

SOIL SURVEY OF BIENVILLE PARISH, LOUISIANA.

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DESCRIPTION OF THE AREA.

Bienville Parish is located almost wholly in the shortleaf pine hill section of northwest Louisiana, between the Red and Mississippi rivers, about 40 miles east of Shreveport. A small portion of the

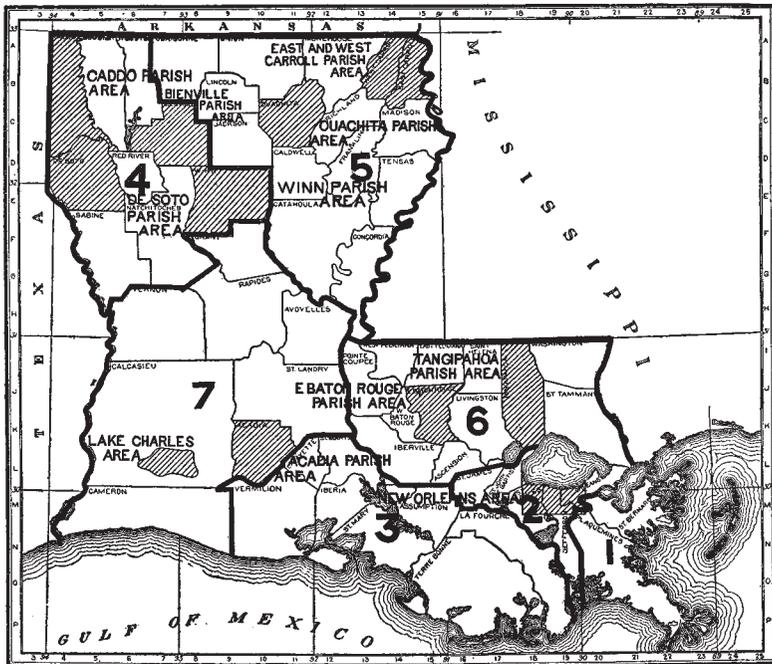


FIG. 21.—Sketch map showing the location of the Bienville Parish area, Louisiana.

southern part of the parish is located in the longleaf pine hill section. The parish lies approximately between parallels $32^{\circ} 8' 53''$ and $32^{\circ} 33' 30''$ north latitude and meridians $92^{\circ} 45'$ and $93^{\circ} 25'$ west from Greenwich. It is bounded on the north by Webster, Claiborne, and Lincoln parishes, on the east by Lincoln and Jackson parishes, on the south by Winn, Natchitoches, and Red River parishes, and on the west by Red River and Webster parishes and Lake

Bistineau separating this parish from Bossier Parish. The thriving town of Arcadia, the parish seat, having a population of about 3,500, is located in the extreme northeast corner, on the Vicksburg, Shreveport and Pacific Railway. Geologically, the parish lies in the Mississippi embayment, and the formations principally represented are within the Tertiary Eocene. There are 519,680 acres, or 812 square miles, in the parish.

The parish is well supplied with streams and branches. The headwaters of Black Lake Bayou, Saline Bayou, and some of those of Dugdemona Bayou start in Bienville Parish, and eventually the entire drainage of the area reaches the Red River through these streams. The parish slopes gradually to the southeast or south. In the northern part, upon the upper reaches of the drainage basins, the hills are higher and more broken than in the southern part. The highest altitude in the parish is about 450 feet, while along the southern boundary, where the streams cross the line, the altitude is about 100 feet, so that there is a range in elevation of about 350 feet within the parish. Very little fall is noticeable along the larger streams, which follow winding, tortuous courses through wide swamps. This lack of fall, together with the crookedness of the stream courses, causes the wide swamp bottoms to be submerged often during the winter months. The water in the small streams and branches, however, runs off rapidly. The interstream areas are often considerably eroded and dissected along the upper courses of the tributary streams, this being especially noticeable in the northern part of the parish. To the southward, however, the country flattens and the interstream areas are lower and less dissected. In the southern part of the parish the swamp areas along the larger streams become wider and more difficult to cross. The drainage of the interstream areas of low elevation is often poor, while to the northward, upon those of higher elevation, the drainage is, if anything, excessive. The drainage of the parish eventually reaches the Gulf of Mexico through the Red and Mississippi rivers.

No permanent settlement took place in what is now Bienville Parish until 1826, when a settlement was made on Black Lake Bayou, 4 miles west of Arcadia. Later, about 1839, another settlement was made at what is now Mount Lebanon. In 1843 Bienville Parish was organized from a portion of Claiborne Parish. The woods at that time were open, there being nothing but large timber and the whole country was covered with a growth of switch-cane, which formed extensive canebrakes in the bottom lands. There was an abundance of game, and hunting and fishing furnished much of the early settler's occupation.

Some of the early military and immigrant trails to Mexico and Texas crossed the parish, and these old overland routes were the scenes of great activity, especially so when Texas was being colonized by Americans. In their westward journey across the country the immigrants, coming mostly from Kentucky, Tennessee, Georgia, the Carolinas, Alabama, and Mississippi, were attracted by the rich, productive red gravelly lands in the northern part of what is now Bienville Parish, and it was at this period that the region received its greatest number of settlers, many of the immigrants having given up their journey westward to Texas, while some of those who continued their journey returned later to take up lands for settlement.

The people who settled on the red gravelly lands in the vicinity of Mount Lebanon, Liberty Hill, and Arcadia established permanent homes. Those, however, who settled in the lower country in the southern part of the parish did not become permanently attached to the land, but moved from one locality to another seeking more favorable range for their hogs and cattle.

The present farming population of the parish is made up almost entirely of the descendants of these early immigrants and of the descendants of the slaves brought in by them. In the northern part of the parish, where slavery was most common, about 25 per cent of the farming population is composed of negro property owners and tenants. Many of the white farmers have acquired considerable wealth and have rented their farms and moved to town. In some of the northern parts of the parish the houses in the country are neat and substantial and the farm buildings commodious. Good churches and schools are convenient to all. The roads are excellent in summer, but in winter they are apt to become badly cut up and in places almost impassable. The population around the larger railway towns has greatly increased, owing to the lumber interests and railway construction. A large percentage of this increased population is made up of colored people, while the increased white population comprises mostly people from Arkansas, Missouri, and Tennessee.

It is estimated that about 50 per cent of the land in the northern part of the parish has at one time or another been under cultivation. There are considerable areas, however, that were once farmed but are now abandoned, either from lack of labor or because the white owners have moved to town. In this part of the parish much of the land is farmed by negroes, who either own the land or work as tenants. Wherever the red gravelly soils are found the country is well settled and cotton is the main product. The roads are well kept, and many of the larger streams are bridged. The rural free delivery of mail is well established and the telephone enters many homes.

In the southern part of the parish, however, where the soils, as a rule, are much less productive, the conditions as to settlement are very

different. Not more than 10 per cent of the land has ever been under cultivation, and the remainder is still in virgin forests or has been recently cut over. The recent activity in lumbering and the high prices paid for timber lands have induced some to leave their farms to engage in day labor about the sawmills, and others to dispose of their entire holdings to the lumber companies. The result has been that in some localities fields once cleared are growing up to brush and briars, and farmhouses, once the homes of thrifty farmers, are unused and tumbling down. The roads in this part of the parish are poorly kept, and only the larger stream crossings are bridged. There is no rural free delivery of mail and the telephone is as yet practically unknown, except about the towns, mills, and logging camps.

About ten years ago there was much public land in the parish, but since timber has become more valuable this land has been rapidly acquired, principally by the large lumber companies, so that at present there is none.

All crops are fenced and stock is permitted to run at large, there being no stock law in the parish.

Arcadia, Gibsland, Taylor, Bienville, and Saline, all located on railways, are the chief towns of the parish. Mount Lebanon and Liberty Hill are the principal towns not on railways. The parish is crossed by several railways, which furnish, as a whole, excellent transportation facilities. The Vicksburg, Shreveport and Pacific Railway crosses the northern part of the parish, passing through Arcadia, Gibsland, and Taylor, and connecting them with Shreveport on the west and Ruston, Monroe, and Vicksburg on the east. The Louisiana and Arkansas Railway crosses the southwestern corner of the parish and brings the farmers into communication with such markets as Winnfield and Shreveport. The Louisiana and Northwest Railroad crosses in a north and south direction, passing through Gibsland, Bienville, and Saline, and furnishing connections with the Texas and Pacific Railway at Natchitoches on the south and with the Cotton Belt Route at McNeil on the north. Besides these, there are two important tram railways, which will be used eventually for passengers and freight. Portions of the southeastern part of the parish are about 15 miles distant from a railway, but this distance will be lessened when one of the tramroads becomes a passenger and freight line.

CLIMATE.

The climate of Bienville Parish is best described as temperate, with an average annual temperature of 65.5° F. During the coldest months, December, January, and February, the mercury seldom goes below the freezing point for more than two or three days in succession. Owing to the high humidity, however, freezing weather is

usually felt with greater severity than farther north or west, where the air is drier.

Spring opens the latter part of March or the first of April, during which months the fields are prepared and planted. The average date of the last killing frost in the spring is about March 25, but truck and fruit, and the tender cotton and corn plants are occasionally injured as late as the first week in April. The summer months, June, July, and August, have an average temperature of about 81° F. After this the weather begins to cool gradually until the latter part of October, when light frost may be expected. The average date of the first killing frost in the fall is about November 15.

The precipitation of the area is usually abundant for all growing crops. For all months of the year except August, September, and October the rainfall is distributed at the rate of 4 or 5 inches per month. It is not always well distributed during the month, however, but sometimes comes in torrents, which cause much damage to the cultivated fields by washing and gulying. During August, September, and October the rainfall decreases to an average of less than 3 inches per month, and although the main part of the growing season is over, crops sometimes suffer from drought.

The appended table, compiled from Weather Bureau records, gives data of temperature and rainfall at Shreveport, situated in Caddo Parish, about 40 miles to the east, and at Liberty Hill, within the parish. They show the annual precipitation to be about 50 inches, and the average annual temperature to be, as above stated, about 65.5° F. The length of the growing season is especially favorable to the production of cotton and corn and all root crops and vegetables, especially Irish and sweet potatoes, two crops of the former often being grown upon the same ground in a single season. Considerable difficulty is experienced with the peach crop. During the progress of the survey, peach trees were seen in bloom as early as January 27, and by the middle of February a good many peach and plum trees were in bloom. On February 20 there was a heavy frost, and an examination showed that about one-half of the blooms were killed. On March 3 peaches and plums were in full bloom. The usual warm days which occur during the late winter and early spring months cause the fruit trees to bloom long before they should, and this, together with the fact that the region lies within the track of "northers," makes the growing of some kinds of fruit rather uncertain. However, peaches are said to be an abundant crop on an average of about every third year, which compares favorably with results in some of the most successful peach-growing sections of the country. Occasionally there is a cold, wet, late spring and the seed cotton and corn do not germinate, which necessitates replanting; but this, considering the long season, is not a serious drawback.

Normal monthly and annual temperature and precipitation.

Month.	Liberty Hill.		Shreveport.		Month.	Liberty Hill.		Shreveport.	
	Temper- ature.	Precipi- tation.	Temper- ature.	Precipi- tation.		Temper- ature.	Precipi- tation.	Temper- ature.	Precipi- tation.
	° F.	In.	° F.	In.		° F.	In.	° F.	In.
January.....	47.6	4.94	45.9	4.60	August.....	82.3	2.83	81.3	2.19
February.....	49.5	4.19	51.2	4.16	September...	75.6	2.95	75.5	3.73
March.....	58.1	5.61	57.6	4.64	October.....	66.3	3.02	65.3	3.11
April.....	65.9	4.64	66.4	5.20	November...	56.3	4.13	54.6	4.78
May.....	73.3	3.39	73.1	4.19	December...	49.2	4.75	49.5	4.68
June.....	79.8	5.06	79.9	3.79	Year.....	65.5	50.38	65.2	48.60
July.....	82.4	4.87	82.5	3.53					

AGRICULTURE.

The first settlers chose the "red lands" in the northern part of the parish, because they had been accustomed to similar lands in the older States whence they came, and they recognized that these soils were more productive than the light-colored, sandy soils in the region to the southward. Those who settled to the southward, however, did so with a special purpose. They preferred stock raising to general farming, and here they found numerous wide swamps with extensive canebrakes, besides many other conditions favorable for the raising of hogs and cattle.

A good many of the settlers brought with them a few slaves, and with the aid of these they constructed for themselves log houses and barns, deadened the timber, and built fences and planted their crops. At first each settler strove only to produce enough corn, fruit, tobacco, vegetables, and meat to supply domestic needs. All crops were fenced, the cattle branded, and the hogs marked and allowed to run at large in the woods and swamps. In the northern part of the parish the hogs and cattle raised were largely consumed at home, while to the southward, where the settlements were sparse and stock raising was the chief industry, there was always a surplus. This surplus was disposed of in winter by driving the hogs and cattle to shipping points on the Red and Ouachita rivers, and from ten days to two weeks were usually consumed in the journey. Some sheep were also kept, and upon the plantations much time was spent in winter in spinning and weaving cloths for home use. Each plantation was practically self-sustaining and sometimes existed as a community by itself. Large plantations, however, were not the rule, as most of the early settlers did all of their own work. Whatever surplus was produced upon the farms besides stock was hauled to market by ox teams. There was much cotton grown around Liberty Hill and Mount Lebanon and farther north around Arcadia and Gibsland

before any railway entered the parish. In fact, cotton was then the staple crop, as it is now, but not so much was then grown. It was marketed mostly at Trenton, a shipping point about 3 miles north of Monroe, on the Ouachita River. Some of the larger cotton planters dealt directly with commission merchants in New Orleans. Most of them, however, shipped from Trenton and a few shipped from a point on the Dorcheat about 2 miles from Minden known as "Chrichten's Landing." The production of cotton proved profitable upon the "red lands," and as early as 1860 considerable wealth had accumulated about Arcadia, Liberty Hill, and Mount Lebanon.

The Vicksburg, Shreveport and Pacific Railway was the first to enter the parish. Though it had been in operation between Vicksburg and Monroe as early as 1857, it was not extended westward through Bienville Parish to Shreveport until 1883. The completion of this road did much toward stimulating the agriculture of the area.

To-day the principal products besides cotton are corn, potatoes, vegetables, small fruits, and forest products. Among the farm products corn stands next to cotton, but there is great opportunity and need of expansion in growing corn to supply the unsatisfied local demands. The potato crop has not as yet assumed any great importance, but it bids fair to do so in the future. Both sweet and Irish potatoes do remarkably well and two crops of the latter can be grown upon the same piece of ground in a single year. The vegetables grown are mostly those for home use. In the vicinity of Gibsland a few farmers are growing some peaches and vegetables for canning. Thus far a ready local market is easily found for all they can produce. The canning industry has great possibilities in Bienville Parish and it is believed that eventually the small individual canners will consolidate.

In the southern part of the parish the forest products exceed all others combined. It is believed that at the present rate of removal of the pine timber it will be less than twenty years before much larger areas will be put under cultivation, thereby greatly increasing the agricultural production of the parish.

It is generally recognized that the "red lands" are well adapted to cotton and corn and to nearly all vegetables and small fruit common to the region. It is believed that by selecting elevated portions of ground, so as to avoid the losses due to frost, peaches will prove a profitable crop. Considerable difficulty is experienced, however, in getting peach trees to live more than six or seven years, and in order to overcome this trouble there are some who set out a few trees every two years or so. A fine grade of tobacco can also be grown upon these "red lands," but the farmers are so engrossed with the

production of cotton that none are growing tobacco on a commercial scale.

The settlers in a good many places in the southern part of the parish did not at first locate permanently, and frequently moved from one locality to another. The importance of acquiring possession of the land and timber either by homesteading or by direct purchase from the Government did not impress them. The necessity of having to pay taxes caused many to have an aversion to acquiring legal possession, and until recent years there were many families who had lived in the parish for forty or fifty years and had never owned any land. The great difficulty of making clearings and the rapidity with which they grew up when neglected or abandoned caused many people to regard the timber as a hindrance to their progress. The great value of the pine and oak forests was not appreciated until about twenty years ago, when northern lumbermen appeared and began to pay from \$2 to \$3 an acre for the land and timber. Since then there has been a steady advance in prices paid, until some of the same land is now held at from \$25 to \$40 an acre.

The great amount of labor employed about the railway and logging camps and sawmills has created an unsatisfied demand for all kinds of farm products, and the result has been to stimulate agriculture throughout the area. The most progressive farmers are trying to satisfy the increased local demands for poultry and eggs, vegetables, fruit, and meat. Stock raising, and especially hog raising, in the southern part of the parish has decreased considerably, largely for the reason that with the cutting of the oak timber for the manufacture of staves the supply of mast has been greatly reduced.

It is generally recognized that the sandy upland soils, especially the red sandy gravelly soil, are better adapted to cotton than to corn. The reverse, however, is true of the bottom-land soils, for there the best yields of cotton are obtained from the heavier soils, while the corn yields best upon the lighter soils. Cotton seems to thrive best upon either a heavy soil or upon a sandy soil with a heavy subsoil not far below the surface. Sweet and Irish potatoes and all kinds of small vegetables do best upon the sandy upland soils. The highest gravelly ridges are the best for peaches, and in the early days a good grade of tobacco was grown for home use in such locations. Sorghum and sugar cane do best where an abundance of moisture is assured, and usually this is upon the small branch-bottom soils or the second bottoms of the larger streams which are not subject to serious overflow. It is believed that alfalfa would thrive upon the heavy clay upland soils, provided the drainage conditions were made perfect. It does not do well upon the sandy soils, because the weeds and grass kill it out. Alfalfa has been tried on a small scale by

sowing and cultivating it in rows, in order to keep down the weeds and grass, but this is not considered profitable by those who have tried it. In general, it may be said that the soils of the area are well adapted to all of the general farm crops of the region.

There is practically no systematic rotation of crops practiced in the area, cotton often being grown continuously upon the same land until the fields have become so badly washed that the yields decrease to a point where it is no longer profitable to grow crops, and then the field is usually abandoned to grow up to brush and weeds. The acreage of corn is so small, as compared with cotton, that the general type of farming may be considered a one-crop system.

Shallow one-horse plowing is the common practice upon light and heavy soils alike, and for all cultivated crops, regardless of drainage conditions, location or kind of soil, the fields are broken in ridges. No green manuring is done and practically none of the barnyard manure is applied to the fields. In winter nothing is done to protect the bare fields from the damaging effects of leaching and erosion. The result is that both the bottom and the upland soils, especially the latter, rapidly lose their original productivity, and instead of building up and maintaining the fields already cleared, the farmers, in order to maintain the cotton production, usually bring new or fresh land under the plow every few years and allow the old fields to gully and wash and become reforested.

Of the 519,680 acres in the parish over 300,000 acres are in farms, and the remainder is either in timber or swamp lands. The number of acres in improved farm lands, however, is, according to the census report of 1900, only about 110,000 acres, or less than one-fourth of the entire area of the parish.

There are no very large plantations in the parish. Most of the farms are small and about 60 per cent of them are worked by the owners, the remainder being worked by both negro and white tenants. There are a good many negro property owners in the northern part of the parish and some of them are thrifty and prosperous.

The average size of the farms is about 125 acres. The holdings, however, range from a few acres to several thousand, and some of the larger timber concerns own more than 20,000 acres.

The price of cleared and improved agricultural land varies with the location and character of the soil and the condition of the fields and the farm buildings. The average price in the hill section, where the "red lands" predominate, varies from \$10. to \$25 an acre, while the light sandy soils, in the southern part of the parish, range in price from \$5 to \$15 an acre. The timber land varies greatly in value according to the location and the amount of merchantable timber standing. Where the land and timber are purchased together the prices range from \$8 to \$40 an acre; where the timber is pur-

chased alone, with an agreement to remove it in a specified number of years, it is estimated and sold by the thousand feet, the price ranging from \$1 to \$3 a thousand feet, depending largely upon the accessibility of the timber to market.

Throughout the area the problem of farm labor is a serious one. Most of the laborers who were formerly available have gone to the public works, and many of the small farmers have sold their timber and cleared land to the lumber companies and have gone to the logging camps and sawmills, being attracted thither by the high wages.

There is much to be said in the way of suggestion for the improvement of the agriculture of the area. One of the greatest losses sustained by the farmers is from the washing and gulying of the fields during the growing season and also during the winter months, owing to the fact that the fields are kept too long in clean cultivated crops, thereby greatly reducing the amount of organic matter that was originally in the soil. This loss of organic matter and the shallow cultivation that is usually given the soil greatly increase the tendencies to erosion. To remedy this, rotation and deep plowing are recommended. The rotation suggested as best suited to the conditions in Bienville Parish is cotton one year, followed by corn, and then by winter oats as soon as the corn is gathered. Cowpeas should be sown between the corn rows at the last cultivation, and if the succeeding oat crop is allowed to mature the ground should be disked as soon as the oats are harvested and again sown to cowpeas. Deep plowing (that is, to a depth of 7 or 8 inches) promotes soil granulation and the capacity of the soil to hold moisture. A thorough preparation of the ground is half of the cultivation. Some farmers complain that whenever the ground is broken to a depth of 7 or 8 inches the unweathered soil thus exposed does not produce well for a couple of years or so. This may be avoided by gradually increasing the depth at each plowing until the required depth is attained. Winter plowing is a good practice, as it exposes the soil during the winter months and subjects it to the pulverizing action of frost and rain. If the plowing is not done in the fall it will be well to bring up only a half inch or so of the subsoil at a time, but this should be increased at each plowing until a depth of at least 7 inches is reached.

On the well-drained sandy types of soil, not steep enough to be subjected to serious erosion, the soil should be broken flat with a disk plow instead of in high ridges. If the land is inclined to wash seriously this can often be prevented by terracing. With deep plowing, even if the natural conditions favor washing and gulying, these tendencies will not be so great, because deep plowing promotes soil granulation, and much of the water which would naturally run off over the surface will be absorbed, which, in addition to checking

erosion, is beneficial, as in droughty times this moisture will be available for the needs of the growing crops.

In places where terracing would be beneficial much good can often be accomplished by breaking the land in high ridges that circle the hill. This will arrest the direct descent of the waters over the surface, and prevent their gathering in dangerous volumes, for each row will carry off its own water. Where the slopes are especially steep zones of plowed land should be alternated with strips of grass or shrub land. Upon the close sticky soils like Susquehanna clay and Greenville loam, and upon the bottom-land soils where water is inclined to stand after a heavy rain or flood, the fields should never be broken flat, but in high ridges. Upon such soils, and especially the bottom lands, tile drainage would be very beneficial and desirable, but often fair drainage can be obtained by large open ditches. An open drain at the base of the hills to carry off the rainwash from above is often important in connection with the drainage of the bottom-land soils.

Another very desirable practice in connection with the thorough preparation of the soil is fall plowing, and the advantages of this are many. The air is allowed to penetrate the soil, and alternate freezing and thawing have a tendency to loosen up the compact stiff soils, thus putting them in better tilth and insuring a better seed bed for the next crop. During the winter months much of the inert plant food is broken down, dissolved, and converted into a form available for plants the next year. Another desirable effect of deep, careful fall plowing is that it enables the soil to absorb and store up the winter rains, thus placing at the disposal of the plant roots for the next year a larger quantity of moisture, and mitigating in this way the effects of the droughty conditions which may prevail from the middle of July to the middle of September. In order to derive the best results from fall plowing upon the heavier types, however, they should be tile drained; otherwise the soil will be inclined to run together and pack, thus increasing its tendency to bake.

If care is not taken the fall-plowed lands will wash badly during the winter months. In order to avoid this the growing of winter cover crops, such as the rust-proof oats, crimson clover, wheat, hairy vetch, and the dwarf Essex rape, is strongly recommended. On the light sandy soils the oat crop is the safest grain crop that can be grown, and if the ground is broken deeply in September or October sufficient moisture will be saved to insure a stand, and the oats will furnish an abundance of winter grazing for stock. If the stand is good and the oats are on good land, grazing will not injure them, but will actually improve the yield. Wheat sown upon good land furnishes a winter pasture nearly equal to oats. The yield of grain, however, is not reliable.

Crimson clover should be sown early for winter grazing. It attains the best growth for grazing during the spring. It is not advisable to cut crimson clover as a hay crop, however, because it is too woody, but being a legume it has great value as a soil builder. Crimson clover should do best upon the heavier clay types, but the drainage conditions will have to be improved before the best results can be attained. Hairy vetch is also a legume and is a very satisfactory winter cover crop upon the lighter sandy soils. The land, however, must be well prepared and well manured.

All winter cover crops more than pay for themselves in the excellent grazing they afford, and if the land is needed for cotton or corn before they mature the farmers can well afford to turn them under in the green state in February to add vegetable matter to the soil.

In recent years a great deal of commercial fertilizer is being used on the cotton crop, especially along the Vicksburg, Shreveport and Pacific Railway, in the northern part of the parish. There is a fertilizer factory at Arcadia which is not able to supply the local demands. The results of using this fertilizer, which is composed of about equal parts of cotton-seed meal and acid phosphate, seem thus far very satisfactory, but it is believed that by pursuing a systematic crop rotation and by following the recommendations and suggestions as to deep plowing and the growing of winter cover crops the heavy outlay made for commercial fertilizers can be greatly reduced.

The recent appearance of the boll weevil in this section of Louisiana is causing the farmers a great deal of anxiety. It is believed, however, that the pest is proving a blessing in disguise, because the uncertainty of the cotton crop is persuading the progressive farmers to diversify more, and instead of growing all cotton and buying everything with cotton money, they are beginning to plant more corn and less cotton, and grow more of the home necessities. Some, however, are convinced that cotton can be grown in spite of the boll weevil. They are basing their convictions upon what has been done in parts of Texas, where the weevil has been for years.

The most successful method of combating the weevil and the one advocated by Doctor Knapp, of the Bureau of Plant Industry, and his agents in this section of the State is as follows: First, reduce the acreage and grow cotton as a surplus crop, and not as the main money crop. Prepare the soil thoroughly and plant early. Growing cotton under boll weevil conditions really resolves itself into a race between the farmer and the pest. The weevils do not appear in great numbers until July, and if the farmer can get his cotton sufficiently far advanced before that date he will be able to make a crop. In order to accomplish this the ground should be broken

deeply and thoroughly pulverized, as this thorough preparation hastens maturity. An early-maturing variety should be selected, and it should be planted in rows far apart, so as to insure an abundance of sunshine upon the entire cotton plant, for shady, damp conditions are especially favorable for the weevil. Frequent, shallow cultivation should be the practice in order to hasten the growth of the plant, and in passing between the cotton rows it is well to attach a short stick to each end of the whiffletree, so as to shake the cotton stalks as much as possible without injury. This knocks off the loose punctured bolls, as well as many of the weevils, a number of which immediately perish in the hot sand. It is best to gather up the punctured bolls and burn them. In the fall the cotton stalks should be gathered and burned. All of the surrounding fences should be kept clear of brush and briars, which furnish a place for the weevils to hibernate.

All of this requires much labor and attention, but if cotton is grown as a surplus only, a few acres will be grown where now many are grown, and it is safe to say that double the yields per acre can easily be obtained.

SOILS.

The soils of Bienville Parish fall naturally into three groups—those of the rolling uplands, of the level or moderately rolling lowlands, and of the swamps.

The rolling uplands include all of the higher portion of the parish and range in altitude from about 350 feet in the highest points to about 150 feet in the lowest. The surface features vary from rolling to hilly. The soils are residual in origin, being derived principally from the Lower Claiborne formation, a subdivision of the Eocene. The highest elevations in the area, however, are sometimes capped by the Lafayette sands. The Lower Claiborne formation is composed of numerous thin layers of fine sand, silt, and clay, some of the layers being semiconsolidated with iron, forming iron sandstone and iron claystone, iron conglomerate, and concretions in great numbers. In the highest parts of the area the crests of the ridges are sometimes so thickly strewn with these ferruginous rocks as to interfere with cultivation, and in the cultivated fields the tops of the hills are often covered with the small iron concretions.

The soils of the rolling uplands belong principally to two series, the Susquehanna and the Greenville, the latter being derived from the more ferruginous layers of the Lower Claiborne, and the former from the clayey and sandy layers of this formation. The uplands are usually well drained and include some of the best soil types in the area.

The level or moderately rolling lowlands occur principally in that portion of the parish below an altitude of about 150 feet. The soil types belonging to this division, however, are found more or less developed adjacent to all of the main drainage courses in the area. The characteristic topography is gently undulating to nearly level, and the natural drainage is deficient. The soils are sedimentary in origin, being derived principally from the Port Huron deposits, though in places the sands of the Lower Claiborne formation have contributed to the soil-forming materials.

The swampy soils have been mapped as Meadow, which is of wide distribution, being found in practically all parts of the area, but especially well developed along the larger stream courses. These bottoms are flat and vary in width from a few rods to 2 miles. They are subject to frequent overflow. The wider bottoms are sometimes covered with water for weeks at a time, while the narrower ones often drain off in a day or so. The soil is still in the process of formation and is of heterogeneous origin, being washed from various sources in the uplands.

The following table gives the name and extent of each of the several types mapped. In the accompanying map the distribution of the soils is shown by means of colors.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Norfolk fine sandy loam.....	152,576	29.4	Orangeburg fine sandy loam..	12,288	2.4
Meadow.....	90,048	17.3	Orangeburg fine sand.....	10,880	2.1
Susquehanna fine sandy loam..	88,960	17.1	Bienville fine sandy loam.....	5,888	1.1
Greenville gravelly sandy loam	64,000	12.3	Greenville loam.....	448	.1
Susquehanna clay.....	37,376	7.2			
Norfolk sand.....	32,256	6.2	Total.....	519,680	.....
Orangeburg sandy loam.....	24,960	4.8			

GREENVILLE GRAVELLY SANDY LOAM.

The soil of the Greenville gravelly sandy loam to a depth of 10 or 12 inches varies from a reddish to grayish fine sandy loam. Throughout the soil and strewn upon the surface are numerous arenaceous and argillaceous brown iron concretions about the size of a pea, and upon the crests of the higher hills crusts of brown hematite and limonite ore often occur in considerable quantities, though not sufficient to be of economic value or to interfere seriously with cultivation. The subsoil to a depth of 36 inches consists of fine iron gravel. The gravel in this soil, which is always of a ferruginous, concretionary nature, is never rounded and waterworn, as is usually the case

with quartz gravel. There are often some fragments of iron crusts disseminated through the subsoil. At a depth of about 40 inches the subsoil sometimes becomes slightly mottled with drab, and resembles the subsoil of the Susquehanna fine sandy loam.

This soil is naturally an easy one to plow and cultivate, and the gravel and sand present tend to keep the tools well scoured and clean. It is locally known as "red sandy gravelly land," and has contributed largely to the reputation of this region and southern Arkansas for cotton production. The fields are usually free from stumps, and the soil has been under cultivation for a long time. Shortleaf pine and oaks were the characteristic native growth.

The Greenville gravelly sandy loam is particularly well developed in the northern part of the parish, upon the hills in the vicinity of Arcadia, Gibsland, and Mount Lebanon. It is also an important soil in the vicinity of Liberty Hill, and there are some large areas in the southwestern part of the parish.

The usual topography of this soil is rolling to hilly, and owing to this and to the somewhat open nature of the subsoil the natural drainage is good.

The Greenville gravelly sandy loam is derived from the weathering of sands and sandy clays of the Lower Claiborne formation, and the few ferruginous rock fragments found upon the surface have been formed from the hardening and cementing together of the sandy and clayey layers, and are not the fragments of indurated rock formations. The soil is characterized by its high content of iron, the presence of large quantities of iron concretions and iron crusts being evidence of this. The underlying unweathered material from which the Greenville soils are derived often consists of bluish, slightly greenish, and grayish marly sandstone, rendered firm and hard by the presence of carbonate of lime. All traces of this calcareous constituent is lost upon weathering and the iron turns the whole mass to a deep-red color. Upon the crests of the hills, where the fine sand and clay particles have been removed by rainwash, these concretions and small fragments of iron crusts are especially numerous and sometimes cover the surface of the ground to a depth of an inch or more.

When first cleared and put under cultivation the average yield on this soil was greater than now. The average yield for cotton is said to have been about three-fourths bale per acre, while that for corn was about 25 or 30 bushels per acre. Continuous cropping with cotton grown upon the same ground for years in succession has reduced the yields so that at present the average yield for cotton is about one-half bale, while that for corn is as low as 20 bushels per acre. Other crop yields have decreased in like proportion. It is an excellent soil for oats; these usually being fed in the sheaf.

With careful preparation and cultivation the land is easily improved and retains very well all improvements in the way of additions of fertilizers. Worn-out fields on this type, if not too badly washed and gullied, are easily put into good condition by deep fall or winter plowing and the sowing of some winter crop, and by practicing the following three-year rotation: First, plant cotton and follow it with corn the next year. Cowpeas should be sown with the corn at the last cultivation. After the corn is gathered, plow about 7 inches deep and sow some good winter cover crop to protect the hills from washing and gullyng during the winter and spring rains. If the winter cover crop is allowed to mature, cowpeas should again be sown after the cutting of the former. In reclaiming these old worn-out fields, cowpeas should figure largely in whatever rotation is followed, because they will not only add the most expensive fertilizing element, nitrogen, to the soil, but will add organic matter and open up the subsoil for aeration.

A considerable amount of commercial fertilizer is being used upon this type where cotton is grown year after year, and the tendency of the fields to wash and gully seems to be yearly increasing. One of the main reasons for this is the diminishing supply of organic matter, which has a tendency to bind the soil particles together. Raw commercial fertilizer should not be used alone year after year, and if used at all should be in conjunction with an abundance of organic matter. The best fertilizer is well-rotted stable manure, but in the present area this is in most cases allowed to go to waste. Rough barnyard manure is next to stable manure in value. Green manuring crops are also helpful to this type, but it is believed that some lime should be applied to the land either just before or immediately after the green crop is turned under. The commercial fertilizer used upon this soil is a mixture of equal parts of cotton-seed meal and acid phosphate.

This soil besides being well adapted to the staple crops of the region—cotton and corn—is also a good soil for Elberta peaches. By selecting the highest ridges on this soil it is believed that the danger from frost will be greatly lessened, and thus profitable crops would be secured with greater regularity. It is also believed that a fine grade of wrapper tobacco can be grown, as is the case on soils having similar characteristics in eastern Texas.

Owing to the desirability of this soil for general farming and the ease with which it is cultivated, it is nearly all cleared and under cultivation and well improved. For these reasons it is considered the most important agricultural soil in the parish. The average price of well-improved land with buildings varies from \$15 to \$30 an acre, depending upon the location and the character of improvements.

The following table gives the average results of mechanical analyses of the soil and subsoil of the Greenville gravelly sandy loam:

Mechanical analyses of Greenville gravelly 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.	<i>Per cent.</i>
18659, 18661.....	Soil.....	2.0	2.1	1.6	47.1	15.6	25.0	6.7
18660, 18662.....	Subsoil.....	2.2	1.9	.9	30.9	8.7	16.1	39.1

GREENVILLE LOAM.

The Greenville loam to a depth of 3 to 6 inches consists of a reddish-brown or chocolate-brown very fine sandy loam or loam which usually contains an abundance of humus. The subsoil to a depth of about 30 inches consists of a brownish-red, friable, heavy clay loam, through which are usually disseminated appreciable quantities of very fine iron concretions, imparting a gritty feel. Below this the reddish material becomes slightly mottled with yellow, which mottling increases with depth and finally changes to drab. At a depth of about 5 feet the material consists of a drab and red clay, resembling the subsoil of the Susquehanna types at a depth of about 3 feet. The air and water are able to penetrate the Greenville loam freely to a greater depth than the Susquehanna soils; hence the above difference in color of the subsoils.

This soil only occurs in small areas and is associated with the Susquehanna clay, being in a way an intermediate type between the Susquehanna clay and the Greenville gravelly sandy loam. It is principally developed in the vicinity of Liberty Hill and also occurs in a considerable area at Gansville, in Winn Parish. The soil also occurs better developed in southern Arkansas, and in some of the Louisiana parishes bordering that State.

The characteristic surface features vary from nearly level to moderately rolling, and the drainage is fair. Artificial drainage would in many cases be helpful.

Under ordinary conditions it is a fairly easy soil to plow and cultivate. In the spring, however, it can not be plowed as early as the more sandy types, and special care must be taken not to plow the ground when it is wet, because the soil, if the plowing has been deep, will bake and dry in very hard lumps. It is locally known as "red land" or "mixed land," and is very highly valued for the production of cotton, corn, and oats. It is exceedingly well adapted to oats, but as they are always fed in the sheaf no definite idea of the yield of grain can be given. It is estimated that the yield would be over 40 bushels per acre.

The Greenville loam is practically all under cultivation, having been cleared of the virgin forest growth, which consisted principally of oak and hickory, with some shortleaf pine. It is considered a very strong soil and easily maintains a high state of productiveness when once put in that condition. As only 0.1 per cent of the parish is occupied by this soil, it is of little local importance. The average price for land of this type, including farm buildings and all improvements, is about \$20 an acre.

The following table gives the results of mechanical analyses of the soil and subsoil of Greenville loam:

Mechanical analyses of Greenville 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.	<i>Per cent.</i>
18653.....	Soil.....	0.5	2.1	2.4	22.7	25.7	38.9	8.2
18654.....	Subsoil.....	1.1	2.1	1.3	10.0	13.6	30.4	41.1

BIENVILLE FINE SANDY LOAM.

The soil of the Bienville fine sandy loam consists of about 8 inches of gray to light-brown loamy fine sand. There is usually no distinct line of demarcation either in color or texture between the soil and the subsoil, but the one grades into the other by imperceptible degrees with increasing depth, until at 24 to 36 inches the material consists of a light-brown or reddish-brown, sticky, fine sandy loam. The reddish color of the subsoil is more pronounced on the crests of slight elevations, the color in leveler areas being lighter. Where this soil grades into the flat woods and swamp lands the subsoil is often slightly mottled with drab.

This soil is found in the neighborhood of the larger streams in the southern part of the parish, and is locally known as "hammock" land. Sometimes it is found as small, islandlike elevations at the junction of large streams and is surrounded on all sides by swamp. In such instances it is called "first hammock." Again, it may occur in the second bottoms, or what is locally called "flat woods," and in such cases it is called "second hammock." Slight elevations in the low-lying leveler areas of Norfolk fine sandy loam often have many of the characteristics of "hammock" land, and are often designated by the people as "third hammock." Of these three different kinds of "hammock" land, the first is the one which occurs in the largest areas, is held in highest esteem by the farmers, and is most representative of the type. The subsoil of the "second hammock" land is inclined to be somewhat lighter colored, more "crawfishy," and more seepy than the typical soil. As a whole, it is an easy soil to

plow and cultivate, and may usually be prepared and planted earlier than the Norfolk fine sandy loam. It was among the first soils to be cleared and put under cultivation.

In surface features it varies from nearly level to rolling, and, owing to this and the porous structure of both soil and subsoil, its drainage is naturally good. It is seldom if ever subject to overflow, but sometimes is cut off from the mainland by inundation of the surrounding swamps.

In the early days these "hammocks" were sought out and cleared because they were considered desirable for home sites and because of their convenience to the extensive ranges for hogs and cattle in the near-by swamps. The soil is naturally a productive one and well adapted to cotton, corn, fruit, and vegetables. It is used exclusively for cotton and corn, and in growing these crops no definite system of rotation is practiced. The average yield for cotton is one-half bale, while that for corn is about 20 bushels per acre. Much larger yields are possible, but the soil has been cultivated continuously for so long that its productiveness is reduced at least one-third. The same rotation is recommended for this soil as for Norfolk fine sandy loam. It is believed that the soil would be an excellent one for peaches, strawberries, and watermelons, besides all kinds of light truck.

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

Mechanical analyses of Bienville 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.	<i>Per cent.</i>
18663.....	Soil.....	0.0	0.3	0.3	17.8	33.1	39.7	9.0
18664.....	Subsoil.....	.0	.0	.1	17.1	34.3	27.5	20.4

NORFOLK FINE SANDY LOAM.

The soil of the Norfolk fine sandy loam, to a depth of 10 or 15 inches, is a grayish fine sandy loam, or a loamy fine sand of the same color. In cultivated fields the line of demarcation between soil and subsoil is often distinct, but in forested areas this is not the case. The subsoil is a yellowish fine sandy loam which becomes heavier with depth, and below 24 inches it usually becomes a yellowish sandy clay. At about 30 inches the yellowish color sometimes becomes mottled with drab and gray, and this is especially apt to be true where the drainage conditions are not naturally good.

This type is found in all parts of the parish, but is especially well developed on the lower slopes of the Dugdemona, Saline, and Black Lake bayous. The characteristic surface features are gently rolling

to nearly level. In the former locations the natural drainage is usually satisfactory, but in the latter artificial drainage, either by means of open ditches or covered drains, is essential to insure the best results. The location of the land is such that artificial drainage is always possible. Owing to these facts and also to its texture, the soil is an easy one to bring into cultivation.

Only a small percentage of the better-lying and better-drained areas are under cultivation, the remainder being still virgin forest or cut-over lands. Formerly the cane, which grew so luxuriantly in the near-by swamps, extended out and covered this soil and furnished an excellent range for cattle. Continuous pasturing has practically removed all of this, and now one of the characteristics of the pine forests upon the Norfolk fine sandy loam is the absence of undergrowth. Shortleaf pine and loblolly pine seem to be the principal growth upon the poorer drained areas, while a few longleaf pines are sometimes seen upon the higher, better drained areas.

The Norfolk fine sandy loam is derived from a veneer of material which reaches part way up the sides of the hills of higher elevation and completely covers many of the hills of lower elevation. It partially fills the large stream valleys and extends under the present alluvial lands of these streams. This deposition probably took place during Port Hudson time.

Thus far only the more rolling and better drained portions of the Norfolk fine sandy loam have been brought under cultivation. On these cotton and corn, and occasionally a small patch of sugar cane, are practically the only crops grown. It is not considered a strong soil by the farmers and there is much complaint that the effects of fertilizers are not lasting. This may be due to the fact that the water table during a large portion of the year stands rather close to the surface, and the greater part or all of the fertilizers which have been applied is carried away by seepage. Upon the higher and better drained areas this trouble is not so serious, but even there the type is not considered a very strong one. The average yield of corn is about 12 bushels, the yields ranging from 8 to 20 bushels per acre. Cotton gives from one-fifth to two-thirds bale per acre, with an average of less than one-half bale.

Judging from the garden vegetables seen growing, and especially the strawberries, it is believed that with available markets or local canning factories the greatest returns would come from growing truck and small fruit crops, instead of cotton and corn. Sugar cane of thrifty growth was seen in small patches in several localities. It is said that the quality of the sirup produced here is excellent and that the average yield is about 250 gallons per acre.

There is a deep phase of the Norfolk fine sandy loam, occurring mainly in the northeastern part of the parish at the headwaters of

Saline and Black Lake bayous and on the divides between these streams, which is somewhat more productive and better adapted to crops than the other portions of the type. This deep phase, which is shown on the soil map by symbol, has a surface soil with an average depth of 15 to 18 inches, the water table is farther below the surface, and the effects of fertilizers are considerably more lasting than upon the shallower areas.

About two-thirds of the area occupied by this phase of the type has been cleared and cultivated for a long time. Cotton, the main crop, and some corn and sugar cane are practically the only crops grown. It is believed that all kinds of truck crops, small fruits, and vegetables would do well, and that some varieties of peaches and a light wrapper tobacco could also be grown with success. Since the establishment of the fertilizer factory at Arcadia a mixture of equal parts of cotton-seed meal and acid phosphate is used in liberal quantities in the growing of both cotton and corn, and the good result is shown in the increased yields. A system of crop rotation, however, on this phase and on the other cultivated areas of the type should be adopted in which cowpeas play an important part, for continuous cultivation to cotton or some other one crop, without adding organic or vegetable matter, will eventually impoverish the soil and in many cases result in damage by washing and erosion. Deep fall plowing and the growing of winter cover crops are especially recommended for the deep phase of the type.

A large portion of the parish is occupied by the Norfolk fine sandy loam, and although at present extensive areas of the type are covered with timber it will be only a matter of ten or fifteen years before this will have been removed and the land made ready for settlement and farming.

The following table gives the results of mechanical analyses of the soil and subsoil of the Norfolk fine sandy loam and the deep phase of this type.

Mechanical analyses of Norfolk 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.	<i>Per cent.</i>
18665, 18667.....	Soil.....	0.5	0.7	1.1	38.9	22.3	32.4	4.4
18666, 18668.....	Subsoil.....	.0	.4	.6	26.9	12.9	29.0	30.3
Deep phase:								
18639.....	Soil.....	.0	1.1	6.6	67.6	3.0	17.1	4.7
18640.....	Subsoil.....	.0	.5	4.5	46.4	1.4	9.8	37.0

NORFOLK SAND.

The material composing the Norfolk sand is made up of gray and white incoherent sand of prevailing medium texture to a depth of

36 inches. In the lower depths there is a tendency toward a yellowish color and this is more pronounced in the areas that occur south of Old Sparta. Where the soil occurs on the hills, however, the color is grayish to a depth of 36 inches.

The Norfolk sand occurs principally in the central and southern parts of the parish, and is especially well developed in the vicinity of Old Sparta. Owing to its loose, open texture it is easy to till. In surface features it varies from nearly level to gently rolling in the lowland areas lying adjacent to the bottoms, to hilly and rolling in the upland areas. The drainage is inclined to be excessive in the uplands, and crops are apt to suffer severely from lack of moisture during dry weather. In the lowland, where the water table comes close to the surface, crops are affected little by ordinary periods of drought. The type is derived from the Lafayette formation.

Because of the unfavorable moisture conditions prevailing over much of its area, very little of this type is under cultivation at present, and for the same reason it is not naturally a very productive type. The effects of fertilizers are not lasting and constant heavy applications are required. Cotton and corn are at present the only crops, the yield of the former being about one-third bale and of the latter about 15 bushels per acre. Crops can be planted upon this soil earlier than upon any other type in the area, and now that the early planting of cotton has become so necessary in combating the boll weevil it is suggested that more of this soil could well be used in cotton production. By following a system of crop rotation designed to add organic matter to the soil (and this can best be done by including some of the legumes, preferably cowpeas), much larger yields of both cotton and corn are possible. The soil is very well adapted to the growing of all kinds of early light-truck crops, as well as Irish potatoes, watermelons, and peaches.

The proportion of the parish covered by this type is not great, but under the present conditions with respect to the boll weevil and the increasing demands of the near-by logging camps and sawmills for fruit and vegetables, to which the soil is especially well adapted, it is destined to become an important factor in the agriculture of the central and southern parts of the parish.

SUSQUEHANNA CLAY.

The soil of the Susquehanna clay to a depth of about 3 or 4 inches consists of a brownish-red or red clay loam, the first 2 inches being darker in color, owing to accumulations of organic matter—the decayed remains of leaves and grass. The subsoil is a stiff, tenacious, plastic red clay to a depth varying from about 20 inches to 3 feet, below which the plastic material becomes mottled with drab and

gray. The proportion of the drab and gray colors increases, until at a depth of 5 or 6 feet the red color disappears and when exposed in road and railway cuts the whole mass is a grayish drab.

Because of the abundance of easily tilled, sandy soils in the parish and the great difficulty of plowing and cultivating the Susquehanna clay, it is held in low esteem for general farming purposes, and practically none of it has ever been cleared and put under cultivation. It occurs in rather large areas south of Gibsland and in the vicinity of Bryceland. It is found in smaller areas in various other parts of the parish.

The topographic features of the Susquehanna clay vary from nearly level to slightly rolling, and in most places artificial drainage would be very helpful if the land were put under cultivation. It is derived principally from the fossiliferous calcareous Lower Claiborne formation which underlies it. There are in some places a good many clayey iron concretions strewn upon the surface, and in other places some broken fragments of fossiliferous clay ironstone were observed.

The type is usually referred to as "hog wallow" or "post oak flats." Scrubby post oak, black-jack oak, some shortleaf pine, and "hog haw" are the characteristic growths upon it. A few farmers have at different times brought small patches of this soil under cultivation where it adjoins or is a part of fields made up of other types of soil, and no one was found who did not believe that the soil is a very productive one if properly handled.

One of the first essentials in putting the Susquehanna clay under cultivation is thorough drainage, both surface and underground. This, together with deep fall plowing and growing cowpeas and other green manuring crops, will loosen and mellow the soil. The soil can be brought to a high state of productivity if plowed deeply for several years and enriched with organic matter; it is very noticeable that the effects of barnyard and stable manure are lasting. Where the drainage conditions are good cotton yields on an average about two-thirds bale per acre. Corn does not do very well, but winter oats seem to thrive. These are always fed in the sheaf, so nothing definite can be said as to the yield of grain. This soil is not well adapted to vegetables or truck crops, but when well sodded with native grasses it produces an excellent pasturage and also fair yields of hay.

Under the present conditions, with an abundance of cheap, easily tilled, productive lands, it is not likely that the Susquehanna clay will be cultivated to any great extent, but if the region eventually becomes thickly settled and land becomes much higher in price it is believed that this soil will be brought under cultivation and its value will be more fully recognized.

The following table gives the results of mechanical analyses of the soil and subsoil of the Susquehanna clay:

Mechanical analyses of Susquehanna 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.	<i>Per cent.</i>
18651.....	Soil.....	1.6	1.9	1.3	10.0	16.1	28.3	40.4
18652.....	Subsoil.....	1.5	2.1	.9	7.6	15.2	17.4	54.8

SUSQUEHANNA FINE SANDY LOAM.

The soil of the Susquehanna fine sandy loam is a gray fine sandy loam, varying in depth from about 6 to 18 inches, with an average depth of about 12 inches. Sometimes there are many iron concretions and fragments of iron crust strewn upon the surface of the hills and ridges. In the virgin state there is a gradual change in texture, with increasing depth; at the surface is found the coarser sand, and the finest materials, like silt and very fine sand, immediately overlie the subsoil. In fields that have been cultivated for several years the soil becomes homogeneous, and the line of demarcation between the soil and subsoil is sharp and distinct. The subsoil consists of a very plastic, tenacious, red or mottled red and gray clay. Very frequently it is a heavy, plastic, tenacious red clay to a depth of 30 inches, below which it becomes mottled with gray or drab, the gray color becoming more pronounced as the depth increases, until, at 4 or 5 feet, the material usually becomes much sandier and lighter colored.

Except where erosion has removed the soil and exposed the subsoil, the type is a fairly easy one to plow and cultivate. Owing to the stiff, clayey nature of the subsoil, the type is not as warm natured as some of the other soils; consequently crops do not start as rapidly as, for example, upon the Orangeburg fine sandy loam. In newly cleared fields the soil is darker colored and more loamy than is usually the case after a year or more of cultivation, unless proper means have been taken to maintain the organic matter content.

The Susquehanna fine sandy loam occurs in large areas in the region south of Gibsland and south of Arcadia and in the vicinity of Bryceland. It occurs on ridges and hills of slightly lower elevation than those upon which the Greenville gravelly sandy loam is found. It is also found in regions where weathering and erosion have been rather active and where the usual surface features are rolling to hilly and often irregular and dissected. This latter condition is especially pronounced at times along the upper reaches of the small streams. The drainage is inclined to be excessive, and, on account of the usual rough topography, great care is necessary in order to

keep the sand from washing off the cultivated fields and exposing the subsoil. Owing to the plastic, impervious nature of the subsoil and the usual loose, sandy nature of the soil, its natural water-holding capacity is not great, and the soil soon becomes saturated, the water running off over the surface and causing excessive erosion. This in large measure accounts for the rough, irregular surface of the type as a whole.

This soil is derived from the weathering of the fine sands and clays of the Claiborne formation of the Eocene. Owing to the abundance of other available and more desirable land in the parish only a small percentage of this soil has ever been cultivated. It is still largely covered with its original forest growth of post oak, black-jack oak, shortleaf pine, and dogwood, and it is characterized by numerous thickets of post oak and black-jack oak, which are sometimes almost impenetrable, even to a man on foot. When well situated and carefully cultivated this is a safe soil for all of the general farm crops of the region, and eventually, when land becomes scarcer and more valuable, larger areas of this type will be brought under cultivation.

Cotton and corn are the principal crops. This soil is usually considered a little better adapted to these than is the Norfolk fine sandy loam, for the reason that it can be built up into a stronger soil and the effects of fertilization are much more lasting. When the land is "fresh," that is, just cleared, and contains an abundance of humus and organic matter, it produces from two-thirds to three-fourths bale of cotton and from 25 to 35 bushels of corn per acre, but after three or four years of continuous cropping the yields usually fall to about one-third bale of cotton and 12 bushels of corn per acre. This soil is also well adapted to truck crops, and it is believed that peaches could be successfully grown on ridges or hills where the sand has a depth of over 15 inches.

Shallow plowing and ridge cultivation are practiced on this soil, as upon all other soils of the parish. Deeper plowing is particularly to be desired, and especially so where the subsoil comes within 7 inches of the surface. The soil is said to be very susceptible to drought, and in overcoming this deep plowing is very essential, for by loosening up the subsoil its water-holding capacity will be greatly increased. In the same way the tendency to erode may be reduced. The growing of deep, fleshy-rooted legumes, like cowpeas, will also aid very materially in opening up the subsoil and increasing its power to absorb rain water.

The oat crop does exceptionally well upon this soil, and since it protects the land from the serious effects of washing and erosion it is strongly advised as a winter cover crop. The following rotation is also suggested as being well suited to the soil and conditions found on this type in Bienville Parish: Cotton one year, followed by corn

the next year. At the last cultivation of the corn cowpeas should be sown broadcast between the rows. After the corn is harvested the ground should be deeply plowed and sown to winter oats, which will furnish an excellent pasture during January, February, and March. Oats are not usually injured by pasturing and they should be allowed to mature, then thrashed or fed in the sheaf. Cowpeas should be sown after the oats are harvested. The ground should always be plowed deeply, and this practice, together with the above rotation, will not only maintain the original productiveness of the soil, but will increase it from year to year. About 17.1 per cent of the area is occupied by this soil, so that it has considerable influence upon the agricultural conditions and value of land in the parish. A large percentage of the soil is held by lumber companies. With the timber it brings from \$15 to \$25 an acre. Cleared land for farming purposes ranges from \$5 to \$12 an acre.

The following table gives the average results of mechanical analyses of the soil and subsoil of this type:

Mechanical analyses of Susquehanna 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.	<i>Per cent.</i>
18655, 18657.....	Soil.....	0.6	0.7	8.6	53.7	13.9	17.4	5.6
18656, 18658.....	Subsoil.....	.2	.4	3.6	20.2	15.8	19.4	40.1

ORANGEBURG FINE SANDY LOAM.

The Orangeburg fine sandy loam consists of 6 to 18 inches of gray or brownish-gray, fine to medium textured sandy loam, underlain by material which ranges from a red clayey fine sandy loam to a red fine sandy clay extending to a depth of 36 inches or more. Usually the line of demarcation between the soil and subsoil is quite distinct both in color and texture. In the forested areas, however, this is not always the case. The surface is occasionally strewn with a scattering of quartz gravel.

Occurring in rather small, disconnected areas, the Orangeburg fine sandy loam is found in all parts of the parish, and especially in the southern half. It is found upon hills and ridges, and has excellent natural drainage. Owing to this, to its loamy texture, and to the usual absence of rough surface features, it is very readily brought under cultivation, and it was one of the first soils to be farmed by the early settlers.

The Orangeburg fine sandy loam is derived from the unconsolidated sandy and sandy clay formations which underlie it. These are probably Lafayette in age. Originally the land of this type of

soil was covered with forests of longleaf and shortleaf pine, with some scattering red oak and hickory. Cotton and corn are the crops, and it is considered a good, safe soil for these in almost any season. The yield of cotton ranges from two-fifths to three-fourths bale per acre, with an average of about one-half bale. Corn ranges from 10 to 25 bushels per acre, with an average of about 20 bushels. It is considered a better soil for corn than for cotton. The above yields are those for crops without an application of commercial fertilizer. By using 200 or 300 pounds of fertilizer per acre some farmers maintain an average yield of about two-thirds bale of cotton and about 25 bushels of corn per acre. Judging from vegetables seen growing in gardens and the success of a few farmers near the towns who have been growing truck on a small scale, the Orangeburg fine sandy loam is one of the best soils in the area for all kinds of small fruit and vegetables, and with the increasing demand for these products it is believed that it would be much more profitable to use the land for these crops than for cotton. In the early days the farmers grew some tobacco for home use upon this soil, and the success had in growing Cuban filler tobacco upon this same type of soil in Texas suggests that this crop might profitably be introduced here. In favorable years Elberta peaches grow to perfection upon this soil, and this is another industry whose development is feasible.

The cultural methods on the Orangeburg fine sandy loam are practically the same as on the other types of the parish. The advantages of deep plowing, of the rotation of crops, and of growing cowpeas or other legumes have been little appreciated. These matters should be given more consideration by the farmers.

Although the Orangeburg fine sandy loam occurs in rather small, isolated patches, these are so numerous and held in such high favor as to make it an important soil locally.

The following table gives the average results of mechanical analyses of the soil and subsoil of the Orangeburg fine sandy loam:

Mechanical analyses of Orangeburg 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.	<i>Per cent.</i>
18645, 18647.....	Soil.....	0.1	0.6	1.9	51.7	16.5	25.0	4.1
18646, 18648.....	Subsoil.....	.0	.1	1.5	32.5	11.6	23.5	30.3

ORANGEBURG SANDY LOAM.

The soil of the Orangeburg sandy loam consists of a gray or brown, medium to fine textured sandy loam, with a depth of about 15 inches. Below this and reaching to a depth of more than 36 inches occurs a

subsoil of brownish-red to yellowish-red, medium to fine textured sandy loam. This material contains much less organic matter and is less coherent than the soil, but judging from a field examination, and also from the mechanical analyses; the size of the soil particles is very nearly the same for both soil and subsoil. Occasionally little lenses of clay 2 or 3 inches in diameter and a half inch or more thick are found in the subsoil. A little gravel is sometimes found strewn upon the surface.

This soil occurs in patches in various parts of the parish, but is especially well developed about 2 miles west of Gibsland and farther south in the central part of the parish. It is an exceedingly easy soil to cultivate, and is highly prized. Wherever found the fields are usually entirely free of stumps and deadened timber, indicating that the land has been under cultivation a long time. The original forest growth is said to have consisted mainly of longleaf pine.

The topography is rolling to slightly hilly and the natural drainage is excellent. In fact, if anything, drainage is too rapid, and great care has to be taken to prevent the hills from washing and eroding, notwithstanding the fact that the subsoil is open and porous. Moles burrow to a considerable extent in this soil and often after a heavy rain gullies are noticeable on the hillsides which before were merely underground mole trails. One very noticeable characteristic of this soil is that the road cuts are deep and often trenchlike where they pass over hills.

The Orangeburg sandy loam is usually associated with areas of Norfolk sand. The latter type appears to have been an ancient beach laid down probably at the close of the Tertiary period, and it is believed that the Orangeburg sandy loam represents a close shore deposit of the same period. The ease with which this soil is handled makes it very popular when well located. The best crop yields are usually obtained during a year of abundant rainfall, as crops are inclined to suffer in times of drought. All of the general farm crops of the region are grown on it, but cotton and corn are the most popular. Cotton yields from one-fourth to one-half bale per acre; a fair average is about one-third bale per acre. Corn yields vary from 8 to 20 bushels, averaging about 15 bushels per acre. A few thrifty-looking peach trees were observed, and it is believed that this soil is well adapted to some such peach as the Elberta. A few cantaloupes and watermelons are grown for home use, and judging from the stated yields there are excellent possibilities in this direction. The success of garden patches of strawberries, radishes, onions, sweet and Irish potatoes, and small berries indicates that all of these crops can be profitably grown provided a market can be had for them. It would seem that as a whole the soil is better adapted to truck farming than to the growing of cotton and corn, and with the

establishment of canning factories in this section the trucking industry would receive its share of attention. Since the advent of the boll weevil this soil is in greater demand for cotton because of the desirability of early planting, thus getting the plant well started before the pest appears in destructive numbers in July and August.

This soil needs yearly attention in order to maintain its productiveness. The effects of fertilizers are not as lasting as upon soils having a heavier subsoil. The best results seem to be secured with well-rotted barnyard manure. The turning under of cowpea vines seems also to be very beneficial. A few farmers have been applying equal parts of cotton-seed meal and acid phosphate with apparently increased yields.

It is recommended that instead of growing cotton and corn year after year the following rotation be used: Cotton one year, followed by corn the next, sowing cowpeas with the corn at last cultivation. After the corn is harvested sow some good winter cover crop to protect the ground from washing and gulying during the winter months and at the same time to furnish winter pasturage. Hairy vetch, which is a legume and a soil renovator of great value, is a very satisfactory winter cover crop for such light sandy types as the Orangeburg sandy loam. The land, however, must be well prepared and well manured to obtain the best results. If hairy vetch is not used, winter oats will be found to do fairly well and furnish some winter pasturage. After the winter cover crop is harvested the ground should again be sowed to peas.

This soil is not of great extent, only 4.8 per cent of the parish being occupied by it, but it was one of the first soils to be reclaimed from the forests and has considerable influence upon the agricultural conditions and value of lands in the parish. It ranges in price from \$5 to \$15 an acre, depending upon location and improvements and the amount of land under cultivation.

The following table gives the results of mechanical analyses of a sample of the soil and subsoil of this type:

Mechanical analyses of Orangeburg 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.	<i>Per cent.</i>
18643.....	Soil.....	0.3	2.2	41.1	29.0	5.8	17.9	3.6
18644.....	Subsoil.....	.0	2.0	36.1	27.8	4.3	20.1	8.9

ORANGEBURG FINE SAND.

The Orangeburg fine sand consists of 10 to 12 inches of light-brown or gray, medium to fine-textured sand, underlain by material

of the same texture, but of reddish color, extending to a depth of 36 inches or more. At about 24 inches the subsoil sometimes becomes slightly sticky. This is an easy soil to till, breaking into a pulverulent seed bed without tendency to pack or bake.

Small areas of Orangeburg fine sand are scattered here and there over the western third and southern half of the parish. It occurs upon the divides and narrow ridges of high elevation, and has a rolling to hilly surface. This, together with the loose, open nature of the soil and subsoil, insures rapid drainage, which is apt to be excessive. As a result, land of this type is usually considered of low value in the production of cotton and corn. Over limited areas the surface features resemble sand dunes, and taken as a whole the soil appears to be the remnant of an ancient beach line. The material from which the type is derived belongs to the Lafayette mantle.

In some of the more level locations, where moisture conditions are naturally the most favorable, small areas are sometimes successfully used for general farming. In such locations light truck crops and watermelons seem to do exceptionally well, but in order to keep the soil in a productive state frequent applications of manure and fertilizers are necessary. No peaches were seen growing on the soil, and if experimented with it is recommended that only the best and most productive portions of the type be tried.

Having a limited area, the Orangeburg fine sand has little or no material influence upon the agricultural conditions and land values in the parish. Most of the type is still forested with longleaf pine and chinquapin. The abundance of the latter and the presence of a weed known locally as "bull nettle" have given rise to the descriptive terms "chinquapin" or "bull-nettle" land.

The greatest value of the type lies in its pine timber. Where this has been removed the land can be purchased for about \$5 an acre.

The following table gives the results of mechanical analyses of the soil and subsoil of the Orangeburg fine sand:

Mechanical analyses of Orangeburg fine sand.

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.	<i>Per cent.</i>
18641.....	Soil.....	0.0	0.8	11.1	71.6	2.7	8.5	5.6
18642.....	Subsoil.....	.0	.8	10.3	71.2	2.7	8.5	6.5

MEADOW.

The Meadow comprises that portion of the stream valleys subject, especially during the winter and spring months, to such frequent overflow as to render the land unfit for farming. The material com-

posing these bottoms is quite variable in short distances, but sand seems to be the predominating material.

Meadow occurs in all parts of the parish, but the largest bodies are found along the larger streams like Black Lake, Dugdemona, and Saline bayous. On the lower courses of these streams the overflow land is sometimes a mile or more in width, and formerly supported dense canebrakes, which furnished excellent winter pasturage. Although the bottoms are wide, the stream channel itself is usually only a few rods in width, and meanders from one side of the swamp to the other, forming innumerable loops, bends, and oxbows. These oxbows sometimes become detached during floods and remain as small ponds or lakes, and occasionally a number of these are found parallel to the main stream.

At present these bottoms have no value from an agricultural standpoint, but it is believed that by diking there are many locations where rice might be profitably grown. To some extent these swamps afford good grazing for cattle and hogs. Formerly there was a great abundance of oaks, which furnished an almost inexhaustible supply of mast for hogs during the winter months. Many of the oak trees have been cut for staves and lumber, so that the quantity of mast is greatly reduced, and the canebrakes have been pastured so long that they are not so good as formerly. Besides several varieties of oak, the native forest consisted of cypress, hickory, beech, white gum, and loblolly pine.

SUMMARY.

Bienville Parish lies near the center of northwest Louisiana. The northern part of the parish is within the shortleaf pine hill belt, while the southern part is within the longleaf pine hill belt.

The earliest permanent settlement in the parish was made in 1826, and most of the important permanent settlements occurred between that date and 1850. The region was settled by emigrants from Kentucky, Tennessee, Alabama, Georgia, and Mississippi. These people and their descendants have been exclusively a farming people, and until the advent of railways stock raising constituted a very large part of their income. In the northern part of the parish, however, cotton was grown to a large extent before the railways entered the parish.

During the last twenty-five years there has been marked progress in all lines, owing largely to the great activity in lumbering and railway construction. More money is in circulation, higher wages are being paid, the population is increasing, a better system of public schools prevails, and the agricultural practices are improving to meet the increasing demands for farm products.

The climate of the parish, besides being well suited to the production of the staple crops of the South—cotton and corn—is also admirably adapted to small fruits and vegetables for canning purposes and to truck crops in general.

The rapid removal of the timber is throwing considerable areas open to settlement, and the people in less favored localities in the surrounding parishes are taking advantage of this opportunity to buy excellent lands at reasonable prices.

The chief towns and trading centers of the parish are Arcadia, Gibsland, and Bienville. The parish as a whole now possesses excellent transportation facilities, and it is believed that when the production of fruit and vegetables exceeds the local demands no difficulty will be experienced in obtaining rates that will enable profitable shipment to outside markets.

Eleven types of soil were recognized and mapped in the parish. The larger part of the parish is covered by fine sandy loams. The Norfolk, the Orangeburg, the Susquehanna, and the Greenville are the most important series. It is believed that on the Greenville gravelly sandy loam Elberta peaches and a fine quality of cigar wrapper tobacco can be profitably grown.

A systematic rotation of crops should be followed on all the soils of the parish. On the upland sandy soils a three-year rotation of cotton, corn, and oats, with cowpeas sown both at the last cultivation of the corn and after harvesting the oats, is suggested. All of the soils need deeper plowing and a more thorough preparation of the seed bed. The heavier clayey types should be tile drained and a four or five year rotation would be best upon them. Cowpeas should figure in all rotations. The growing of winter cover crops and more forage crops, level cultivation on level well-drained lands, and the use of better farm machinery are strongly recommended.

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