Issued February 25, 1914.

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE STATE OF MISSISSIPPI, E. F. NOEL, GOVERNOR;
E. N. LOWE, DIRECTOR, STATE GEOLOGICAL SURVEY.

SOIL SURVEY OF WARREN COUNTY, MISSISSIPPI.

BY

W. E. THARP, OF THE U. S. DEPARTMENT OF AGRICULTURE
AND W. M. SPANN, OF THE MISSISSIPPI GEOLOGICAL SURVEY.

HUGH H. BENNETT, INSPECTOR IN CHARGE SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1912.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1914.

[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., May 29, 1913.

SIR: In the extension of soil-survey work in the State of Mississippi work was undertaken in Warren County during the field season of 1912. This work was done in cooperation with the State of Mississippi and the selection of the area was made after conference with State officials.

I have the honor to transmit herewith the manuscript report and map covering this area, and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1912, as provided by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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SOIL SURVEY OF WARREN COUNTY, MISSISSIPPI.

By W. E. THARP, of the U. S. Department of Agriculture, and W. M. SPANN, of the Mississippi Geological Survey.

DESCRIPTION OF THE AREA.

Warren County is situated in the western part of Mississippi, about 75 miles from the southwest corner of the State. It embraces most of the wedge-shaped area lying between the Mississippi and Big Black Rivers for a distance of about 40 miles above their junction. The county has an area of 588 square miles, or 376,320 acres. It is bounded on the north by Issaquena and Yazoo Counties, on the east by Hinds, and on the southeast and south by Claiborne County. The extreme southern boundary for a distance of about 4 miles follows an obscure channel connecting the Big Black and Mississippi Rivers. The vagaries of the river channel in transferring considerable tracts of land from one side of the river to the other account for the occurrence of several small areas belonging to Louisiana within the apparent limits of Warren County, and the present isolated position of Davis and Diamond Islands, which lie west of the main channel of the Mississippi.

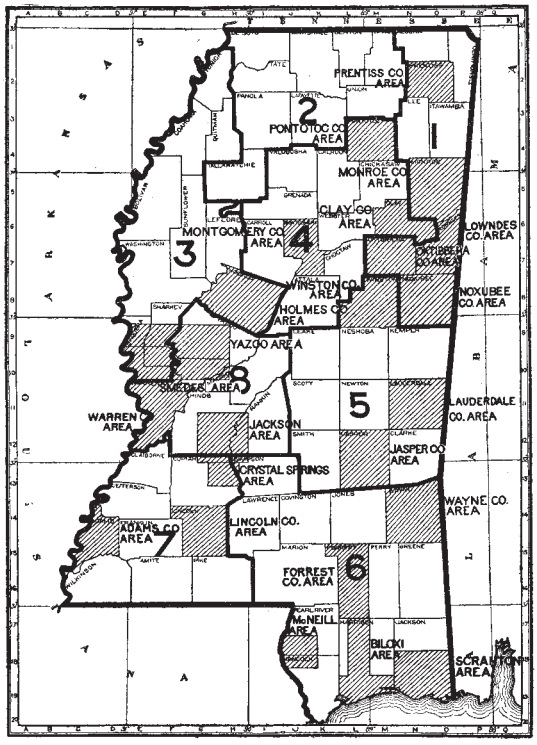

FIG. 1.—Sketch map showing areas surveyed in Mississippi.

The county is marked by two very distinct physiographic divisions—a broad, level plain, forming the extreme southern end of the

Delta region of the State, and the hilly uplands, extending to within a few miles of the Big Black River. The Mississippi Plain opposite Vicksburg is about 100 feet and the hills in the city about 250 feet above Gulf level.

The western edge of the highlands consists of a line of rather steep hills and bluffs rising abruptly from the river plain and ranging from 75 to 125 feet in height. The general appearance of the bluffs does not materially change from the city northward to the county line. Southward from Cedars, however, the elevation becomes less and the slopes more gentle when viewed from the valley. To the east the uplands slope gradually to the Big Black Valley, without any bluffs such as are formed near the Mississippi and Yazoo Rivers.

The watershed separating the drainage westward to the Mississippi and that which is tributary to the Big Black River is known as the Nanachehaw Ridge. In most instances it is simply a narrow divide, not noticeably superior in elevation to the innumerable short ridges branching from it or the hills at a distance on each side.

The small creeks west of the Nanachehaw Ridge have a general southwesterly course. The largest is Stouts Bayou, the central branch of which has a total length of 15 miles. Above Vicksburg several of the creeks flow in a northwesterly direction before leaving the hills. Their north-flowing branches and nearly all of the head ravines are in very rough, hilly country, the local relief in many instances exceeding 100 feet. The same is true of all the short drainage lines opening directly into the great valley to the west.

East of the main watershed of the county several larger creeks are found. Bear Creek and its tributaries drain much of the extreme north-central portion of the uplands, while Clear Creek receives the waters from some 30 square miles of territory northwest of Bovina. Few of the smaller tributaries of the Big Black River to the south of Bovina are more than 6 or 8 miles in length. The larger streams are perennial, but most of the smaller branches are dry in summer. A few constant springs are found in the hills, but such sources of supply are unusual. Water for domestic use is secured by building cisterns, wells being unsatisfactory, as the water is strongly impregnated with lime. In the lowlands shallow wells are considered unsafe and most homes of white residents have cisterns. In the hills a supply of water for stock is obtained by constructing dams across shallow depressions and impounding surface drainage waters.

The uplands are thoroughly dissected by drainage lines, the main ridges in each locality being of considerable length and for the most part running parallel to each other. The summits are rather narrow and rounded and the slopes fairly steep. The tops of the main divides frequently expand into comparatively level areas of cleared land of

irregular outline and inconvenient of access from the little valleys lying from 50 to 100 feet below them.

This description is applicable to much of the uplands north of Vicksburg and in a northeasterly direction to Oak Ridge. The northern part of the county, and also the extreme southern part near Yokena, have about the same general topography. South and southeast of Vicksburg the topography is smoother, many of the ridges being flat topped with short, sharp slopes. Farther south toward the Big Black River the uplands merge into broad, rolling ridges, which in turn pass into the wide, flat terrraces forming a characteristic feature of the lower Big Black Valley. In many places, noticeably in the northeastern part of the county, the land immediately west of the valley is quite broken.

The first bottoms of this stream vary from a quarter to a mile in width on the Warren County side. Above the Baldwin Ferry Bridge much of the country consists of open fields, the timber occupying the lower situations and in a few instances forming cypress brakes. Below the road a large portion of the lowland is covered with a growth of oak, gum, maple, sycamore, elm, and other hardwoods. In places there is a very heavy growth of tall canes.

More than 80 per cent of the uplands are covered with a forest growth consisting of white, red, post, and other varieties of oak, and of beech, poplar, and magnolia. Hickory, ash, and sweet gum are common, but not so numerous as the varieties just mentioned, while walnut, cherry, linden, elm, honey locust, and pecan are frequently seen but seldom form any considerable proportion of the larger growth. Old-field pine is found everywhere, but most extensively in the eastern part of the county on old Flat Hills. Red cedar trees are found on nearly all the old homestead sites. The latter are also frequently indicated by patches of black locust or China trees of exceptional size.

Some of the more open woods have but little undergrowth, Bermuda grass and lespedeza forming a good sod wherever the ground is not shaded. The untilled fields are usually first occupied by broom sedge and other tall grasses and weeds, but in a few years plum, sassafras, sumac, and saplings appear, while blackberry bushes cover the ditches and low places.

In the virgin woods haw, crab apple, dogwood, and ironwood form much of the secondary growth. Wild cane was formerly abundant, growing so densely as to exclude other undergrowth from much of the upland forest, hence the name Cane Hills which was long ago applied to the region. This growth is still found on all the rough land, but most of it is switch cane, the dense brakes being confined to deep ravines and low grounds.

The extremely varied character of the forest on the loess hills is in striking contrast with that of the Norfolk and Orangeburg types in the southern and eastern counties of the State, where little timber aside from longleaf pine and oak is found. The native vegetation here has a closer resemblance to that of northern States where soils of loessial origin occur.

From the north line of the county nearly to Allen Station the east side of the Mississippi-Yazoo Valley is practically a continuous stretch of open land. The country lying between the foot of the bluffs and the Yazoo & Mississippi Valley Railroad is mostly low, sloping bench land. It narrows near Vicksburg and again below Yokena, where the lowlands extend almost to the foot of the hills. Above Redwood there is but little bench land until Ballground is reached, where the sloping phase of the Lintonia soils expands to a width of about a mile and with the adjoining bottoms forms very fine farming lands.

The lowest portions of the wide flood plain of the Mississippi-Yazoo Valley are heavily forested, but most of the front lands are cleared. On Davis Island and around Eagle Lake there are a number of large plantations. These two localities resemble the Delta section of the State, much more so than the Yazoo and Big Black Valleys. Most of the individual holdings on the Mississippi River include at least 1,000 acres and some of them several times this number. The plantation houses are generally situated in fine groves of oak and pecan trees, while the negro cabins are scattered along the roads through the fields which extend back to the "swamp," as the low forested ground is called. With the exception of small cypress ponds, there is very little true swamp, but owing to the constant shifting of the channel of the Mississippi River, there are many stretches of land along its course densely covered with willows and cottonwoods.

Many years ago levees only a few feet in height afforded protection for all the front lands, except during the highest overflows. Now the privately maintained levees on Davis Island and near Eagle Lake are from 5 to 15 feet high and built to withstand the greater volume of water turned toward the Mississippi side of the river since the building of the Louisiana levees. In 1897, 1903, 1907, and 1912 all of Davis Island was inundated and more or less of all the other Mississippi-Yazoo lowlands were submerged. The spring freshets have had more serious results in late years than formerly, since the presence of the boll weevil renders late planting of cotton almost useless.

In a number of instances the owners make their homes at their large plantations on the river, but many of these estates are still managed by overseers.

The population of the Delta region consists chiefly of negroes. In the hill section there is a large proportion of white people, most of whom own their own farms, many of which are well improved. There are also large tracts of land on which there are no buildings except negro cabins. These tenants usually cultivate a small acreage of the more easily tilled land and make but little effort to prevent the encroachment of brush and trees upon the margins of their fields or to check the severe erosion on the steeper hillsides.

The white population of the county, except in the city of Vicksburg, has been decreasing since the war. Within the last decade there has been a total decrease in rural population of 9,404, caused in a large measure by the movement of the negroes toward the towns and, in recent years, to the migration to the Delta counties on account of the invasion of the boll weevil. According to the Thirteenth Census reports, the total rural population is 16,674, of which 2,536 are white. Vicksburg has a population of 20,814, of which 8,756 are white.

The main roads of the uplands are generally free from heavy grades, except as they cross the larger creek valleys, but many of the secondary roads are very hilly. There is also a good highway paralleling the Yazoo & Mississippi Valley Railroad from Yokena to Redwood, thence to the north side of the county. The roads throughout the lowlands are generally in good condition during the summer and fall, but often in the spring and winter those sections on the Sharkey clay and similar soils are nearly impassable. The Davis Island and Eagle Lake plantations depend largely upon river transportation.

Besides the railroad mentioned above, which affords direct communication with New Orleans and points north of Vicksburg, the Alabama & Vicksburg Railroad crosses the county from east to west, connecting Vicksburg with Jackson, on the main line of the Illinois Central Railroad. The trains of the Alabama & Vicksburg Railroad are ferried across the Mississippi River, giving direct connection with Louisiana points.

A number of steamers make regular trips between Vicksburg, Natchez, Greenville, and intermediate points. Vicksburg also receives much heavy freight by barge from distant river points. The Yazoo River affords cheap and convenient transportation of plantation products and supplies as far north as Greenwood.

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CLIMATE.

The United States Weather Bureau records at Vicksburg show a mean annual temperature of 65° F. Freezing weather is sometimes experienced as far south as the coast in the months of November and March, though the winters, as a rule, are short and mild. Damp and cloudy weather usually prevails in January and February, and the summers are long and hot. The most agreeable weather conditions occur during April, May, October, and November.

The precipitation during the summer months is local in character and that of the winter months general and often excessive. Autumn rains are rather infrequent and generally result from Gulf disturbances or hurricanes. Excessive precipitations within 24 hours sometimes measure as much as 6 or 8 inches and monthly amounts range from as high as 15 inches to less than 1 inch. The average annual snowfall in the latitude of Vicksburg, Jackson, and Meridian is a little less than 2 inches, gradually decreasing to the south. The maximum amount ever recorded in any continuous storm was 11.7 inches at Jackson (40 miles east of Vicksburg) in January, 1904. Sleet seldom occurs.

The average number of days with thunderstorms is approximately 55. These disturbances occur throughout the year and are of frequent occurrence in summer. They are usually of moderate force and not often accompanied by hail.

Killing frost has occurred at Vicksburg as early as October 19 and as late as April 6, but the average dates are November 13 and March 6. In the immediate vicinity of the Mississippi River tender vegetation often escapes injury when that on higher grounds at some distance from the stream is affected.

In the spring of 1912, when vegetation was somewhat later than usual, peaches, plums, and pears were in full bloom about March 15. Lespedeza and white clover in favorable situations afforded pasturage before that date, while Bermuda grass was not well started until a little later.

The following table, compiled from the records of the Weather Bureau station at Vicksburg, gives the normal monthly, seasonal, and annual temperature and precipitation:

Normal monthly, seasonal, and annual temperature and precipitation at Vicksburg.

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year.	Total amount for the wettest year.	Snow, average depth.
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December	50	79	12	5.2	1.4	4.1	0.1
January	48	82	3	5.6	3.9	1.8	0.8
February	52	83	− 1	4.8	10.1	4.6	0.7
Winter	50	.....	.....	15.6	15.4	10.5	1.6
March	58	87	24	6.2	3.2	11.2	T.
April	66	92	31	5.2	2.3	9.1	0.0
May	73	95	44	4.5	2.4	6.0	0.0
Spring	66	.....	.....	15.9	7.9	26.3	T.
June	80	101	52	4.4	5.9	6.4	0.0
July	82	100	62	4.4	1.1	4.9	0.0
August	81	100	54	3.2	1.1	5.7	0.0
Summer	81	.....	.....	12.0	8.1	17.0	0.0
September	76	98	42	3.4	0.3	10.5	0.0
October	66	94	34	2.6	3.6	5.8	0.0
November	56	86	22	4.3	2.7	14.2	0.0
Fall	66	.....	.....	10.3	6.6	30.5	0.0
Year	65	101	− 1	53.8	38.0	84.3	1.6

AGRICULTURE.

The agriculture of the county has never recovered from the military operations around Vicksburg during the Civil War. Prior to that time the upland sections of the survey were well improved with plantations over all but the roughest portions. Many fine old plantations were found on Davis Island and along that part of the river now known as Eagle Lake. A number of farms were located on the east bank of the Yazoo River. All of the more desirable front lands of the Mississippi River were brought under cultivation, and also the bench lands and most of the Flat Hills, with the intervening branch bottoms. In the Cane Hills section a very large proportion of the ridge land was cleared and many more farms were found throughout the region than at present. The profitable cultivation of the rough lands was then practicable, since slave labor was almost exclusively employed. Cotton was the chief crop and hand

and small 1-horse implements were about the only kinds of tools in use. Corn, peas, potatoes, sugar cane, pork, and beef were produced in quantities amply sufficient for local use. In this respect each large plantation was practically independent of outside sources of supply. The culture of tobacco, rice, and indigo never received much attention. Cattle and hogs were raised in considerable numbers and allowed to range in the woods and "swamps," as the low overflow lands were called.

At the close of the war the majority of the planters possessed nothing except their land. In many instances the buildings had been destroyed, and as a rule but little stock and few tools remained. From such conditions most of the owners of large plantations and many of the smaller farmers never recovered. The lack of capital, the increasing difficulty of managing free labor, and the greater cost of tilling the hilly lands, as compared with alluvial soils, led to the practical abandonment of thousands of acres in the uplands. The white population decreased, its place being taken by negro tenants, although in recent years many of the latter have moved to the towns or migrated to the Delta. The latter section has also attracted planters who had formerly operated farms in the eastern part of the county.

Throughout all of the reconstruction period following the war cotton continued to be the principal crop. It is the only crop that can be sucessfully grown by colored tenants and therefore the only line of farming that could be followed by the large landowners. It is the universal basis of credit for tenants and for the smaller land holders. The production of other commodities has not been encouraged until very recently or when the advantages of more diversified farming have become generally apparent.

Until recent years the yields of cotton on the heavier types of alluvial soils averaged about 1 bale per acre. Both the short and long staple (or "bender") varieties were grown. Although yields of the long staple were generally smaller than those of the short-staple cotton, this was more than offset by the higher price paid for the former. Since the advent of the boll weevil in 1909 average yields of cotton on the well-managed plantations have dropped below 1 bale per acre, and on estates where especially unfavorable conditions or poor mangement have obtained one-third bale per acre has been the highest yield obtained. The late planting and indifferent cultivation often given by negro tenants frequently result in an entire crop failure, the boll weevil destroying all of it.

The customary rent of the Delta plantations a few years ago ranged from 60 to 80 pounds of lint cotton per acre. When the land was worked on "shares" the landowner furnished tools, work stock, and seed, receiving one-half the crop. In the Big Black Valley the usual rent for many years past has been 1 bale of cotton for each 10 acres

of land farmed. In nearly every case the landlord advanced the tenant all necessary supplies. Few of the negroes produced enough corn, vegetables, or pork for their own use, so that most of them were generally in debt to the full extent of their crop.

During the past two years a large acreage of cotton land has lain idle. Many negroes have migrated to the northern counties or sought employment in the towns. In some sections of the county the available farm labor has been reduced about one-half. Rents have generally been lowered from 10 to 25 per cent, or to meet existing conditions. Many landowners now rent on shares, keeping the supplies advanced to tenants down to the lowest possible figure. The present price of labor is from 75 cents to $1 per day for men and about 50 cents for women.

On most plantations, both in the uplands and in the river bottoms, 1-horse implements are in general use. The "bedding-up" method of preparing land is universal and considerable manual labor is necessary before the crop is laid by. No commercial fertilizer and very little barnyard manure is applied to the land. No crop rotation is practiced.

The long-staple varieties of cotton, such as the Allen and Black Rattler, are quite extensively grown, but have been reluctantly dropped by many planters since the appearance of the boll weevil, and more of the short-staple varieties, such as Simpkins, Tooles, and Cleveland Big Boll, grown.

The Sarpy and Sharkey very fine sandy loams and the Sarpy silt loam are preferred for cotton. The "buckshot" lands and all of the clay and heavy silt types are too late to be safe, even in those seasons when there are no overflows. Crops on the Memphis silt loam and Lintonia soils suffered severely from the weevil in 1910 and 1911. The last-named type is not an early soil, but the best drained portions are fairly well adapted to cotton under present conditions.

The Memphis silt loam is more retentive of moisture and tends to encourage a later growth than the lightest alluvial soils. Methods of tillage, variety planted, and seasonal conditions, however, are the dominant factors in crop success, rather than the selection of any particular soil type. The clay loams, formerly held in high esteem, have given poor returns the past two or three years.

In combating the weevil early maturing varieties should be selected and planted as early as practicable. The application of fertilizers to hasten maturity can not be recommended, except on poor soils, where the increased supply of immediately available plant food enables a crop to start off promptly and thus shortens the period it might otherwise require in reaching maturity. On some of the Memphis silt loam such treatment may be advantageous, but it is doubtful if the alluvial types will respond in any marked degree. Of course, wide

spacing of rows and frequent tillage, as well as thorough preparation of the soil, are absolute essentials. The burning of stalks is of little use where the fields are so generally surrounded by timber as in this area.

To appreciate the ravages of the weevil it is only necessary to call attention to the returns of the census for the cotton crop in 1900, when 47,347 acres produced 26,388 bales, and in 1910, when the acreage dropped to 28,925, with an output of only 10,040 bales, representing a decline in average yield per acre from slightly more than one-half bale to one-third bale.

The advent of the boll weevil is effecting an economic change of far-reaching importance in the commercial and agricultural interests of the county. The almost exclusive culture of cotton has diverted attention from the possibilities in other lines of production and largely monopolized the credit in which they should have participated. It has tended to the perpetuation of large holdings of land and given rise to a system of tenancy that has discouraged the immigration of people who could develop the diversified agriculture to which the natural resources of the region are highly favorable.

The Memphis silt loam, with its associated types, and most of the Sharkey and Sarpy soils are adapted to a wide range of staple crops, with such local limitations as topography or drainage may impose. The adaptability of these inherently fertile soils to general farming, with stock raising as the main feature, has not been generally appreciated. All these types support a number of valuable grasses, insuring ample pasture and hay at minimum expense. The similarity of these soils to some of the great grain-producing types of the upper Mississippi Valley indicates their adaptability to corn and oats, especially the former. The loess soils of the uplands and river terraces are suitable for many kinds of truck where quality and yield rather than earliness are desired.

Corn can be grown on all the well-drained alluvial soils, especially the Sarpy clay, under the same methods as are practiced in the corn-growing States. On the Memphis and Lintonia silt loams lack of humus is the main objection, and its incorporation should be made one of the main ends in the management of these types. Only level to moderately rolling land should be used for corn, and a systematic rotation of crops is necessary if the best and most economical results are to be secured. Fall-sown oats, with or followed by a leguminous crop, form a desirable rotation with corn. The oats should be drilled in during October or early November. Crimson clover or vetch may be sown with them, and in favorable seasons contribute much valuable forage as well as improve the soil. Cowpeas may be planted after the oats are removed. If sown broadcast, the ground should be disked or otherwise stirred and pulverized

immediately after the oats are cut to avoid the loss of moisture which so frequently prevents a good stand. If prepared in this manner, peas sown broadcast or planted in rows will make a heavy growth. For this purpose the rank-growing varieties like the Clay are preferable to the Whippoorwill. The vines should be plowed under at rather shallow depths to hasten decomposition. The seed bed should be plowed later, very deep and thoroughly disked. If handled in this manner the light-brown soils that so frequently clod or puddle after rains will assume a darker color and a mellowness of structure highly favorable to corn and be well supplied with available nitrates. The plan here outlined is as economical a method of restoring fertility as can be practiced. The peas may be gathered and the vines pastured, but in the latter case the stock should remain on the land, so there will be no loss of manure.

On the level or moderately rolling lands "flat breaking" is to be recommended in preference to the ridge preparation now generally practiced. The latter is almost unavoidable on the hillsides and has some advantages in the way of surface drainage on flat ground, where underdrainage is rather slow, as on some of the Lintonia soils. As a rule deep plowing, with frequent shallow cultivation, will give the best results. At present much of the plowing and nearly all of the cultivation of corn and cotton are done with 1-horse plows. In the economical production of corn, hay, and other foodstuffs, as well as cotton, more efficient methods must be adopted. Relatively less colored labor must be employed and a greater number of owners of farms engage directly in the labor of caring for their crops. In handling modern machinery and in the care of live stock negroes are generally unskilled.

Bermuda and lespedeza thrive on the Memphis silt loam and its associated types. They have become well established on practically all the untilled cleared land in the uplands. The lespedeza usually forms most of the early pasture in the spring and is much in evidence in the fall on moist ground or where there is some manure. The Bermuda makes a more continuous growth, especially if grazed off but not excessively pastured during the season. These two pasture grasses afford from eight to nine months of grazing each year. In sections where the wild cane is still abundant cattle can go the entire year with little or no winter feeding. Few of the farmers in the eastern section of the county make provision for winter forage, except for work horses and milch cows. On the Vicksburg silt loam a stand of nearly clear lespedeza is frequently noted, the plants growing from 18 to 20 inches high and yielding about a ton of hay to the acre. Usually this clover and the Bermuda are more or less mixed with other grasses, and in many instances the branch bottoms are well set with Johnson grass. The latter frequently makes three or four

cuttings a year, the total being from four to six tons to the acre. On the Sarpy clay and "buckshot" lands the yields of hay are generally heavier than on the lighter colored types. The demand for native hay is good and the price in recent years has averaged from $10 to $15 per ton.

Both white and bur clover are found in all the open hill lands, although not forming so much of the pasturage as the plants mentioned above. There is also a good deal of vetch growing wild by the roadsides and in some places in the woods. Red clover has been tried with fair success and often persists for several years in old pasture lots. The many badly eroded hillsides, if partially improved by plowing or otherwise filling in the gullies, would afford good locations for red clover and other plants requiring calcareous soils. In many such places the calcareous substratum is exposed or found at slight depths. Where the washings from such abandoned lands have accumulated in the creek bottoms the resulting soil, if well drained, is suitable for the clovers and alfalfa. The latter has been grown experimentally in a number of places. In most instances the stand becomes so thin in two or three years as to be unprofitable. All the Memphis and Lintonia soils are deficient in humus, and the latter, especially, are so lacking in lime that they are not naturally adapted to crop production. The suggestions concerning the preparation of land for corn apply with force to alfalfa, particularly that with regard to increasing the organic-matter contents. An application of not less than 1,000 pounds of slaked lime per acre would be beneficial. After a good stand is secured on the Memphis silt loam the calcareous substratum should supply sufficient lime for this plant.

Sweet clover (Melilotus) is not found in this area, and it is probable that inoculation will be necessary to secure a stand. Either the seed should be treated or soil from an old alfalfa field obtained and scattered over the surface, but in all instances thorough preparation of the land is essential. This should be begun early enough to permit the germination of all weed seeds and the frequent stirring of the surface to kill them. This treatment also insures a deep but well-settled seed bed.

Sorghum, vetch, and rape are being grown in a limited way, generally as green forage for hogs and cows. Vetch may be planted either in the spring or fall and seldom fails to make a crop. Sorghum is a most valuable forage crop, but as yet has not been so used to any extent. Peanuts do exceptionally well on the Memphis silt loam and the lightest Sarpy types.

One of the features which militates against the extension of the stock-raising industry is the aggregation of land in the county into large holdings, now devoted to cotton, and the inexpediency of changing from this crop while dependent upon colored labor. Many

of the smaller landowners are in such straitened financial circumstances as to be unable to properly fence their lands and meet the initial expense of a new and, for them, untried line of farming. Although almost every farmer raises a few cattle and a number of hogs, neither have been regarded as a very important source of income. Heretofore on most of the farms only enough hogs were raised to supply meat for the family and a few rough-dressed carcasses to local dealers. Very rarely has a carload of either hogs or cattle been shipped from the county. From 30 to 40 per cent of the meat consumed in the city of Vicksburg has come from Northern packing houses. As a result of the increased interest in stock raising, however, a large acreage of the rougher lands has been fenced and more hogs and cattle are being raised. A stockyards company has been recently formed in Vicksburg to facilitate the marketing of live stock. The cattle tick is a rather serious pest in the upland districts, but many farmers have built dipping vats and the results of this treatment so far have been very satisfactory. In the Delta lands the overflows destroy the ticks.

A few herds of beef cattle of good breed are found in the county and many farmers have good dairy cows. Most of the latter are found within a few miles of Vicksburg, where dairying is a business of local importance.

A rather limited number of sheep and goats are now raised. They do well on the hill lands, but are subject to much loss by dogs. Horses and mules could be raised with proper attention. Practically all those now in use were imported from western and northern States.

The deep loess soils like the Memphis silt loam are well adapted to tree fruits. Some of the best apple-growing sections of the upper Mississippi Valley have soils of loessial origin. This fact and the extremely varied character of the native forests indicate the suitability of this soil for such fruits as find the climatic conditions favorable. On all the old upland plantations apples, peaches, pears, and figs were produced in quantities more than sufficient for domestic use. A commercial nursery established near Bovina in 1861 included 100 acres of bearing pears and about 75 acres of apple trees, with less extensive plantings of other varieties of fruits. At the time of its greatest development the nursery of young stock covered about 30 acres. New Orleans and other Mississippi River cities were the chief markets for the fruit, but much of it was made into wine and brandy.

This nursery and most of the orchards were destroyed in 1863. Practically all of the old apple orchards that were in bearing until about 25 years ago have disappeared, with the exception of an occasional tree. There are a few younger orchards that bear fairly well, and it seems probable that with proper selection of varieties, attention to spraying, and cultivation profitable crops could be grown. High prices always rule in Vicksburg for even inferior fruit.

The chief obstacle in the way of growing peaches on a commercial scale is the late frosts, although there is no greater liability to injury from this source than in other localities where the peach is profitably grown. Low ground should always be avoided. The north slopes of high ridges are much safer locations, and if possible free air drainage should be secured by having cleared land on all sides. By spraying in the early spring with lime-sulphur wash [1] and later with Bordeaux mixture the San Jose scale, brown rot, or other diseases could be controlled. The scale is said to have appeared about five years ago.

Pear trees grow exceedingly well, but are all more or less subject to blight. The Bartlett pear was quite commonly grown until about 1880, when all the trees succumbed to this disease. A few Le Contes are still found, but most of the trees now bearing are Kieffers. Formerly, when this fruit was shipped in quantities to the New Orleans market, the quality was pronounced by dealers to be much superior to that of the same varieties grown on sandy lands near the coast.

Wild grapevines are exceedingly abundant in the woods, but cultivated varieties do not generally prove successful. The native dewberries and blackberries grow in profusion in all cleared lands that are not cultivated. Their culture on a commercial scale has never been attempted. Japanese plums and other introduced varieties of this fruit do not bear well, but the native kinds are very abundant in most years.

Very little attention is now given to the cultivation of strawberries, the great amount of labor required in keeping the patches free from grass being given as the chief cause of the abandonment of this industry. The Vicksburg market is almost entirely supplied by fruit from other localities. By planting in straight rows on level ground and using 1-horse implements especially designed for the tillage of this plant the labor of keeping the ground clean and runners clipped back would be greatly reduced. Setting plants in the spring or early summer necessitates a rather long period of culture before a crop is secured, but if properly done insures very strong, deep-rooted plants. In such a season as that of 1911–12 fall-set plants would have made very poor growth. To check the growth of plants in the fall, after a good development has been secured as suggested above, it would be advisable, as a rule, to sow corn between the rows in October or November, the time depending upon the condition of the plants and the season. This would also serve as a mulch after being killed by the first frost. Such a plan has been successfully followed in some northern areas.

[1] For direction concerning the use of sprays and other information on fruit growing in this State see Bulletins Nos. 146 and 147, Miss. Agr. Expt. Sta.

Pecans are indigenous to this region. On the lighter types of the Mississippi-Yazoo Valley there are hundreds of fine trees, many of them bearing nuts of good quality. Near Eagle Lake there are several groves consisting chiefly of the large "paper shell" varieties. Single trees of these choice kinds are found in all parts of the county. The Sarpy silt loam and Sarpy and Sharkey very fine sandy loams afford excellent sites for commercial groves. The Memphis silt loam and associated types are also suitable soils, but hardly so desirable as the well-drained alluvial types.

The local markets are generally well supplied with cabbage, turnips, tomatoes, peas, beans, onions, potatoes, and other garden crops. Much of this produce is raised by Italian gardeners near Vicksburg. Watermelons, sweet potatoes, and sugar cane are common crops on the small farms near the towns, but no organized attempt has been made to produce them in quantities sufficient for shipment to outside points. Recently a truck growers' association has been formed in Vicksburg to encourage this plan.

The Thirteenth Census gives the size of the average farm in Warren County as 67.7 acres. This figure is hardly representative, however, as most of the holdings of the wealthier class of white citizens are over 1,000 acres, and several estates include many times this acreage. Most of the white farmers in the hill section own from one to several hundred acres, the large farms being the more numerous. Many of the negroes have small farms of from 5 to 40 acres, but few of them own any considerable acreage of desirable land. The total area of improved land in farms is placed at 81,019 acres, with a valuation of $2,716,874. The buildings are valued at $933,833, implements and machinery at $171,414, and live stock at $805,076. The entire area of cultivated crops in 1910 was less than 48,000 acres.

The economic changes now in progress have already affected land values, and in the near future must necessarily cause more or less change in the average size of holdings, as well as in the acreage that can be profitably cultivated.

SOILS.

The soils of this area fall into two groups—upland soils and land bottom soils.

The thickness of the loess covering the uplands varies, being greatest on the tops of the ridges a short distance back from the bluffs facing the Yazoo-Mississippi Valley. It thins somewhat to the eastward, but the uplands and terraces along the Big Black River consist entirely of the same silty material, the underlying strata being rarely exposed. At Vicksburg the maximum depth undoubtedly exceeds 100 feet, but the average is much less. In the interior of the county numerous road cuts 25 to 30 feet in depth fail to expose the underlying Coastal

Plain sands and gravels. These and other evidences indicate an average depth of the loess of not less than 40 to 50 feet. Along the bluffs from Vicksburg northward the limestone formation of the same name outcrops frequently, with occasional exposures of gravels above it. The latter also come to the surface along some of the creeks and branches in the southeastern part of the county. Neither of these older formations has entered into the composition of the soils to any appreciable extent.

The loess of this area consists of two distinct strata. The upper, termed the "brown loam" in Hilgard's classification of the soils of the State, has an average depth on the crests of the ridges and over the undulating area of 8 feet. On the hillsides it is very thin, but seldom entirely lacking, for it laps well down on even the steepest slopes. The texture, structure, and color of the material is given with some detail in the description of the Memphis silt loam, the subsoil of that type being practically identical with the average section of "brown loam." The mechanical analyses of samples of the subsoil of the above-named type indicate its mechanical composition.

The Memphis silt loam is everywhere underlain by a lighter-colored material consisting of about 80 per cent of silt and very fine sand. The road cuts expose it in hundreds of places throughout the county. The vertical walls stand unusually well, and such caving as occurs is generally caused by undermining along the roadside ditches, whereby great blocks split off along the irregular vertical lines of rather obscure cleavage. The material is porous and very friable, crumbling under slight pressure to a floury mass when dry.

The color is a pale grayish brown to almost buff in fresh exposures. Fossil snail shells are abundant throughout this stratum of the loess, and in the lower portion, particularly, cylindrical lime concretions often occur. The calcareous material and increased content of silt, as well as a marked difference in the mode of weathering, make it readily distinguishable from the surface layer.[1]

While this calcareous silt undoubtedly influences the surface soil to some extent where the "brown loam" is thin or has been deeply eroded, it usually occurs at such a depth—6 or 8 feet—that it can not exert a very direct effect upon the 3-foot soil section. It affords excellent underdrainage and also facilitates the aeration of the brown silty clay above.

The generally accepted explanation of the origin of loess on high uplands near great river valleys is that of a wind-blown dust derived from alluvial deposits developed by climatic conditions accompanying the glaciation of adjacent regions.

[1] See Bul. No. 5, Miss. Geological Survey, "A Preliminary Study of the Soils of Mississippi," p. 57.

Loess is usually rich in all of the essential mineral elements of a fertile soil, and the formation here is no exception to the rule.[1] The unweathered portion, particularly, is similar in general appearance and physical properties to the heavy deposits extending as far north as Illinois and Iowa on the east side of the Mississippi and Missouri Rivers. In those States it is the parent material of many soils of strong fertility and high agricultural value.

A composite sample of the "brown loam" taken between Vicksburg and Bovina near the main road at a depth of 3 feet, and fairly typical of the lime content of the subsoil of the Memphis silt loam, showed about 0.09 per cent of the material. The analyses of samples of the lighter-colored loess taken in the same places at 10 feet from the surface show a lime content of 4.29 per cent.

The alluvial soils in the Big Black River bottom consist largely of reworked loess. Everywhere silt and clay are the predominating grades of material giving rise to large areas of comparatively heavy types. Sandy loams have an extremely limited development along the Big Black River in this area, although the swiftness of the current and its frequent widespread floods afford suitable conditions for development of various types of soils if the materials for their formation were within reach of the stream.

The soils of the Yazoo Valley have a somewhat greater range in textural character, but the prevalence of brown silt loams and silty clay loams suggest the loess-covered hills as the source of much of the material.

In the valley of the Big Black River and, to a less noticeable degree, in that of the Yazoo River, a regular and comparatively uniform accretion of material is in progress. These channels are fairly permanent, new inundations leaving a fresh deposition of silt and clay. The continuation of this process has resulted in deposits of rather heavy material of such depth that the sandy substratum is seldom exposed by the eroding action of tributary streams crossing the alluvium. The types have heavy subsoils and no very direct influence of an open substratum is apparent, except in some instances near the river banks.

The Mississippi flood plain within this area is essentially a deep bed of sand, with a relatively thin surface covering in which very fine sand, silt, and clay are the chief constituents. The soils vary in texture from a loamy fine sand to a very heavy clay. The lighter type is usually some shade of brown or grayish brown, with a tendency to darker tints as the texture becomes finer and the depth increases.

[1] The average results of analyses of loess found at Dubuque, Iowa; Galena, Ill.; Kansas City, Mo.; and Vicksburg, Miss., show the following average percentages of lime, phosphoric acid, and potash: Lime (CaO), 4.41 per cent; phosphoric acid (P_2O_5), 0.13 per cent; potash (K_2O), 1.77 per cent.

In the latter case, where the aeration is less effective than in the shallow and coarser textured soils there may be a good deal of mottling, caused by unequal oxidation of the iron content. But there is very little development of the light-gray or whitish coloration observable in nearly all alluvial soils that suffer from long periods of saturation. The presence of the sandy substratum prevents this undesirable effect and insures thorough aeration and underdrainage to all the lighter types, and very favorable effects even in the deepest and heaviest phases of the clay soils or "buckshot" land. Except in the latter soil the humus content is low.

The differentiation of the surface deposits into several types of soil is an attempt to express in terms of the latter the very irregular occurrence of the different sediments. If the channel of the stream were more stable and no levees had been built in this section of the valley, these types would be found in something like a progressive order—the coarsest textured near the river and the finest or heaviest along the foot of the hills, in accordance with the well-known law governing the deposition of material by flood waters. It is well illustrated in the distribution of the sediments from any one flood, but the continuity of process is so often interrupted by changes in the channel that the soils resulting from a succession of overflows usually present wide variations in structural and mechanical composition. This is especially true of the lighter types developed near the channel, and frequently a large interior area of "buckshot land," whose origin is the result of long-continued deposition from "back water," may be suddenly invaded by currents carrying so much sand and silt that the character of much of the surface is soon changed.

The crumbling of the banks of all the outer curves causes a great loss of valuable land each year. In the southwestern part of the county entire plantations have been destroyed, their sites subsequently reappearing on the opposite side of the river as worthless sand bars. In a few cases the bars have been built up within a few years to so near the average height of the banks as to receive deposition of flood-water sediments. The latter process is too slow, however, to compensate in any measure for the destruction of the original soil.

These alluvial types are all inherently fertile. For present utilization of the land absolute protection is desirable, but the former widespread inundations were valuable, in that beneficial sediments were laid down at each overflow.

The following table gives the names and extent of the several soils mapped in the county:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Memphis silt loam	143,936	47.3	Vicksburg silty clay loam	12,544	3.3
Smooth phase	34,304		Sharkey silt loam	12,160	3.2
Sharkey clay	40,640	11.2	Sarpy very fine sandy loam	11,392	3.0
High phase	1,152		Sharkey very fine sandy loam	9,280	2.5
Sarpy silt loam	25,408	6.8	Riverwash	8,576	2.3
Vicksburg silt loam	24,000	6.4	Vicksburg very fine sandy loam	640	.1
Lintonia silt loam	12,032	5.0			
Slope phase	6,848		Total	376,320	
Sharkey silty clay loam	17,920	4.8			
Sarpy clay	15,488	4.1			

MEMPHIS SILT LOAM.

The surface soil of the typical Memphis silt loam consists of a light-brown, smooth, and friable silt loam, from 6 to 8 inches deep. The subsoil is a buff or reddish-yellow silty clay loam which is rather plastic when wet, and compact and crumbly when only moderately moist. Frequently in the lower portion of the 3-foot section there is present less clay and more silt than in the upper subsoil, and the structure is more friable. Also this lower subsoil frequently shows less red, being instead yellowish brown, often mottled with gray. Beginning at about 40 inches, the substratum is usually a light-brown to yellowish-brown silt loam, mottled with gray and white and is noticeably more friable than the upper subsoil. The humus content of the type is low, even in virgin woodland areas.

Throughout the entire extent of this soil, which is locally referred to as the Cane Hills, the surface is a succession of rather narrow, irregular ridges and hills separated by ravines and deep valleys. Much of the country is too rough to be conveniently worked with farm machinery. In some sections, particularly to the south and southeast of Vicksburg, the ridges are flat topped, including areas varying from as much as 20 or 30 acres to less than 10 or 15 acres. In such locations and on the milder slopes the soil conforms most closely to the type description Nearly all the hillsides which were formerly cultivated are badly eroded, much of the soil material having been washed down along the base of the slopes. Formerly the owners of estates took measures to prevent serious washing on the hillsides, but since so much of the land has been cultivated by negro tenants severe erosion has resulted in many places. The injury is not permanent, for by plowing to fill in the gullies all the eroded places may be made suitable for grazing land and eventually

cultivated. On some farms where short, steep hills prevail along the bottom lands erosion has been encouraged in order to reduce the slope and fill depressions occupied by the Vicksburg silt loam.

The Memphis silt loam is deficient in humus. In old fields that have received insufficient care there is very little vegetable matter in the soil; practically none in many instances. Even on the crests of ridges in wooded areas the organic-matter content is noticeably low. On the lower slopes where the original forest has not suffered changes by cutting or pasturage there are usually several inches of loose vegetable mold. The increased fertility of the soil in such places is doubtless due in part to the lessened depth at which a calcareous substratum is found, but the favorable physical characteristics, together with a higher content of humus and of moisture, are also important factors.

In the chapter on soils the mineralogical composition of the "Brown loam," of which the Memphis silt loam is but the surface expression, is discussed and its high degree of potential fertility with regard to the mineral elements is indicated. The physical properties of the material are also highly favorable to the condition that make for a productive soil. The internal drainage is good, and aeration and capillarity are effective throughout the soil section—3 feet—and to a depth in the underlying strata. This must appreciably improve the conditions in the surface layer, in which the roots of plants find nourishment.

Most of the Cane Hill soil is forested or used only for pasture. The cultivated portions are now confined chiefly to the tops of the hills and milder slopes.

The soil itself is well adapted to the principal crops grown in this section of the South, topography alone preventing its more extensive use for a wide range of products. The soil can be easily improved by a crop rotation which provides for the incorporation of vegetable matter. It also responds to the direct application of fertilizers, although in ordinary farm practice stable manure would effect the desired results. Cottonseed meal materially benefits crops. Where quick results are desired, as in trucking, commercial fertilizers may be profitably used, but the incorporation of liberal quantities of vegetable matter by plowing under the legumes will assure, with proper tillage, all nitrogen necessary for the crop and also render available sufficient potash and phosphorus, as the latter constituents are not lacking in the soil material.

The yields of short-staple cotton were formerly one-half to 1 bale per acre. In this estimate, however, the returns from plantations where the cultivated lands consist chiefly of the smooth phase, described further on, are included. The steepest hillsides give practically as good yields under careful tillage.

It is difficult to state even approximately the average yields of corn on this type. At present the negro tenants grow very little, but their shallow plowing of the soil, destitute of humus and trampled by stock during the winter months, when wet, often accounts for the poor results. On new land the returns were formerly very satisfactory, and even at the present time, under management tending to maintain the humus content of the soil, the yields should not be less. In normal seasons, 30 to 40 bushels of corn should be secured on the best land by careful management.

Sugar cane, sorghum, sweet and Irish potatoes, peanuts, cabbage, and tomatoes all do well on this type. For such crops the more silty and friable phases are desirable. This type includes occasional spots having an ash-colored surface soil and gray or mottled gray and yellow subsoil, with small black oxide of iron concretions, abundant on the surface and throughout the soil section.

Lespedeza and Bermuda grass have so generally taken possession of all uncultivated cleared land that they appear indigenous to the country. Each thrives exceptionally well on all the Memphis silt loam. White and bur clover are also found in many localities, and red clover, where once sown, persists for several years. Alfalfa has been tried in a few instances, with rather doubtful results. This failure to secure a stand was probably due to the unsuitable physical condition of the soil, or possibly to failure to inoculate properly.[1] In old fields the soil may be slightly acid, especially where there is little humus. An application of a few hundred pounds of lime per acre would correct this acidity and assist the plants in attaining a development of the root system whereby the more calcareous subsoil and the very limy substratum would be drawn upon for this essential mineral. Inoculation of the soil, or of the seed before planting, is also advisable.

The adaptability of the Memphis silt loam to fruit growing is discussed in the chapter on Agriculture. The type and associated soils offer many advantages in the way of stock raising. As already stated, the cleared land affords fine pasturage from seven to nine months in the year. The most practicable method of destroying the brush and nearly valueless trees that encumber much of the hills is to fence with woven wire and pasture closely with sheep or goats.

The present valuation of the type ranges from $5 for the roughest portions to $10 or $15 for areas including a considerable acreage of wide ridges and more or less bottom land. Near Vicksburg small farms range in value from $15 to $40, depending upon location and character of improvements.

Memphis silt loam, smooth phase.—Typically this phase consists of a brown or light-brown silt loam, underlain at an average depth of

[1] See Farmers' Bulletin No. 339. Alfalfa.

about 8 inches by reddish-brown or buff heavy silty clay loam, which grades below into light-brown floury silt loam. The silty clay loam portion of the subsoil is quite compact in many areas. When dry it is friable, but when wet the material is moderately plastic. The soil and subsoil of this phase of the Memphis silt loam are identical in their important characteristics with the corresponding sections of the Cane Hill phase of the type. The distinction is almost purely topographic. While the surface features in but few instances strictly conform to the configuration suggested by the term Flat Hills, a considerable proportion of the entire area designated has rather mild contours and the average relief is less than that of the Cane Hill phase. In the central part of the county most of the phase immediately east of the Nanachehaw Ridge consists of broad, rolling areas, in which the local elevations are very irregular in height and form. Many of the minor depressions are rather wide swales, while the larger ones usually are branch bottoms, bounded on one or both sides by much gentler slopes than prevail to the west of the ridge.

Near the valley of the Big Black River, where the flat hills merge into the highest terraces of Lintonia silt loam, the characteristic hills form a rather broad ridge, with a general slope to the southeast. Portions of the hilltops may be comparatively level, but more generally they have a moderate pitch toward the crest of the steeper flanks, so that individual elevations somewhat resemble table-lands. The ravines are usually shallower and the rough, untillable land near them and along large drainage lines does not constitute so large a proportion of the total area as in the Cane Hills. In the southeastern part of the county the phase consists of rather wide and evenly rounded hills that spread out in broad terracelike elevations near some of the creeks. These high benches, however, are frequently cut into ridges and irregular hills by the numerous shallow ravines. Some of the smoother areas near streams may have been influenced by stream action.

In general from 50 to 75 per cent of this phase admits of tillage by machinery, and even a greater proportion if a 1-horse equipment is employed.

The boundary between the type and its smooth phase, as indicated upon the map, is rather arbitrary, only the larger areas of less pronounced topography being represented. The widest ridges and many of the low hills in the rough section of the county are essentially the smooth phase, but can not be properly represented except upon a topographic map of a larger scale than that used in the survey.

Practically all of the smooth phase on the eastern side of the county was formerly included in well-kept plantations. Much of the southeastern part of the area is still in cultivation, although everywhere are fields more or less injured by unchecked erosion and rapidly

reverting to pine and oak forests. In many places deep gullies in the upper portions of the long slopes grade into broad washes, where as much as 8 or 10 feet of the original deposit has been removed over several acres.

Most of the smooth phase of the Memphis silt loam is thinly settled, a condition largely resulting from the distance from towns and railways, the lack of labor, and the difficulty in securing tenants. Notwithstanding these unfavorable conditions, much of this land, with the included Vicksburg silt loam, offers very desirable locations for small farms. The present price ranges from $10 to $20 an acre.

VICKSBURG SILT LOAM.

The surface soil of the Vicksburg silt loam consists of a loose, light-brown, mellow silt loam, containing but little humus. In places the content of very fine sand is high, especially near the banks of streams. The subsoil is a dark-brown, friable silty loam continuing to a depth of several feet and often showing mottlings of dull reddish brown or streaks of gray in the poorly drained areas. The soil is well drained, yet the structure and texture are such as to favor good capillary movement of moisture, making the type capable of resisting drought almost indefinitely.

This type, which constitutes a large proportion of the tillable lands in the hill section of the county, is derived entirely from the loess. While most of it is reworked surface material from the Memphis silt loam, the calcareous substratum has undoubtedly contributed a considerable proportion of the soil mass.

The type occupies bottom lands along the small streams in the hills. On all these creeks and along most of their branches having valleys too wide and deep to be classed as ravines there is more or less development of alluvial soils. On the lower course of the larger streams the bottom lands are from one-fourth to one-half mile wide, thence narrowing upstream to less than one-eighth of a mile above the junction of the principal tributaries. On the latter the breadth of the little valley flats is quite variable, usually ranging from 200 or 300 yards to practically nothing as the upper branches are approached. In many instances little valleys are found in the larger ravines, the width being but a few rods and the length usually less than one-half or one-fourth of a mile. Very frequently there are small, irregular benches or secondary levels at the foot of the slopes or a narrow terracelike recession of the otherwise steep hillside that increases to some extent the area of tillable land. Within the smooth phase of the Memphis silt loam the valleys are often bordered by comparatively gentle slopes. The minor areas are not shown on the map as they could not be outlined on the scale used.

Near the channels of the larger creeks the soil over limited areas is a silty very fine sandy loam. In many instances deposition of material from the surrounding hills has been rapid and the alluvial flats built up several feet above their original level. Over such areas both soil and subsoil consist of a brown silt loam slightly lighter in color than the typical soil and somewhat varied in the relative proportion of silt, very fine sand, and clay. The structure is more open than that of the hill soils, with a consequently increased capacity for and a more rapid absorption of water. A dark-brown to nearly black layer of silt loam several inches thick is frequently found at a depth of a foot or two. The humus content is generally low.

The lateral movement of the ground water throughout the soil mass is facilitated by the deep channels of the streams. Few of them are less than 5 and many of the larger ones are 10 or 12 feet in depth throughout their course. This depth and the corresponding width, with the further high gradients most of these drainage lines possess, enable them to carry without overflow comparatively large volumes of water. At times all but the highest parts of the valley may be flooded, but such inundations seldom last more than a few hours. Some of the widest valleys are rarely overflowed by the central stream, the discharge from small tributaries or surface wash from adjoining hills more frequently causing injury to growing crops.

Nearly all of the Vicksburg silt loam is cleared and at present devoted to cotton, corn, and grass. Formerly it was highly esteemed for the first-named crop, but under present conditions it is not quite so safe as those types that may be planted somewhat earlier and have less tendency to promote late growth. With good tillage, a bale per acre was very commonly secured, but during the last two years less than one-fourth bale has been the more common return.

The greater part of the corn produced in the hill section of the county is grown on this type. The average yields in some of the larger valleys of the northern part of the county have been about 40 bushels per acre. Practically all this soil is well adapted to corn, although its productivity would be greatly increased by the incorporation of more organic matter.

Sugar cane and sorghum make a rank growth and yield a larger percentage of juice than is usually secured from cane grown on the Memphis silt loam. A number of market gardens near Vicksburg consist chiefly of little, narrow valleys where the well-manured soil is friable and loamy, well adapted to cabbage, sweet potatoes, and tomatoes, and fairly well suited to early onions, lettuce, and radishes. In wet seasons much trouble is experienced in keeping the ground in good tilth and crops are often delayed more than on high land. By establishing proper drainage, Irish potatoes, beans, peas, radishes, and other vegetables could be successfully grown.

The type is admirably adapted to lespedeza, which grows from 12 to 18 inches high and yields a ton or more of hay per acre. In many instances the first cutting in a field consists chiefly of this legume, while the later cuttings contain more Bermuda, or consist entirely of the latter grass.

Johnson grass is troublesome on this type in cultivated fields, but in mowings often makes good yields of hay, ranging from two to three cuttings or upward of a ton per acre each time. In one instance, on a sloping phase at the base of the hills where much sediment from deep gullies above had been deposited, alfalfa did well for several years. In this instance the ground had been well manured.

Except in a few of the largest valleys, this type does not form more than a small proportion of each farm, although it often embraces most of the cultivated land thereon. The value of a small farm, including both hills and valleys, is determined largely by the extent and character of the latter.

The type as developed along Big Black River is somewhat different from that along the smaller streams.

The Vicksburg silt loam of the Big Black River bottoms consists of a friable brown silt loam with a rather high percentage of clay, in places ranging to a silty clay loam. In old fields the originally low content of humus has been so reduced as to make the surface color a light brown. Near the stream channels and in some of the sharp curves of the river considerable very fine sand is encountered and the surface of the type is more loamy than the heavier phase. The subsoil is generally similar to the soil in texture, although in places it is somewhat lower in content of very fine sand. The subsoil may have very nearly the same color as the soil, but it is often light brown, mottled with grayish brown or drab and rusty brown.

This land has an extensive development in the bottoms of the Big Black River. It is derived from the deposition of sediments in which silt rather than very fine sand or clay is the predominant constituent. In all places the soil materials have been chiefly derived from loess-covered uplands. The areas bordering the slope phase of Lintonia soils represent a gradual change from that type to the strictly alluvial deposits nearer the stream. While all the Vicksburg silt loam of the Big Black River is subject to overflow, it has a somewhat higher average elevation than the silty clay loam of the same series or the larger areas of Sharkey soils in the Mississippi Valley adjoining it. The surface is slightly undulating and the broad swells or occasional narrow ridges of a few feet elevation often escape inundations that partially fill the depressions and entirely cover the lower areas of heavier types.

This soil forms a considerable proportion of the first bottoms of the Big Black River from the Baldwin Ferry Bridge northward. South of this the valley lands are more frequently overflowed and the deeper deposits of silt and clay have generally given rise to a heavier type of soil—the Vicksburg silty clay loam—although the textural differences between these classes of soil is not marked.

Drainage as a rule is fairly well established when the river is at normal height. The local depressions in many cases are uncleared, the forest consisting of white, red, and water oak, with more or less gum, maple, sycamore, and elm. There is usually but little cane remaining on the type.

In several instances recent clearings were observed where a very heavy growth of lespedeza had taken possession of the ground. As a hay or pasture land practically all the type has a high value. Corn does well and as a rule the floods of the Big Black River subside early enough to admit of this crop being planted in time to mature before frosts occur in the fall. It is, of course, unsafe for any winter crop except grass. Formerly the most of this land was usually planted to cotton, both the long and short staples sorts doing well. In the last few years a few planters, by careful supervision, have secured about one-half bale per acre of short staple. Some attempts are being made to continue the crop, but the type as a whole is not favorable to its growth under boll-weevil conditions.

Practically all of this soil is suitable for corn, grass, and forage crops. As a part of a small farm any of this silt loam has a high value for the crops suggested above. Some portions could be used for rice, the heavy subsoil rendering the flooding of the surface feasible. Most of the type is now included in large estates where little else than cotton has been grown for years past. The yields compare well with those of the best valley soils. In recent years the advent of the boll weevil has caused much of this type to be thrown out of cultivation. Such neglected lands soon become covered with weeds, wild pea vines, and brush.

The following table gives the average results of mechanical analyses of samples of the soil and subsoil of the Vicksburg silt loam:

Mechanical analyses of Vicksburg silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
422211, 422243	Soil	0.0	0.0	0.1	0.2	1.3	87.2	11.2
422212, 422244	Subsoil	.0	.0	.1	.6	2.5	86.3	10.6

VICKSBURG VERY FINE SANDY LOAM.

The Vicksburg very fine sandy loam consists of a brown or light-brown very fine sandy loam, underlain by lighter-colored very fine sandy loam to silt loam. The texture ranges to fine sandy loam or sandy loam in the stream channels.

There are only a few small areas of this soil, and these occur along the banks of the Big Black River, mostly between Askew Bridge and Baldwin Ferry Bridge. The material is washed largely from the loess, though the sand is probably from the underlying Coastal Plain deposits.

While the type is subject to overflow, it is used between inundations for cotton, corn, and other crops with fair to good results. The soil is very well suited to the production of sorghum, Johnson grass, cowpeas, and such vegetables as potatoes and cabbage.

VICKSBURG SILTY CLAY LOAM.

The surface soil of the Vicksburg silty clay loam consists of a brown, heavy silty clay, rather plastic under ordinary conditions of moisture and slightly granular and crumbly when dry. The subsoil consists of a silt loam or silty clay loam, usually a lighter shade of brown than the surface soil, particularly in the lower portion of the 3-foot section, where mottlings of gray and shades of brown appear. Near the river bank the sand content is fairly high and the type correspondingly lighter. The soil and subsoil are composed for the most part of comparatively recent sediments. During the frequent overflows the water is heavily laden with yellowish silt, the color and character of the material suggesting the loess-covered hills as the chief points of origin.

This type represents the lower portions of the flood plains of the Big Black River. The extreme elevation is but a few feet above the banks of the stream, while much of the surface is lower than the ground on the immediate margin of the channel. Practically all of the type is inundated during the usual winter and spring overflows, while a considerable portion is overflowed whenever the river approaches flood stage. At such times the innumerable low swales are filled with water from the small streams crossing the bottoms and later by back water from the main channel—the latter occurring most frequently along the lower course when the Mississippi River is high.

Only a small proportion of the surface of this type is level. In most instances there is either a very gradual inclination toward the river or, more frequently, low swells and many irregular depressions are encountered, varying from old channels to broad swales. There are a number of permanent lakes or lagoons and a good many small

cypress brakes, but with these exceptions the surface is completely dry during ordinary stages of the river.

Internal drainage is good and aeration to the depth of several feet is apparent from the uniformity in coloring of the type.

The channels of the Big Black River and most of the streams crossing the bottoms are cut from 15 to 20 feet below the general surface, insuring good local drainage at ordinary levels of the river of the land in the immediate vicinity of these streams. It appears that these comparatively deep channels, combined with the local relief enjoyed by most of this type and the generally porous nature of the material, insures fairly effective internal drainage. During the summer and fall of 1911 the water table could seldom be found with a 3-foot soil auger. White or mottled gray and white phases of the soil occur, but are not extensively developed.

Most of the type is densely forested with oak, black gum and sweet gum, sycamore, elm, maple, ironwood, and other deciduous trees. Overcup oak, so characteristic of the lowlands of the Mississippi, is not abundant on this soil and there are but few cottonwoods or willows.

In many places there is a very heavy growth of tall cane, often forming impassable jungles. The cypress is generally of inferior size as compared with that in the lowest places, the best having been removed.

Some of the higher lying portions of this type have been cleared. The soil here is usually a dark-brown silty clay, easily tilled when in proper moisture condition. Since the advent of the boll weevil such land is unavailable for cotton, but can be planted to corn with reasonable assurance of safety in most seasons.

Corn could be grown upon a large proportion of this land if cleared, since in most years there are few extensive overflows after the middle of June. Bermuda grass and lespedeza do well on all except the lowest areas, while Johnson grass and redtop could be grown nearly everywhere.

The present valuation of any section of this land depends almost entirely upon the character of the forest growth. As a very general estimate most of the type is now worth from $5 to $10 an acre.

LINTONIA SILT LOAM.

Where typically developed the Lintonia silt loam consists of a light-brown silt loam, underlain at 6 to 8 inches by reddish-brown or buff silt loam to silty clay loam. In places the substratum is slightly mottled with gray. Where the subsoil consists of silty clay loam the material is slightly plastic when wet. The soil and subsoil of this type closely resemble the corresponding sections of the Memphis silt loam, the important difference being in topography. The soil of these comparatively level bench lands has been termed Lintonia silt

loam to distinguish it from the soils of the rolling uplands and the lower, sloping areas at the foot of the hills.

The type includes all the soils of the high benches or second bottoms, characteristically developed along the western side of the Big Black Valley. The surface of most of these terraces is either level or slopes gently toward the river. In many instances the topography becomes undulating near the hills and in places the outer margin is indented by short, shallow ravines opening into the lowlands. Small streams from the hills have cut rather narrow, flat-bottomed trenches through these terraces, with a consequent development of short slopes too steep to admit of convenient cultivation. With this exception, the type includes very little land on which farm machinery can not be used.

Small areas of bench land also occur on the lower course of the creeks tributary to the Big Black River, with a limited development of terrace formation in the Mississippi Valley near Cedars. The material appears to have been deposited by the streams when flowing at higher levels.

The largest area of Lintonia silt loam is located a few miles northeast of Bovina. The general elevation, which is greater than that of the bench lands farther down the valley, varies fron 50 to 100 feet above the river and the surface is sufficiently undulating to give good drainage to practically all the plateau.

Most of the surface of the areas south of the railroad varies from gentle undulations to nearly imperceptible slopes. Absolute flats occur, but they are usually limited to a very few acres. In most instances the outer margin of the terraces is a sharp bluff rising 20 to 40 feet above the first bottom.

Practically all of the terraces are open fields and have been in cultivation many years. The light-brown silty soil is easily cultivated, although usually lacking in humus. On this account it is inclined to pack when wet, but otherwise it is friable and loamy if properly handled. The average yields of cotton, until recently, were upward of 1 bale per acre of the short-staple varieties and somewhat less of the long staple. These returns were obtained under almost continuous planting of this crop and without fertilization, except the occasional plowing under of cowpeas and weeds.

During the last two years the acreage of corn has been considerably increased. A liberal use of cowpeas in a rotation of fall-sown oats, cowpeas, and corn or cotton increases the humus content of the soil to a point where the yields of corn in normal seasons should be from 40 to 50 bushels per acre. In the production of corn, oats, and hay the surface conditions admit of the most economical use of improved machinery.

Cowpeas, peanuts, soy beans, sweet potatoes, sugar cane, and sorghum do well, the adaptability of the type in this respect being similar to that of the Memphis silt loam. Cabbage, Irish potatoes, tomatoes, and a number of other vegetables can be successfully grown. Alfalfa has not been tried, but undoubtedly could be grown if the soil were suitably prepared. Inoculation would be necessary and liming would tend to eliminate any traces of acidity and also flocculate the soil. The calcareous stratum underlying the Memphis silt loam at a depth of 6 to 10 feet is found only two or three times at this depth on the terraces, if, indeed, it occurs at all on the lower bench lands, indicating that the lime within reach of plant roots is considerably less in this type than in the Memphis silt loam. There is no marked deficiency of this essential mineral in the normal soil of the terraces, although some portions are acid.

This condition is noticeable in some of the flat areas where the surface soil is much lighter colored than in the well-drained locations. Such spots would be greatly improved by open ditches or tiles, the light color of the soil resulting from inadequate aeration and almost constant saturation during rainy seasons. The liberal incorporation of vegetable matter and the application of lime would also improve the structure.

Some "alkali" spots are seen in depressions, evidently former sites of ponds, where the extremely poor underdrainage has given rise to a white, floury surface soil full of small, dark-colored iron concretions and a subsoil that is either white or mottled gray and brown silt loam quite lacking in granular structure. Adequate drainage is the first requisite for the improvement of such areas.

With the exceptions noted above, the Lintonia silt loam is a highly desirable soil for general farming. At present much of it is worked by negroes and practically unimproved. The price of land of this type ranges from $10 to $20 an acre, depending upon location.

Lintonia silt loam, slope phase.—This phase of the type varies widely in its development in the area. On the more pronounced slopes much of the original soil has been washed away, leaving a rather heavy silt loam. Over areas of slight slope or depressions the soil consists of a friable brown loam, varying in depth from several inches to a foot or more, underlain by a dark-brown or chocolate-colored spongy silt loam high in organic matter. Underdrainage is better over the slight slopes which are high in organic matter than in those spots where the surface is light colored and contains numerous small, black iron concretions. As in other types, the latter condition is the result of slow drainage. Most of these departures from the normal phase are limited to a few acres, but some of the lowest land is so poorly drained that it remains wet and cold late in the spring.

The soil material represents outwash from the loess hills, containing in most instances a slightly higher percentage of very fine sand and less clay than the upland types. As a rule the subsoil is not quite so compact as that of the hill soils, which affects to some extent its moisture-holding properties.

This phase embraces the gently sloping lands at the foot of the hills overlooking the larger valleys. It is most extensively developed along the base of the bluff facing the Yazoo-Mississippi lowlands, where an almost continuous border of semialluvial soils extends from the north county line to the point of the highlands between the Big Black and Mississippi Rivers. It varies in width from a few hundred yards to nearly a mile, the average being less than one-half mile. The strip of Lintonia silt loam widens to fan-shaped areas at stream confluences, the outer margin usually merging imperceptibly into the lowlands beyond. The largest of these deltoid areas is at Ballground, where several square miles of the Lintonia soil slopes imperceptibly toward the Yazoo River, all of it lying well above ordinary overflows. Smaller developments occur where other streams leave the uplands, but the areas are not so large as the one at Ballground and the surface inclination is more pronounced. The narrowest strips usually have the higher gradients, ranging from 5 to 10 per cent in many places. The elevation of the middle of most of the narrow areas varies from 15 to 20 feet above the adjoining Sharkey silt loam. The boundary between the two types represents the limits of the average flood in the Mississippi and Yazoo Valley.

All of this phase is under cultivation, most of it having been cleared many years ago. Its crop adaptation and the cultural methods necessary to insure the best returns are practically the same as those suggested for the typical soil. While not so fertile as the adjoining lowlands, the better surface drainage and immunity from overflow of this soil give it a higher value for general farm crops.

Owing to its location with regard to other types, few farms consist chiefly of this slope phase, the present price, which generally ranges from $20 to $30 an acre, depending upon the associated soils.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Lintonia silt loam:

Mechanical analyses of Lintonia silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
422215	Soil	0.0	0.1	0.1	0.4	2.5	88.3	8.5
422216	Subsoil	.0	.1	.2	.7	4.1	89.4	5.6

The following sample contained more than one-half of 1 per cent calcium carbonate ($CaCO_3$): No. 422215, 5.50 per cent.

SARPY SILT LOAM.

The Sarpy silt loam consists of a brown silt loam often of light texture underlain at about 15 to 20 inches by a brown or light-brown very fine sandy loam to light silt loam, the silt content lessening with depth, until in the lower portion of the 3-foot section the type may be a comparatively loose, very fine sand.

The Sarpy silt loam owes its origin to the comparatively recent deposition of fine sediments over the sandy material. The latter was deposited under flood conditions that resulted in its distribution in roughly parallel slight ridges or swells. The subsequent deposits consisted chiefly of finer sediments, occasioned by changes in the location in the main channel or by the increasing elevation of the general surface of the ridges, both factors in most instances being involved. The greater depth of water in the depressions in the later inundations and their longer submergence under such conditions accounts for the greater accumulation of silt on the lower ground. The variation in texture of the surface soils in the different locations may range from a clay to a fine sandy loam. As a rule, in the areas mapped as Sarpy silt loam, the soil of all the highest ground is a very fine sandy loam. On the slight elevations it is a silty very fine sandy loam, grading to heavy material, often a silty clay, in the depressions. The textural variations within a depth of 6 to 20 inches are of such frequent occurrence and so intimately related to the topography that all have been included in one general type.

The type occurs along the Mississippi River front and near the larger lakes or partially abandoned channels through the bottoms. The surface of the larger areas consists of low ridges or broad flats separated by long, shallow depressions, the maximum relief being 10 to 15 feet and the width varying from a few rods to one-eighth or, in a few instances, to one-fourth of a mile. The narrow strips along the lake fronts are usually high ground sloping back to the heavier types in the rear.

The areas near Eagle Lake consist largely of a rather dark-brown silt loam on the highest ground, grading to a dark-colored silt or clay loam in the depressions. The heaviest of the clay loam approaches the Sharkey clay and is a very heavy granular phase of the Sarpy clay. Most of the type in that locality where protected by levees is cultivated. The areas outside the levee are subject at times to severe overflow, and for this reason are not so generally cultivated as formerly.

The type as found on Davis Island is a brown fine sandy loam. Except near the Sharkey clay types, the low-lying areas are very slightly darker in color but considerably heavier in texture.

Most of the type is a warm, early soil, well drained and easily cultivated. Since the appearance of the boll weevil this soil has become highly valuable because of its adaptability to the early-maturing cotton. It can generally be prepared earlier than any other alluvial type, except the Sarpy very fine sandy loam—a much less fertile soil. The yields of early varieties of short-staple cotton in recent years have averaged about one-half bale to the acre. On one well-managed plantation consisting largely of this type the yield was one-half to three-fourths of a bale per acre in 1911.

The Sarpy silt loam is adapted to a wide range of crops, including all those that can be profitably grown on a well-managed Delta farm. Except for danger from overflows, the lighter phases are well adapted to oats, cowpeas, sorghum, sweet potatoes, and peanuts. By turning under a green crop the soil of the ridges, which in places has been somewhat run down by long cropping to cotton, may be greatly improved for corn. The latter crop does better on the lower ground, especially in seasons of normal river floods. Planting is sometimes delayed by seepage waters on these low areas. In such areas if corn be planted by the middle of June it is reasonably safe from late frosts.

Bermuda grass and lespedeza do not make quite so heavy a growth as on the Sarpy clay, but any of the type affords excellent pasture and hay. Alfalfa should succeed on this land where the drainage is good.

The original forest growth consisted of oak, sycamore, cottonwood, gum, and other hardwoods, all of which has now been removed, leaving open fields. Several of the old Delta plantations consisted largely of desirable front lands as found on Eagle Lake and Davis Island.

As little of this type has been on the market recently, any attempt at valuation is more or less arbitrary. A fair valuation seems to be from $30 to $50 an acre, depending on improvements and location.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Sarpy silt loam:

Mechanical analyses of Sarpy silt loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
422234	Soil	0.0	0.1	0.1	1.3	37.5	46.4	14.8
422235	Subsoil	.0	.0	.2	.5	24.2	68.7	6.8

Another sample of subsoil (No. 422210) contained 2.15 per cent calcium carbonate ($CaCO_3$)

SARPY CLAY.

The Sarpy clay consists of a dark-brown or brown silty clay, underlain at 12 to 24 inches by light-brown, very fine sandy loam, or light silty loam, which changes below into a uniformly brown, very fine sand. The substratum is invariably a loose, grayish, very fine sand. Silt and very fine sand predominate in the subsoil, which is lighter in color and texture and more open in structure than the surface soil, the sand content becoming quite pronounced at depths below 25 to 30 inches. The surface soil crumbles on drying out, but is somewhat plastic when wet. The upper subsoil frequently shows mottlings of brown.

As the type owes its origin to the comparatively recent depositions of fine sediments from slack water over coarser deposits previously laid down by currents, the relative thickness of the heavy surface layer and the subsoil section necessarily vary considerably. The arrangement of the different textured sections of the soil profile is determined largely by the local topography and the relative position of the type with regard to surrounding soils.

The surface configuration of most of the areas in which the Sarpy clay occurs is characterized by low parallel ridges alternating with shallow depressions, the total relief seldom exceeding 10 feet. Some of the depressions are mere swales, while others are often from one-eighth to one-fourth of a mile wide and a mile or more long. The individual areas of higher ground are correspondingly irregular in outline, ranging from long, low ridges only a few rods wide to flat areas of several hundred acres. Where such topography prevails near large developments of "buckshot" land the Sarpy clay is found on the higher ground, while if associated with the Sarpy silt loam it invariably occurs in the depressions.

In the vicinity of Eagle Lake most of the type has a dark surface soil very similar to that of the Sharkey clay, but much more easily kept in good tilth, on account of better underdrainage and aeration effected by the lighter subsoil and the tendency of the surface material to granulate on becoming dry.

A similar phase of the type occurs near the large area of Sharkey clay southwest of the Yazoo Diversion Canal. The small areas lying west of the Old River are, for the most part, low ridges separated by depressions of Sharkey clay. The soil of the higher ground is a rather silty clay of crumbly structure, but much more compact at a depth of a few inches. The brown loamy subsoil is usually within 20 inches of the surface.

An extensive area of this type occurs on Davis Island. Most of the areas within the levee represent a gradual transition from the central tract of Sharkey clay to the lighter clay. In the slight depressions and near the "swamp," as the Sharkey clay is locally

termed, the Sarpy clay is noticeably heavier, adhering to a soil auger in a mass if wet and inclined to be compact when dry. These heavy phases have a granular structure and show considerable rusty brown mottling. The depth to the lighter subsoil is generally from 1 to 2 feet and sufficiently close to affect the drainage favorably.

Most of the small, narrow areas are depressions where the soil varies from brown silty loam to a dark clay, approaching the "buckshot" land in appearance and physical properties. In seasons of frequent rainfall or high water these depressions are too wet to be successfully farmed.

There has been considerable development of the type outside of the levees in recent years. Except on the northeast and southeast shores, the current is generally deflected from the banks when the river is high, with a constant tendency to slack water against the levee. The sandy ridges formed when Palmyra Lake was the main channel are now covered with a stiff, dark-colored silty clay, varying from a few inches to several feet in depth. The high ground of Palmyra Island and much of the area west of the levee corresponds in structure with the typical Sarpy clay, although extremely variable with regard to depth at which the light subsoil is found.

The light subsoil and sandy substratum facilitate drainage, allowing this land to be worked soon after a rain, provided the water table is at the height at which it stands during medium or low stages of the river. When the latter is high the water table rises in portions of this type, keeping it wet, or seepage water may cover the surface. The higher ground is not so affected, although all of it lies below the ordinary flood level. During the summer, when the ground water is low, the surface of practically all the type dries rapidly after each rain and is soon in condition for tillage. The combined depth of the soil and that part of the subsoil composed of a silty or fine loam is sufficient to retain enough moisture to meet the demands of a growing crop in any short period of drought. There is, doubtless, more or less capillarity between this superficial layer and the permanently saturated substratum of sand, so that droughty conditions in a properly tilled field are practically impossible. The heavier phase should be plowed when wet. It will then crumble, on drying, into a loose mulch. Some of the lighter-colored phases, where the soil is a silty clay loam inclined to pack under pressure and assuming a crumbly condition only when dry, must be handled rather carefully. If worked when wet they become cloddy. Some of these should not be plowed too deep. Winter plowing and exposure to freezing is beneficial and an increase in vegetable matter content would improve some old lands.

The Sarpy clay is a fertile soil, well adapted to cotton, grain, and grass. Formerly it was highly valued for the production of cotton,

which made a rank growth and good yield. The short-staple cotton tends to lengthen the fiber after being grown a few years on this type.

Corn, which is being more extensively grown since the appearance of the boll weevil, thrives as well on nearly all phases of this soil as on the black alluvial lands of the upper Mississippi Valley. The yields depend largely upon seasonal conditions. On several well-managed farms, where the heavy, dark-colored phase of this type prevails, deep plowing (flat breaking) as early as the condition of the ground permits, followed by frequent shallow cultivation, has given as high as 60 bushels per acre. From 30 to 40 bushels is an average crop when seasons are less favorable. Planting as late as the middle of June will enable the farmer to harvest his crop before the fall frosts.

Fall-sown oats make a rank growth and may be pastured, if the surface is not too wet, without decreasing the yield of grain.

Vetch, rape, and sorghum are being grown to some extent for forage and on the better drained areas make most satisfactory growth. The clovers have been tried to a limited extent, and success with them is chiefly a question of local drainage and protection from overflow. Only the highest ridges should be selected. The soil itself is not essentially different from land elsewhere on which clover and alfalfa thrive.

Bermuda grass does not spread over this type or the associated areas of Sharkey clay as rapidly as upon lighter soils, but the yields after the grass is well established are surprisingly heavy. In favorable years three cuttings, averaging nearly 2 tons per acre each, have been reported. Alfalfa can be successfully grown on this soil where the water table does not rise too near the surface. Pecans do well on this type.

The above conditions apply to lands under levee, but in the areas not so protected, such as those west of the old channel of the Yazoo River, northwest of Vicksburg, and on portions of Davis Island and elsewhere, a considerable acreage is successfully cultivated.

The following table gives the results of mechanical analyses of samples of the soil, subsoil, and lower subsoil of this type:

Mechanical analyses of Sarpy clay.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
422223	Soil	0.0	0.0	0.1	0.9	3.0	58.2	37.6
422224	Subsoil	.0	.0	.0	.6	30.7	56.5	12.2
422225	Lower subsoil.	.1	.0	.0	.3	12.9	60.6	26.1

The following sample contained more than one-half of 1 per cent calcium carbonate ($CaCO_3$): No. 422224 4.04 per cent.

SARPY VERY FINE SANDY LOAM.

The surface soil of the Sarpy very fine sandy loam consists of a light-brown very fine sandy loam, from 12 to 15 inches deep, slightly incoherent and moderately compact. The subsoil is lighter in color and texture than the surface soil, consisting principally of grayish-brown fine sand. A lighter phase of the type, found along the river bank, consists of a loamy sand, somewhat coarser than the average of the type. In the latter phase the subsoil is a fine grayish sand, containing so little silt and clay as to be comparatively clean. The subsoil may sometimes consist of a layer of loose, light-colored fine sand, underlain by a light-brown loam, or the relative positions may be reversed. As a rule the lower portion of the soil section exhibits less uniformity in structure than the surface soil.

The type represents recent deposits on the front lands of the Mississippi River. The flood waters which break over these lighter portions of the river bank carry but little material coarser than fine sand. As the water spreads over the surface the coarser sediments are dropped near the river bank, the sand in some instances being carried well back toward the lower and heavier soil areas. This is noticeable particularly on those necks of land over which the floods sweep with increasing force as changes in the channel decrease their width.

No very sharp distinction can be made between the lighter phases of this type and riverwash. The normal developments of the latter are found on the inner or concave side of the curves and at a lower level than the Sarpy soil. The latter is submerged only at flood stages of the river and in normal seasons is ready for the plow a little earlier than the larger areas of heavier soils adjoining. The surface usually has a perceptible inclination away from the river bank. In most places it is somewhat hummocky, and the larger depressions, seldom more than a few feet lower than the higher ground, are roughly at right angles to the river. The drainage, with regard to rainfall, is good, and the moisture conditions are favorable for early crops.

This soil undoubtedly carries a high proportion of available plant food. Many kinds of weeds make a rank growth on the untilled portions. Bermuda grass soon forms a good sod on all the heavier phases and even binds the light soil of the crests of minor ridges and drifts of sand. On several tracts of front land the yield of Bermuda hay averages about 1 ton per acre, although the first cutting may be delayed or even entirely ruined by floods.

The limited acreage now cultivated is devoted to cotton, which formerly yielded about 1 bale per acre. It is a warm, early soil, valuable not only for cotton but for other crops wherever the danger of overflows is not too great. There are many locations along the Mississippi River where in most seasons Irish potatoes could be planted early in January and marketed in May. While the possi-

bilities for early truck growing are lessened because of the probability of injury by the May and June floods, much of this type could be safely utilized for late-planted truck and forage crops. Onions and potatoes could probably he made successful crops.

No consistent statement regarding the value of the type as a whole can be made, as the probability of loss by caving into the river or of injury through fresh depositions of stream sediments must always be considered. The alterations may be rapid, depending upon the frequency of floods, changes in the main stream, and the chutes. The area near Eagle Lake is slowly changing to the Sarpy silt loam, as are other areas where the floods are chiefly caused by backwater. Some areas—such, for instance, as those on the inner sides of the bends—are, of course, safer in this respect than others, and in a few locations, like that north of Davis Island, promise permanent improvement by the comparatively rapid increase in elevation of most of the surface.

SHARKEY CLAY.

The surface soil of the Sharkey clay consists of dark-brown clay, 6 to 8 inches deep, faintly mottled with drab and rusty-brown iron stains. The subsoil [1] is a drab to bluish-drab sticky, plastic, waxy, heavy clay, usually mottled with rusty-brown. When dry the subsoil material becomes stiff and unyielding. The soil crumbles into small cubes on drying, and cracks to a depth of several feet, this feature being characteristic of the type. Accumulations of organic matter make the surface soil slightly porous in places, but as a rule the humus content is low. Unless handled under proper conditions this soil proves very refractory. The close structure of the subsoil makes aeration very imperfect, resulting in only a faint development of the brown mottlings commonly observed in the subsoils of associated types. Wherever the mottlings extend to a depth of 2 feet or more there is a decidedly increased tendency of the material to break into cubical fragments. Such a condition is preferable to that where the light bluish-drab coloration prevails throughout the subsoil section. In the latter the underdrainage is extremely slow, although in no instance does the material seem to be entirely impervious. On the outer border of the areas of Sharkey clay the depth of the sandy substratum is not more than a few feet, but in the interior, where the accumulations of clay are deeper, the depth to coarser textured material is correspondingly greater.

The Sharkey clay, commonly called "buckshot" land, owes its origin to the deposition of fine material from the annual flood waters which fill the greater depressions of the alluvial plain. These areas, locally termed "swamp" if uncleared, are inundated chiefly by the

[1] One sample was analyzed for lime. This showed a content of 1.29 per cent calcium carbonate ($CaCO_3$).

back water that flows through old channels and bayous, and by a reversal in the direction of the flow quietly overspreads the surface. The lack of currents prevents the transportation of the sand and also admits of the deposition of the suspended material, most of which is fine silt and clay.

The larger areas of Sharkey clay are near the Mississippi River, there being no development of it on the Big Black River within this county and practically none wholly within the influence of the Yazoo overflows. A large area of the type is found in the northern part of the county bordered on the east and west, respectively, by the front lands of the Yazoo and Mississippi Rivers. A limited acreage on either side is now under cultivation, but the interior is uncleared. The surface is slightly undulating, with occasional low mounds or ridges representing a rather heavy phase of the Sarpy clay, which was not separated from the Sharkey clay on account of the small size of the areas.

Another area in the neighborhood of Yokena includes the lowest part of the Mississippi flood plain between the present channel and the hills. Much of it is a heavy phase of the type, but along the northern and western border washings from the adjoining elevated fields or deposits of sand and silt from the Mississippi River are rapidly modifying the surface. The average surface is flat to slightly hummocky. Often there is very little or no difference between the soil on the hummocks and in the depressions.

The narrow areas indicated in other places are for the most part old lake beds in process of filling up. The material is not representative of the type, there being more or less admixture of sand, according to varying conditions of deposition. As these mud deposits become exposed their surfaces are overgrown by willows and cottonwoods, the latter trees usually preferring more sandy soils. The characteristic vegetation of the Sharkey clay is water oak, white oak, post oak, and sweet gum, with some willow, hickory, haw, ash, elm, box elder, honey locust, cottonwood, sycamore and hackberry. The undergrowth is often so dense as to be almost impenetrable. This consists of bamboo vines (smilax), grape vines, poison ivy, and a variety of shrubs. The pasturage afforded by uncleared areas is poor, the surface being shaded to such an extent that the grasses are thin and scattering. Cane does not grow on this heavy soil. Its presence indicates a Sarpy soil.

This type is of high natural fertility and is adapted to a wide range of crops, especially to corn and cotton. Yields of the latter crop were formerly as high as a bale per acre, but with the coming of the boll weevil the soil has proved to be too late to be used for this crop. It has recently been devoted to corn, and its adaptability to that crop is being generally recognized. It is not essentially different from the

heavy alluvial soils of the upper Mississippi Valley, which are extensively used for corn.

Fall-sown oats and rye do well, making such vigorous growth that they may be pastured to a considerable extent in the winter and early spring without lessening the yield of grain. Vetch and rape have been tried, also red clover to a limited extent, with good results. These suggestions apply to fields near levees, where the surface has sufficient local elevation to prevent injury by heavy rains.

Until a few years ago a slowly increasing acreage of Sharkey clay was being brought under cultivation annually, but the unsuitability of late soils for cotton has halted the clearing of new areas. Its present value lies chiefly in its production of corn and grass. Bermuda grass makes a heavy yield, but it is rather difficult to secure a good stand.

The value of large tracts unprotected by levees has been determined chiefly by the forest growth, ranging from $10 to $12 an acre. The small areas under levee are held at $35 to $40 an acre. The customary rental was formerly about 80 pounds of lint cotton per acre, but the present figure is considerably lower.

Sharkey clay, high phase.—South of Eagle Lake there is an area of Sharkey clay, several square miles in extent, having somewhat better local drainage than most of the type. The rather broadly undulating surface has sufficient relief to afford fair surface drainage, resembling the Sarpy clay in this respect more than the wide areas of heavily timbered Sharkey clay to the northeast. Throughout most of this phase the light-brown silty or very fine sandy stratum is found at less than 40 inches and can be reached with a soil auger. The occurrence of this light material at such a comparatively slight depth favors the better aeration and underdrainage that most of this land seems to possess. In places the soil is black, or nearly so. In other respects the soil and subsoil resemble the typical phases of the "buckshot" land. Most of the area is open land, and until the appearance of the boll weevil was planted almost continually to cotton, with high average yields. Except for danger from Mississippi floods, this tract and the adjoining somewhat higher soils are highly desirable for corn, grass, and forage crops.

SHARKEY SILTY CLAY LOAM.

The Sharkey silty clay loam consists of a dull-brown to grayish heavy, silty clay loam to silty clay, from 6 to 8 inches deep, of a decidedly granular structure when dry, and sticky when wet. It grades below into a stiff, plastic, bluish-gray clay, mottled with rusty-brown, especially in the lower part. The lower portion of the subsoil is usually a dense, heavy clay, except in the vicinity of the lighter types, where a brownish loam or sandy material is sometimes encountered at a depth of 40 inches or less, such areas representing

an approach toward the Sarpy soils. Mottlings of bright reddish-brown and ferruginous concretions are usually found in the surface few inches of soil.

The topography is gently undulating, flat areas being of limited extent and rather infrequent occurrence. As in the other alluvial types, bayous and lakes are numerous, the surrounding soils varying according as they are overflow channels or basins in which impounded waters part with their finest sediments.

The largest areas of the Sharkey silty clay loam occur near the eastern side of the Yazoo River. They represent the heaviest sediments laid down by this stream in this part of its flood plain. The areas near the Mississippi River are not well differentiated from the Sarpy clay. In most instances they are broad transitions between the lighter soils and the heavy Sharkey clay.

A limited acreage near Vicksburg is cultivated, but with this exception the type is uncleared. The surface, if well cultivated, is crumbly or finely granular and may be kept in this state of tilth in normal seasons with but little cultivation. Since the material is very retentive of moisture, care must be exercised in working it at the proper moisture content. It is a strong soil and the annual overflows are the chief cause of its nonutilization.

The present average valuation is about $10 an acre, any higher figures depending upon the amount of standing timber, the dominant variety of which is over-cup oak, with more or less white and water oak and hickory.

SHARKEY SILT LOAM.

The Sharkey silt loam consists of a friable, brown to grayish-brown silt loam, underlain at about 8 to 15 inches by light-brown to drab silty clay loam to silty clay, usually mottled with rusty brown and frequently with bluish gray. The subsoil has the main characteristics of the prevailing subsoil of the Sharkey series. The drainage is fairly well established between overflows. The surface is usually somewhat hummocky or ridgy.

The material of the Sharkey silt loam has been deposited by overflows from the Mississippi River. The most important areas occur in the vicinity of the Yazoo River, on Davis Island, and south of Vicksburg, mainly close to the line of the Yazoo & Mississippi Valley Railroad.

In the Yazoo Valley this type is usually a rather heavy silt loam, varying from a pronounced brown to a dull grayish brown or brownish gray. The latter shade usually indicates silty clay loam, or the heaviest phase of the type. Near areas of the heavier Sharkey soils the lower subsoil is generally a bluish-gray clay, with consequently slow underdrainage. Along the crests of the low ridges and near the areas of very fine sandy loam the soil is more sandy and the subsoil a brown

silt loam of open structure. Such phases are higher, more easily tilled, and considerably earlier than the lower ground. These local variations are of minor importance, except in the cultivation of cotton.

Practically all of the Sharkey silt loam occurring along the Yazoo & Mississippi Valley Railroad is a brown silt loam, low in organic matter, but friable and easily cultivated under proper moisture conditions. It is inherently fertile and well adapted to a very wide range of crops, the agricultural value of any particular tract being determined largely by local drainage conditions. There is some seepage in places from higher ground to the east, while along the lower or western border a rather dense subsoil may prevent as effective underdrainage and aeration as desirable. The danger from overflow is also a factor to be considered. This type has an average elevation of several feet above the Sharkey clay, and, with the exception of local depressions, is all higher than the Sharkey silty clay loam. Because of its heavier subsoils the surface of this type does not dry so rapidly after heavy rains, or following the withdrawal of flood waters as the surface of the Sarpy soils.

In the areas on Davis Island the soil ranges from a rather dark colored very fine sandy loam to a heavy silt loam. Much of the latter merges into the Sarpy clay so gradually as to make the location of boundaries between the two types more or less arbitrary. The subsoil of all the areas adjoining the "buckshot land" is usually a heavy, brownish silty clay, grading with depth into a dull-drab clay too heavy to admit of good underdrainage. In the areas outside the levees the subsoil is underlain by sand at a few feet.

The type is best suited to the production of corn, grass, and forage crops. It has been in the past used mainly for cotton, but the acreage of this crop has recently been reduced owing to the presence of the boll weevil. Cabbages and onions can be successfully grown, and it is believed that Irish potatoes also could be made a profitable crop. Portions of the type could be utilized in the production of rice.

SHARKEY VERY FINE SANDY LOAM.

The Sharkey very fine sandy loam consists of a brown or light-brown, friable, silty, very fine sandy loam. When wet it is of a much darker shade of brown and slightly compact. This material becomes heavier with depth, grading at 20 or 30 inches into a silt loam, or silty clay loam, rather crumbly when dry and somewhat plastic when wet. At 40 inches or less the material consists chiefly of a brownish very fine sand or very fine sandy loam. The color of the subsoil ranges through shades of brown, with more or less grayish mottlings. The open structure in the lower portions permits sufficient aeration to

insure a uniform color throughout that part of the soil section. Near the Yazoo River the heavier phases of this soil resemble the silt loam of the series and the slope phase of the Lintonia silt loam.

This type is characteristically developed along the Yazoo River from Haynes Bluff to the diversion canal. As a rule, the lightest phases are found on the highest banks of the river, where the surface is not submerged except by the highest overflows. From these local elevations the ground generally declines to the somewhat lower areas of Sharkey silt loam. The greater part of the very fine sandy loam represents an intermediate development between the lightest phases and the silt loam. The surface is more or less undulating, and in many instances consists of low, broad ridges, from 5 to 10 feet above the lower depressions or intervening swales, through which the flood waters flow outward as the river rises. With this exception, most of the type along the Yazoo River has a moderately heavy silty subsoil. It stands drought well, a feature which, combined with the friable, easily tilled surface and generally good local drainage, renders all of the type very desirable for cotton. Most of it is a warm, early soil that admits of tillage very soon after a rain or the rather infrequent overflows of the Yazoo River.

The type along the Mississippi River below Vicksburg in places is not markedly different from the Sarpy very fine sandy loam. As a rule, the areas indicated as Sharkey very fine sandy loam have a rather silty soil and a moderately heavy silt loam subsoil, features which are entirely due to more or less admixture of material from the adjoining loess hills. The soil is generally lighter and has better surface drainage than the adjoining areas of Sharkey silt loam. It is not so subject to change in surface configuration by the Mississippi floods as the neighboring areas of Sarpy very fine sandy loam.

Nearly all of the Sharkey very fine sandy loam has been devoted to cotton, which is less subject to injury by the boll weevil on this type than on the heavier alluvial soils. The yields on well-farmed lands have averaged one-half bale or more per acre during the last two years, although formerly 1 bale per acre was considered about a normal yield. The adaptability of this soil to other crops is determined chiefly by local conditions with respect to drainage and overflow. It is not so well adapted to corn as the darker-colored soils, but fair returns are the rule where the ground is well cultivated.

Forage crops do well, and some of the best drained land along the river supports a vigorous stand of Bermuda grass. Much of the low ground has been thrown out of cultivation in recent years on account of the floods and the difficulty in securing tenants since the cotton crop has become so uncertain.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Sharkey very fine sandy loam:

Mechanical analyses of Sharkey very fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
422219	Soil	0.0	0.1	0.1	2.0	40.4	47.8	9.4
422220	Subsoil	.0	.0	.1	.5	29.4	54.4	15.7

RIVERWASH.

The areas indicated as Riverwash include low-lying tracts bordering the main channel of the Mississippi River. Some are sand bars exposed at ordinary stages of the water, although the classification in this instance may also embrace the mud flats and low strips of land undergoing rapid change in surface conditions through the deposition of fine sediments. Most of this low ground ("batture land") is covered with willow and cottonwood, the latter being found on the higher portions.

The soil consists of a dark-colored clay, often similar to the Sarpy clay. Indeed no close distinction can be drawn between many of the willow-covered mud bars and the above-named type, except in relative elevation. In due time—and assuming that no change in the channel occurs meanwhile—most of such land will resemble the heavy alluvial types now under cultivation. In recent years the cottonwood on such lands has become very valuable and the dense growth of willow in places furnishes much material for revetment work on the river.

SUMMARY.

Warren County is situated in the southwestern part of the State of Mississippi between the Big Black and Mississippi Rivers, which form its eastern and western boundaries. It has an area of 588 square miles, or 376,320 acres.

The total population is 37,488, of which 26,196 is colored and 11,292 white. Vicksburg, a city of 20,814, is the county seat and the industrial and financial center of the county.

Cotton has long been the principal crop and its culture has dominated the agricultural interests to the entire exclusion of other lines of farming. Since the advent of the boll weevil in 1910 the total production of cotton has dropped almost to one-third of the average export for former years. The result has been an exodus of the colored labor and a general decline in land values and rentals. It has tended also to revive interest in the more diversified lines of farming to which the county as a whole is well adapted.

The present price of land ranges from $5 to $50 an acre.

The hill and bench-land types of soil are all light-brown silt loams, or simply the weathered surface of the deep deposit of loess which is the superficial formation throughout the uplands. The bottom lands of the Big Black River and most of the alluvium of the Yazoo Valley are brown silty soils consisting chiefly of reworked loess. The types of the flood plains of the Mississippi River are mostly dark-colored loams and clays. All of the alluvial types are very fertile and subject to overflow.

The Memphis silt loam is the dominant type of the uplands. It is very hilly and most of it is now forested, but it is well adapted to grass, truck, fruit, and general farming wherever the topography admits of tillage.

The Lintonia silt loam, or bench lands of the Big Black River, is admirably adapted to general farm crops and cotton. The slope phase of this types lies somewhat lower but has about the same agricultural value.

The Vicksburg silt loam represents the narrow, flat bottoms of the small streams in the hills. It forms a large proportion of the regularly tilled lands in the interior of the county and produces good crops of corn, hay, and cotton.

The Vicksburg very fine sandy loam, occurring along the banks of the Big Black River, is subject to overflow. It is used between inundations for cotton, corn, and other crops, with fair to good results.

The Vicksburg silty clay loam lies somewhat lower than the Sharkey silt loam and is nearly all uncleared.

The Sarpy silt loam is a very desirable type for general farming and especially so for early cotton.

The Sarpy clay is somewhat more fertile than the loam and is an excellent type for corn.

The Sarpy very fine sandy loam represents the later deposits along the Mississippi River. It is quite productive, but of low agricultural value on account of frequent changes by overflows.

The Sharkey clay, or "buckshot" land, is distinguished by its dark granular soils and heavy subsoils. It is productive, but much of it lies so low as to be unavailable for cultivation.

The Sharkey silty clay loam is somewhat lighter colored, less granular, and usually lighter than the typical "buckshot" land. With the exception of a small acreage near Vicksburg under cultivation, this type is uncleared.

The Sharkey silt loam is a rather heavy soil, varying considerably with regard to drainage and susceptibility to injury from overflows. It is very fertile. Much of it is now cultivated and all of it was formerly held in high esteem for cotton.

The Sharkey very fine sandy loam is the lightest type along the Yazoo River and is now valued as an early cotton soil, but is also adapted to other crops.

Riverwash includes low lands that are essentially a part of the channel of the Mississippi River. There is practically no true swamp land within this survey.

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[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.

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