface and the soil thin, there are large areas of treeless country, called prairies, and, when rather wet, savannas.

Savannas are no more than natural reservoirs, like swamps, except that they are covered with grass and herbs instead of with trees and vines. They are usually founded on clay or marl, but sometimes on hard sand. They are frequently extensive, and form excellent grazing lands.—*Williams.*

The transition from low hummocks through prairies to savannas and everglades is by imperceptible gradations, and they differ from each other only in degree of moisture and thickness of the soil overlying the limestone.

4. *Everglades.*—On account of the interest which attaches to this part of Florida, and the meagerness of the literature of the subject, I have subjoined the following extract from Williams' *Florida*, which gives perhaps the best published account of the Everglades:

That part of the peninsula of Florida that lies south of the twenty-eighth degree of north latitude declines toward the center in the form of a dish, the border of which is raised toward the coast. Near cape Florida this border is from 12 to 20 miles from the sea-beach. It is formed of the same calcareous rock which skirts the Gulf of Mexico as far west as the Apalachee river. This vast basin is filled with marshes, wet savannas, intersected by extensive lakes and lagoons, forming a labyrinth which, taken together, is called the Everglades. It is very little known. It is drained on every side by rivers of different dimensions. The Saint John's drains it on the north; the Saint Lucie, Greenville, Jupiter, New, Rattones, and Miami on the east; and Snake, Swallow, Caloosahatchee, and Macaco on the west. Behind cape Florida the glades approach within 12 miles of the coast. The inlets may here be ascended in one day, notwithstanding the swiftness of their currents.

On reaching the level of the glades a vast grass meadow is expanded, apparently as boundless as the ocean. You then pass on the winding lagoons from 6 to 12 miles westwardly, and the grass by degrees disappears, and you are left in an unexplored grassy lake, to which you can discover no bounds. It probably extends near to the eastern shore of the Gulf. The grassy borders of this lake are usually covered with water during the winter season; not so deep, however, as to hide the grass, which is very thick and tall. During the summer the ground is often dry and hard for 10 miles from the timbered land. This tract is at all times stocked with wild game, and would afford a superior range for cattle.

The border of savanna and prairie land which skirts the Everglades passes gradually into rocky pine land with *P. Cubensis*, which forms the rim of the basin occupied by the glades. This rim is on an average some 20 feet above the sea, but occasionally it rises to a much greater height, as on the border of the Saint Lucie river, where, according to Williams, the land is at least a hundred feet above the Atlantic.

5. *Marshes* are of two kinds, fresh and salt. The former are usually situated on the borders of some large body of water in the interior of the country; the latter on the sea-coast or near the estuaries of rivers.

There is a great diversity of marshes, and much depends on the substratum on which they are based. For instance, the most extensive marshes of west Florida are based on limestone, which renders them extremely fertile; some of the fresh marshes, on the contrary, are merely quicksands covered with a very thin soil, and are of course quite barren, while others have a clay foundation, and may be cultivated to advantage. Marshes produce no trees; a few shrubs sometimes skirt the edges of them. The salt marsh has been found to be an invaluable manure for our sandy soils. (*a*)

The principal grass-like plants growing in the salt marshes are as follows:

GRASSES.—*Spartina juncea, S. gracilis, S. glabra, Eustachys petræa, Leptochloa polystachya, Paspalum vaginatum, Muhlenbergia capillaris.*

SEDGES.—*Cladium effusum, Cyperus Nuttallii, Eleocharis albida, E. arenicola, Scirpus pungens, S. Olneyi, S. lacustris, S. maritimus, Fimbristylis spadicea, Juncus maritimus, J. scirpoideus.*

A few of the most important areas of coast marshes have been laid down upon the map. In some localities along the eastern shore of the peninsula, in Saint John's and Volusia counties, fine plantations were formerly cultivated, which were salt marshes drained. On all the water-courses in this part of the state there are extensive marshes, which are valuable, as the expense of draining is less than that of clearing the heavy timber from the swamp lands.

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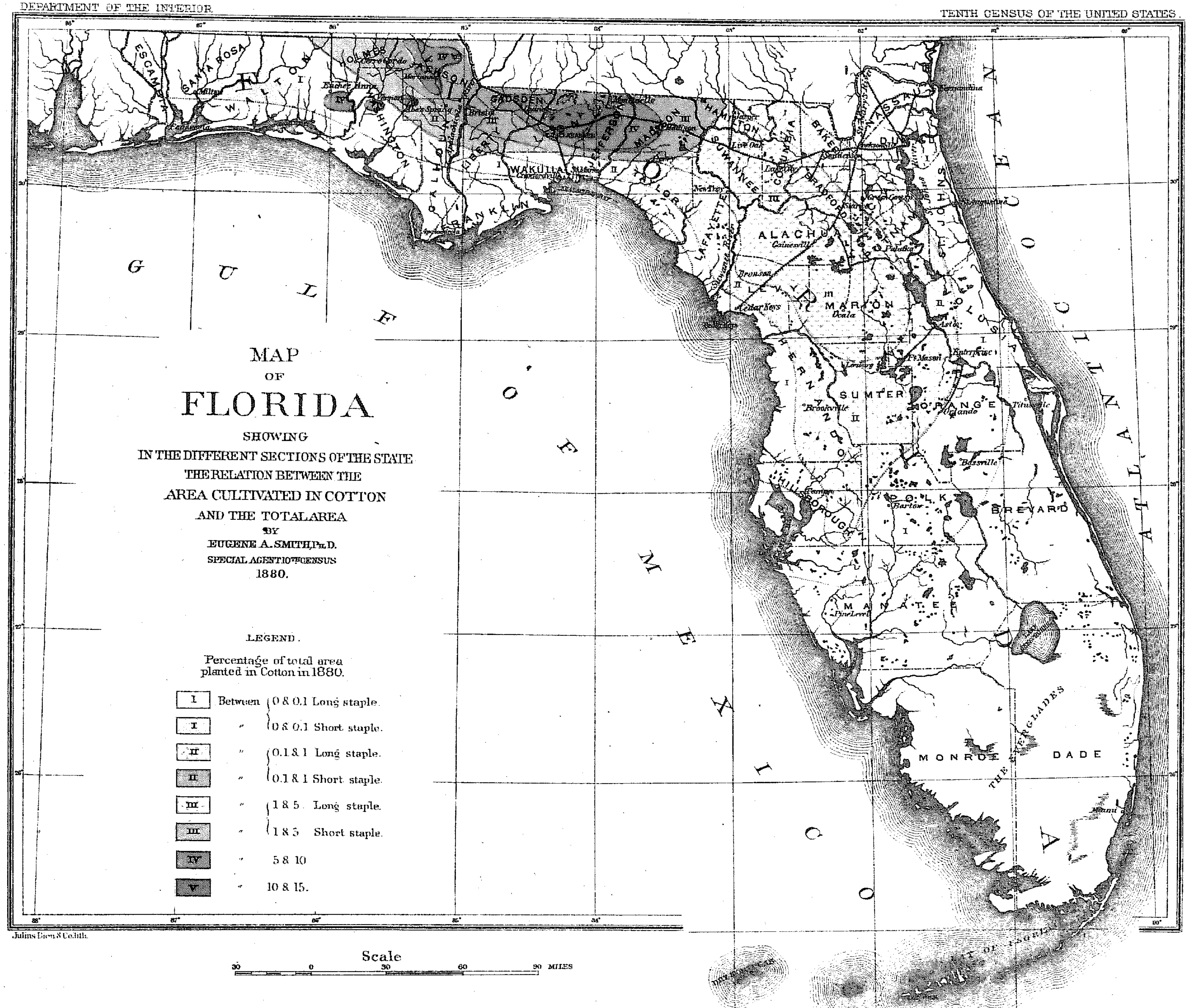
a Williams, *Florida*, p. 96.


MAP
OF
FLORIDA
SHOWING
IN THE DIFFERENT SECTIONS OF THE STATE
THE RELATION BETWEEN THE
AREA CULTIVATED IN COTTON
AND THE TOTAL AREA
BY
EUGENE A. SMITH, Ph.D.
SPECIAL AGENT 10TH CENSUS
1880.
LEGEND.
Percentage of total area planted in Cotton in 1880.
I Between 0 & 0.1 Long staple.
I 0 & 0.1 Short staple.
II 0.1 & 1 Long staple.
II 0.1 & 1 Short staple.
III 1 & 5 Long staple.
III 1 & 5 Short staple.
IV 5 & 10
V 10 & 15.
GULF OF MEXICO
ATLANTIC OCEAN
ESCAMBIA
SANTA ROSA
WALTON
HOLMES
JACKSON
WASHINGTON
CALHOUN
GADSDEN
LIBERTY
WAKULLA
FRANKLIN
JEFFERSON
MADISON
TAYLOR
HAMILTON
SUWANNEE
LAFAYETTE
COLUMBIA
BAKER
NASSAU
DUVAL
BRADFORD
CLAY
ST JOHNS
ALACHUA
PUTNAM
MARION
VOLUSIA
LEVY
HERNANDO
SUMTER
ORANGE
HILLSBOROUGH
POLK
BREVARD
MANATEE
MONROE
DADE
THE EVERGLADES
Gainesville
Ocala
Cedar Keys
Bronson
Brooksville
Orlando
Titusville
Bartow
Pine Level
Live Oak
New Troy
Palatka
Miami
Julius Bien & Co. lith.
Scale
30 0 30 60 90 MILES

GENERAL DISCUSSION OF COTTON PRODUCTION IN FLORIDA.

Among the cotton states, Florida stands fourteenth in population (total 269,493), tenth in total cotton production (54,997 bales), and fourteenth in product per acre (0.22 bale).

The following tabulated results of the enumeration, which relate to the production of cotton, are here inserted for convenience of reference:

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

Agricultural regions.	POPULATION.			COTTON PRODUCTION.										
							Average per acre.				Total in tons.			
	Total.	White.	Colored.	Acres.	Percentage of tilled lands devoted to cotton.	Bales.	Fraction of a bale.	Seed-cotton in pounds.	Lint in pounds.	Seed in pounds.	Lint.	Seed.	Percentage of state's total product in lint.	Average cotton acreage per square mile.
Oak, hickory, and pine uplands	77,066	21,579	55,487	155,854	35.16	*37,824	0.24	345	115	230	8,984	17,968	74	40.48
Long-leaf pine	174,417	107,221	67,196	*5,948	*13.43	*1,041	*0.28	*393	*131	*262	*390	*780	26	2.91
				†83,787	†21.45	†15,530	†0.19	†260	†65	†195	†2,718	†8,154		
Pitch pine, treeless, and alluvial	18,010	13,805	4,205	6	.....	†2	0.33	464	116	348	.....	.....	.....	.....
Total	269,493	142,605	126,888	245,595	27.67	54,997	0.22	*348	*116	*232	12,092	26,902	100	4.53
								†264	†66	†198				

*Short staple: 1 bale = 475 pounds. †Long staple: 1 bale = 339 pounds.

TABLE IV.—"BANNER COUNTIES" AS REGARDS TOTAL PRODUCTION AND PRODUCT PER ACRE IN EACH AGRICULTURAL REGION.

Regions according to product per acre.	Average product per acre of the region in bales.	Counties in each region having highest total production.	Rank in product per acre in the state.	Cotton acreage.	Total product in bales.	Product per acre in bales.	Counties in each region having highest product per acre.	Rank in total production in the state.	Cotton acreage.	Total production.	Product per acre in bales.	Rank in product per acre in the state.
Oak, hickory, and pine uplands	0.24	Jefferson	4	37,500	10,368	0.28	Jefferson	1	37,500	10,368	0.28	4
Long-leaf pine	0.19	Alachua	22	14,646	2,519	0.17	Levy	10	3,665	1,951	0.34	1

For the state: In cotton production, Jefferson; in product per acre, Levy.

NOTE.—In making estimates for this table all counties are excluded whose total production is less than 100 bales.

The cotton production of Florida in 1860 was estimated at about 65,000 bales, in 1870 at about 39,000 bales, and in 1880 at about 55,000 bales. This decrease becomes all the more noticeable when we take into consideration the increase of population during the same period.

In Wakulla county alone it is said that there are from four to six thousand acres (the greater portion of which is rich hummock, not worn) that have been permitted to go out of use since the war, the fencing having rotted or been burned; and these once flourishing and famous plantations are now common grazing grounds. It is a matter of common remark in the cotton-producing sections of the state that the great plantations of the past have either been allowed to go into disuse or have been cut up into smaller ones. The reason for this state of things has been correctly given by Hon. Dennis Eagan, former commissioner of immigration: "The new conditions of labor have operated largely to reduce the acreage of this staple (cotton), and the attention of planters has been turned to the culture of other crops requiring the employment of a less number of hands."

COMPARISON OF THE LONG AND SHORT STAPLE VARIETIES.—In discussing the cotton production of Florida it is necessary to bear in mind that there are two kinds of cotton in cultivation, the long and short staple varieties.

Geographical distribution.—The short-staple, or upland cotton, which makes nearly 72 per cent. (39,465 bales) of the entire crop, is cultivated exclusively in the northern and western counties, *i. e.*, those north of latitude 30° 15′ and west of the Suwannee river. These counties are Jackson, Gadsden, Leon, Jefferson, and Madison, forming the oak and hickory uplands of the preceding section, together with parts of Liberty, Calhoun, Holmes, Washington, Walton, Santa Rosa, and Escambia, belonging to the long-leaf pine region.

West of the Apalachicola river no sea-island or long staple cotton is produced, but east of that river, even in the upland region, the sandy soils of the pine ridge lands have lately been found to be very well suited to its cultivation; yet the great bulk of the crop in these five counties, and in Liberty, adjoining, is of short-staple cotton. In Jefferson county the uplands in the northern half produce the short, and the lowlands of the south the sea-island variety, though in comparatively small quantity. In Hamilton county, which is also a border county,

both kinds are cultivated, but chiefly the long staple. There is naturally no hard and fast line separating the areas producing these two kinds, and in the analysis of the enumeration results given below the counties where both staples are produced have been classed according to the predominant variety.

Soils.—Loamy soils, with somewhat heavy clayey subsoils, produce nearly all the upland cotton of Florida, while the sandy soils, with light loamy or sandy subsoils, are specially suited to the sea-island variety.

In the counties of Liberty, Calhoun, Washington, and Walton (which produce most of the short-staple cotton outside of the upland region proper) almost the entire crop grows upon those small, outlying areas with loam soils and clayey subsoils (described in the county details), and not upon the sandy soils, which characterize the long-leaf pine region as a whole.

Upon second-class sandy soils, where the upland cotton will barely attain the height of 12 inches, the sea-island variety appears to thrive, and may grow to the height of 3 or 4 feet.

With the same height of stalk the upland cotton seems to be more prolific of fruit, and the proportion of seed-cotton to the lint is greater than is the case with the long staple. The ratios of seed-cotton to lint are usually assumed to be 3 to 1 for upland cotton and 4 to 1 for the sea island; but in reality the yield of lint is seldom so high in either case

Ginning, baling, and weight of bales.—The lint of the upland cotton adheres closely to the seed, and in separating it a gin with steel saws is commonly used; but the saws have been found to injure the fiber of the long-staple cotton, and since the lint in this variety is very easily detached from the smooth, black seed, the roller-gin is used. In this gin the fiber is drawn by means of a leather roller between a metal plate and a blade which moves across the plate like the blade of a pair of shears, and thus knocks or beats back the seed. The saw-gins are all modifications of the Whitney gin, and those most in use are Pratt's, Brown's, Gullett's, and Carver's. Of the roller-gin, the McCarthy, or some modification of it, is in general use.

The short-staple cotton is packed by means of a screw or lever press into bales wrapped with coarse bagging and bound with iron or rope ties, the average weight of a bale being 475 pounds. This mode of packing has generally been considered injurious to the long-staple cotton, which is usually packed more loosely in a long bag, the open end of which is suspended so as to hang vertically, with the closed end touching the ground; and the cotton is put in and packed down by a man with an iron crowbar or pestle. In some parts of the country, however, the common screw or lever press is used for packing both long and short staple, and without any injury to the fiber of the former, so far as can be seen. The desired weight of a bag of sea-island cotton is 350 pounds.

Price and product per acre.—If we assume the average price of the upland cotton to be 10 cents a pound and that of the sea island to be 30 cents, we may get an estimate of the comparative values of the two varieties. (In making this estimate it will be understood that we take only the data furnished by the reports of the correspondents and the results of the enumeration.)

The product per acre of upland cotton is 0.24 of a bale (of 475 pounds), equal to 114 pounds of lint. This, at 10 cents a pound, will bring $11 40, from which must be deducted the cost of production, 7 cents a pound (average estimate of correspondents), or $7 98, leaving $3 42 average profit on one acre cultivated in upland cotton.

The product per acre of the sea-island cotton is 0.19 of a bale (of 350 pounds), equal to 67 pounds of lint, which, at 30 cents a pound, will bring $20 10; deduct 20 cents a pound ($13 40), cost of production, and the average profit on one acre cultivated in sea-island cotton will be $6 70.

Finally, with reference to the two varieties, it may be repeated that many of the sandy soils of the upland region east of the Apalachicola river, which until recently have never been planted in cotton at all, are now known to be well suited to the cultivation of the sea-island variety, and its production in this part of the state is evidently on the increase, although it has not yet reached any large proportions.

COMPARISON OF THE AGRICULTURAL REGIONS.—The five counties of Jackson, Gadsden, Leon, Jefferson, and Madison, which lie within the limits of the oak, hickory, and pine upland region, produce 69 per cent. of the cotton of the state (all short staple); the twenty-nine counties of the long-leaf pine region the remaining 31 per cent. (of which 28 per cent., referred to the total production of the state, is long staple, and 3 per cent. short staple); while the four counties forming the lower extremity of the peninsula, together with Franklin, constituting the pitch-pine, treeless, and alluvial region, produce practically none.

To keep distinct the relations between the short- and long-staple product, the yield of Liberty, Calhoun, Holmes, Washington, Walton, Santa Rosa, and Escambia, which belong to the long-leaf pine region, should be included with that of the five upland counties above named, since only the short-staple cotton is produced there in any large quantity. The upland areas, as thus extended, yield 72 per cent. of the whole cotton crop, all of which is short-staple cotton; and the remaining counties of the state produce almost exclusively sea-island cotton, which forms 28 per cent. of the entire crop.

To go more into detail, the upland counties proper, with an area of 3,850 square miles, have 18 per cent., or 443,211 acres, in cultivation, of which 35 per cent. is in cotton, while the long-leaf pine region, with eight times the area, or 30,830 square miles, has only 2.2 per cent., or 434,826 acres in cultivation, and only 21 per cent. of this in cotton.

These comparisons show more strikingly the relations of the two regions to the cotton production of the state.

The average product per acre of the uplands is 0.24 of a bale; that of the long-leaf pine region 0.19. These figures might be taken as indices of the relative fertility of the soils in the two regions; but a comparison is vitiated by the circumstance that in the first the upland or short-staple cotton is almost exclusively produced, and in the second the long-staple or sea-island variety, which, with the same height of stalk, is much less prolific of fruit than are the varieties of upland cotton in common cultivation. On the other hand, it must be stated that upon the second-class sandy soils, where the long-staple cotton will attain a height of 3 feet, the short-staple variety will barely average 12 inches.

The relations between the population and the cotton acreage and production in the two regions are as follows:

In the uplands 40.48 acres are in cotton in each square mile, producing about 10 bales per square mile; and each square mile supports 20.02 people, which would give the proportion of 2 acres in cotton, yielding about half a bale (0.49) to the inhabitant.

In the long-leaf pine region the cotton acreage is 2.91 to the square mile, and the product a little over half a bale (0.56) per square mile. The population is 5.65 to the square mile, and this gives the proportion of about half an acre of cotton (0.51) and one-tenth of a bale to the inhabitant.

The relative parts borne by the white and the colored population in the production of cotton may be roughly stated thus: In the uplands, where 69 per cent. of the crop is produced, the colored element outnumbers the white in the ratio of 2.6 to 1, while in the pine region, which produces only 31 per cent. of the cotton, the whites outnumber the blacks in the proportion of 1.6 to 1.

Comparison of the counties in the upland region.—In this region Jefferson county stands first in respect both to total production and to product per acre. Its rank in product per acre is due to superior fertility of soil or to better cultivation, or to both combined (see Hilgard, Census Bulletin No. 251, p. 2).

Comparisons of total production are apt to be misleading, because of the inequality of the areas of the counties; and if we eliminate this element we still find Jefferson county occupying the first place, since 29 per cent. of the whole area is under cultivation, and of this 29 per cent. over one-third (0.36) is in cotton.

Leon county has a slightly larger proportion (0.41) of its tilled land in cotton, though only 18 per cent. of the whole area is under cultivation. The remaining counties stand, in these respects, in the following order: Gadsden, Madison, and Jackson. In cotton acreage per square mile, population per square mile, and cotton acreage and production to the inhabitant, Jefferson county likewise takes the lead.

Comparison of the counties in the long-leaf pine region.—In making the comparisons it will be most convenient to group the counties in three sets, comprising, respectively: 1st, those producing less than 100 bales; 2d, those producing more than 100 and less than 1,000 bales; and, 3d, those producing over 1,000 bales each. We find that the seven counties of Suwannee, Hamilton, Columbia, Bradford, Alachua, Levy, and Marion, forming the third set, produce 12,367 bales (all sea-island cotton), or 72 per cent. of the crop of the entire region; the other two sets, embracing twenty-two counties, yield the remaining 28 per cent., or 4,804 bales. Of these twenty-two, the eight counties of Escambia, Santa Rosa, Nassau, Duval, Saint John's, Clay, Volusia, and Polk, forming the first set, have a total production of only 350 bales (about 2 per cent.), the fourteen counties of the second set producing the remainder of 4,454 bales (about 26 per cent.). In the following comparisons the eight counties producing less than 100 bales will not be taken into account.

The average product per acre of the seven counties whose yield is over 1,000 bales each is 0.18 of a bale; that of the fourteen yielding between 100 and 1,000 bales is 0.24 of a bale. This difference may be accounted for by the superior fertility of the particular soils on which alone the cotton is to any great extent cultivated in these last-named counties. Thus the comparatively high products of Walton (0.27), Washington (0.32), Holmes (0.24), Calhoun (0.24), and Liberty (0.27), in which they resemble the upland counties, is undoubtedly due to the fact that in these five counties the small outlying areas possessing brown loam and red lime-soils (see map) yield the great bulk of the crop, the small acreage in each case showing that cotton cultivation is confined to narrow limits. In these five counties short-staple cotton only is produced.

Similarly, the high products of mostly long-staple cotton of Wakulla (0.24), Taylor (0.21), Lafayette (0.23), Levy (0.34), Hernando (0.30), and Hillsborough (0.27) may be traced to the rich Gulf hummocks, which in some of these counties form a considerable proportion of the farming lands.

The average product per acre (0.18) of the seven principal cotton-producing counties of this region may be taken as a fair index of the general character of the pine lands upon which the greater part of the cotton is produced and of the average yield in sea-island cotton.

In product per acre Levy county leads the entire state (0.34); and this figure, taken in connection with the circumstances that of the entire area of the county only about 2.6 per cent. is under cultivation at all, while of this tilled land nearly one-fourth (23 per cent.) is in cotton, shows that the soil is peculiarly adapted to the cultivation of sea-island cotton.

Alachua county holds the first rank in the pine region as regards total cotton production, and this not so much in virtue of its large area (seven counties, with a yield of over 100 bales, exceeding it in this respect) as by reason of the large proportion of its area under cultivation, and especially of the high percentage of tilled lands in cotton (29 per cent.), in which it leads the state, followed closely by Hamilton and Columbus.

Leaving out of account, as before, the eight counties which produce less than 100 bales each, but which have large towns within their limits, it is seen that the seven counties above named as producing 72 per cent. of the cotton of the long-leaf pine region have a population of 64,927, or considerably over half that of the twenty-one cotton-producing counties. In these seven counties the proportion of white to colored is as 1 to 0.96, the two classes being about equal in number. On the other hand, in the fourteen counties which produce 4,456 bales, or only about 26 per cent. of the crop, the whites outnumber the blacks in the proportion of 39,661 to 11,114, or nearly 3.6 to 1.

Of the seven principal (sea island) cotton-producing counties of the pine region the product per acre shows an almost uniform increase going southward, Levy standing highest and Columbia lowest. Their ranks in the proportions of cotton acreage to the inhabitant, cotton acreage to the square mile, and population to the square mile, on the contrary, are almost directly proportional to their degree of proximity to the upland region. This uniformity is interrupted in each case by a single county. Thus the large population to the square mile of Alachua county (13.07) places it at the head of the list, instead of in its proper place geographically; and to its large population is probably also due its exceptional rank (between Columbia and Suwannee counties) in cotton acreage to the square mile.

In cotton acreage to the inhabitant Marion county is eccentric, standing between Suwannee and Columbus.

FERTILIZERS.—It may be inferred from the reports which have come from some of the counties, and it is also clearly shown in the low product per acre of the principal cotton-producing counties, that the use of fertilizers is not general in Florida. It is only in those counties whose total product is a few bales, or, in other words, where cotton is cultivated only in small patches for home use, that a high yield is noticed (except in the case of Levy county, already referred to). Cotton-seed meal, barn-yard compost, and guano appear to be used in small quantities in many parts of the state, but such a thing as systematic application of manure to the fields is essentially unknown.

Marls.—Samples of marl from various parts of the state have come under notice, and a few analyses have been made.

Marl from Wakulla county.

Insoluble residue	35.555	39.011
Soluble silica	3.456	
Potash		0.372
Soda		0.338
Lime		30.986
Magnesia		0.424
Manganese (brown oxide)		0.134
Peroxide of iron		0.534
Alumina		1.196
Phosphoric acid		0.014
Sulphuric acid		0.331
Carbonic acid		24.253
Water and volatile matter		3.074
Total		100.667

This is the marl which gives to the Gulf hummocks of Wakulla county their exceptional fertility.

A marl from the vicinity of Live Oak was analyzed with the following result:

Marl from Live Oak, Suwannee county.

Insoluble residue	1.070
Lime	56.634
Carbonic acid	42.146
Iron and alumina	0.123
Phosphoric acid	0.200
Total	100.173

This is almost pure carbonate of lime, and hardly a marl, strictly speaking, but well adapted to use as such.

Specimens of marl from various localities in Clay county have been received, but have not been analyzed.

In many counties, especially southward, and in the near vicinity of rivers and other water-courses, are great heaps of the shells of recent fresh-water species; and these have been used to a limited extent.

In Volusia county a very friable shell-marl, apparently not of living species, has been dug and applied to the fields in certain localities. Indeed, from the very nature of the geological formation which makes the substratum of the entire state, it seems almost certain that calcareous material suitable for agricultural purposes will be found in most of the counties.

Phosphatic rock.—Among the samples of building-stone sent to Dr. George W. Hawes, of the National Museum, was one from Hawthorne, in Alachua county. Upon analysis this rock was found to be rich in phosphoric acid, which led to the examination of a number of specimens. One of the analyses gave only 3 to 4 per cent. of phosphoric acid; another as much as 16 per cent.; and I have taken the following analysis as representing probably the average composition of the material:

Phosphatic rock from Hawthorne, Alachua county.

Insoluble matter	50.73
Potash	0.33
Soda	0.32
Lime	12.01
Magnesia	0.34
Peroxide of iron	1.83
Alumina	12.85
Phosphoric acid	13.09
Carbonic acid	0.86
Water and volatile matter	8.39
Total	100.75

Of the extent of this deposit little is as yet definitely known beyond the fact that specimens were collected from localities at least a mile apart. This occurrence of phosphatic rock will probably be thoroughly investigated and utilized.

Marsh muck.—Of this substance I have nothing to say from personal knowledge, but from the statements of Williams and others it appears that it has been tried in many instances, especially on the eastern side of the peninsula, and has been found to be a valuable fertilizer for the sandy pine lands.

Since marsh muck is humus, resulting from the partial decay of vegetable matter in marshes and bogs, the beneficial effects of its application to the sandy soils of the peninsula are two-fold: physically, it improves the sandy soil by making it more coherent, and on account of its capacity for absorption of water it increases its moisture; and chemically, since the muck holds all the mineral substances contained in the plants from which it was derived, and as its organic acids fix the ammonia resulting from the decomposition of the nitrogenous parts of the plants, it may be looked upon as a complete manure, furnishing directly all those ingredients which the growing crop can assimilate from the soil. Its acidity should, wherever possible, be counteracted by the simultaneous use of marl or lime.

Of the great quantity and easy accessibility of marsh muck in most parts of Florida there can be no doubt; the humus from bogs and swamps inland might be profitably used in the same way as marsh muck.

Table of analyses of Florida soils, marls, etc.

No.	Name.	Locality.	County.	Depth in inch.	Vegetation.	Insoluble matter.	Silica soluble in Na_2CO_3.	Total insoluble residue 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°).	Analyst.
	SOILS.																						
	Oak, hickory, and pine lands.																						
1	Red loam soil	Spring creek, near Campbellton.	Jackson	10	Hickory, sweet-gum, post, red, and Spanish oaks, and short-leaf pine.	84.240	3.250	87.490	0.072	0.019	0.266	0.105	0.077	1.456	6.885	0.222	0.033	.....	4.053	100.678	4.291	21.8	Cory.
2	Upland brown loam soil.	Six miles northeast of Tallahassee.	Leon	9	Post, red, and Spanish oaks, hickory, sweet-gum, short-leaf pine; long moss on trees.	86.460	2.640	89.109	0.065	0.013	0.243	0.023	0.024	1.491	3.977	0.323	0.011	.....	3.982	99.252	4.159	21.1	Do.
8	Table-land soil	Mount Pleasant	Gadsden	9	Long-leaf pine, black-jack, red, and post oaks, and some hickories; wire-grass and oak-runners.	93.362	1.721	95.083	0.045	0.018	0.064	0.005	0.220	0.941	1.339	0.066	0.091	.....	2.422	100.294	1.830	21.1	McCalley.
	Long-leaf pine region.																						
6	First-class oak, hickory, and pine land soils.	Nine miles north of Ocala.	Marion	10	Long-leaf pine, red oak, and hickory.	94.460	1.665	96.125	0.189	0.038	0.072	0.039	0.055	0.321	0.915	0.110	0.091	.....	1.884	99.839	2.138	26.1	Durrett.
7	Second-class gray sandy pine-land soils.	Five miles north of Lake City.	Columbia	10	Long-leaf pine, with wire-grass undergrowth.	95.630	0.879	96.509	0.117	0.064	0.058	0.042	0.049	0.224	0.473	0.092	0.058	.....	1.807	99.493	1.043	24.5	Do.
5	Dark-gray (high) hummock soil.	One mile south of Ocala.	Marion	10	Live, water, and white oaks, hickories, magnolia, bay, sweet and sour gums.	90.585	1.380	91.965	0.112	0.035	0.185	0.033	0.027	2.048	2.494	0.110	0.054	.....	3.583	100.646	4.210	26.6	Do.
4	Light (low) hummock soil.	Leesburg	Sumter	8	Hickory, live and water oaks, red bay, evergreen.	97.350	0.214	97.564	0.052	0.015	0.077	0.019	0.032	0.214	0.628	0.079	0.053	.....	1.675	100.408	1.199	23.8	Do.
	MARLS.																						
3	Marl from Gulf hummock.	Six miles north of Saint Mark's.	Wakulla	.....	.....	35.555	3.456	39.011	0.372	0.338	30.986	0.424	0.134	0.534	1.196	0.014	0.331	24.253	3.074	100.667	.....	.....	McCalley.
	Marl from Live Oak	.....	Suwannee	.....	.....	.....	.....	1.070	.....	.....	56.634	.....	.....	0.123	0.200	.....	42.146	.....	.....	100.173	.....	.....	Loughridge.
	Phosphatic rock, mean of two analyses.	Hawthorne	Alachua	.....	.....	50.730	.....	.....	0.330	0.320	12.010	0.340	.....	1.830	12.850	13.090	.....	0.860	8.390	100.750	.....	.....	Dr. George W. Hawes.
	Phosphatic rock	do	do	.....	.....	46.830	.....	.....	.....	.....	2.750	0.270	.....	1.640	19.610	16.020	.....	.....	14.280	101.400	.....	.....	Do.