MISSISSIPPI STATE GEOLOGICAL SURVEY

E. N. LOWE, DIRECTOR

BULLETIN No. 8

A Preliminary Study of Soils of Mississippi

1911

Mississippi
State Geological Survey

E. N. LOWE, Director

BULLETIN No. 8

A PRELIMINARY STUDY
OF
SOILS OF MISSISSIPPI

BY

E. N. LOWE

BRANDON-NASHVILLE

STATE GEOLOGICAL COMMISSION.

His Excellency, E. F. Noel	*Governor.*
Dr. Dunbar Rowland	*Director of Archives and History.*
Dr. A. A. Kincannon	*Chancellor of State University.*
Prof. J. C. Hardy	*President A. & M. College.*
Hon. Joe N. Powers	*State Superintendent of Education.*

GEOLOGICAL CORPS.

E. N. Lowe	*Director.*
Dr. W. N. Logan	*Assistant Geologist.*
Dr. Calvin S. Brown	*Assistant Geologist.*
A. L. Goodman	*Assistant on Soil Survey.*
W. M. Spann	*Assistant on Soil Survey.*
E. M. Jones	*Assistant on Soil Survey.*

LETTER OF TRANSMITTAL.

JACKSON, MISSISSIPPI, February 21, 1911.

To Governor E. F. Noel, Chairman, and Members of the Geological Commission:

GENTLEMEN: To satisfy an insistent and growing demand, I have prepared this Preliminary Study of the Soils of Mississippi, which I submit herewith to be published as Bulletin No. 8 of the Mississippi Geological Survey.

Very respectfully,

E. N. LOWE, *Director.*

PREFACE.

The office of the Geological Survey has for several months been in receipt of insistent requests for information about the soil conditions of the State. Since December, 1909, the U. S. Soil Bureau and the Mississippi Geological Survey have been co-operatively engaged on a detailed Soil Survey of the State, which will furnish the most accurate and detailed information of the soils of each county, with accompanying large soil maps.

To complete this work will take several years, and to meet the immediate demand coming from prospective investors outside the State, as well as from citizens of the State, this preliminary study of our soils has been undertaken. It is, as the title indicates, preliminary and general in character, and is in no sense expected to take the place of the more accurate detailed survey. In those counties which have already been surveyed by the Soil Bureau detailed information should be sought in the reports on those several counties.

Some features of this report, such as the present state of culture, the native growth and the water supply of the various soil regions, and the chapter on Soil Erosion, it is hoped, will add to its practical value.

In the preparation of this study numerous sources of information have been used, among which may be mentioned: In the general discussion, Chamberlin and Salisbury's Geology, Vol. I, Hilgard's Soils, Earle's Southern Agriculture and Bulletins of the U. S. Department of Agriculture; in the special discussion of Mississippi soils, the Reports of the U. S. Soil Bureau, field notes of A. F. Crider in five counties of S. E. Mississippi, the Bulletins of this Survey, the Bulletins of the various Experiment Stations of the State, Hilgard's Report, and the writer's field notes for the past two years.

The mechanical analyses of soils were all made by the U. S. Soil Bureau; a number of the chemical analyses were made by Dr. Hilgard, the distinguished former State Geologist; nearly a hundred partial analyses (determination of humus and available plant food) were made by the Chemical Department of the State University for this Survey in December, 1909.

I am indebted to the State Department of Agriculture for Figs. 1 and 10, and for some statistical matter on the Boys' Corn Club contest; to the Illinois Central Railroad for Figs. 3, 4, 5, 6, 9, 19, 21 and 22, and statistical data of value contained in several bulletins by Capt. J. F. Merry; and to the New Orleans Great Northern Railroad for Figs. 10a, 11, 12, 13, 14, 16, 17 and 18, the plates of which were obtained through the courtesy of Mr. F. L. Merritt. The Jackson Evening News has kindly loaned the plates of Figs. 2, 8 and 15, which appeared in the Fair Edition of 1910; to M. & O. R. R. for Fig. 13; to Mr. A. H. Cauthen, of Business Men's League, of Canton, Miss., for Fig. 7.

E. N. Lowe.

TABLE OF CONTENTS.

PAGE

Constitution of the Earth 12

Consideration of Soils in General 12
- Definition 12
- Origin 13
- Chemistry of Rock 13
- Rocks 14
- Igneous Rocks 14
- Sedimentary or Fragmental Rocks 14
- Metamorphic Rocks 15
- How Sediment becomes Rock 16

Weathering 18

Physical Phase of Weathering 20
- Change of Temperature 20
- Wedge Work of Frost 21
- Organisms 22
- Wind 23
- Rain 23
- Gravity 23
- Weathering in Arid regions 24

Chemical Phase of Weathering 24
- Not prominent on mountain tops or in deserts 24
- Conditions 25
- Why more active in valleys than in mountain tops 25
- Hydration 27
- Oxidation 27
- Carbonation 27

Vegetation and Humus 28

How Soils Are Formed on Level Surfaces 29

How Vegetation Took Possession of the Rock .. 29

Soils Differ as to water Content 31

Transported Soils 31

Relative Importance of Chemical and Physical Properties of Soils 32

PAGE

PREPARATION AND TREATMENT OF SOILS 34
Plant Food 34
Soil Bacteria 35
Clearing the Land 36
Drainage 39
Fertilizing 43
Ammonia Nitrogen 45
Nitrogen as Nitrates 46
Phosphoric Acid 46
Mineral Phosphates 46
Organic Phosphates 47
Potash 47
Humus 48
Barnyard Manure 49

CROP ROTATION 50

GEOLOGIC STRUCTURE OF MISSISSIPPI 51
DEVONIAN 51
MISSISSIPPIAN, OR LOWER CARBONIFEROUS 51
CRETACEOUS 52
Tuscaloosa 52
Eutaw 52
Selma Chalk 52
Ripley 53

TERTIARY 53
Midway 53
Wilcox 54
Claiborne 54
Jackson 55
Vicksburg 55
Grand Gulf 55
Lafayette 55

QUARTERNARY 56
Loess 56
Brown Loam 57

RECENT ALLUVIUM 58

PAGE

PHYSIOGRAPHIC REGIONS OF MISSISSIPPI 60
Tennessee River Hills 60
Black Prairie Belt 61
Pontotoc Ridge 62
Flatwoods 62
Northern Lignitic Plateau 63
Jackson Prairie Belt 64
Long Leaf Pine Hills 65
Loess or Bluff Hills 65
Yazoo Delta 66

SOIL CLASSIFICATION 67
Soil Type 67
Soil Class 68
Soil Series 69

TENNESSEE RIVER PINE HILLS 70
Boundaries of the Region 70
Topography 70
Character of Soils 72
Upland Soils 72
Bottom Soils 74
Native Vegetation 75
State of Cultivation and Crops raised 77
Recommendations 79
Water Supply 82

BLACK PRAIRIE BELT 82
Boundaries of the Region 82
Topography and Drainage 83
Character and Distribution of Soils 85
Upland Soils 85
Bottom Soils 88
Native Vegetation 89
Cultivation and Crops 92
Recommendations 95
Water Supply 97

PONTOTOC RIDGE 97
Boundaries 97
Topography and Drainage 98

PONTOTOC RIDGE—*Continued.* PAGE

Soils of Pontotoc Ridge 98
Native Vegetation 99
Cultivation and Crops 100
Recommendations 100
Water Supply 101

FLATWOODS REGION 102
Boundaries and Topography 102
Soils of Flatwoods 102
Native Growth 104
Cultivation and Crops 104
Recommendations 105
Water Supply 106

NORTHERN LIGNITIC PLATEAU 106
Boundaries 106
Topography and Drainage 107
Character and Distribution of Soils 111
Upland Soils 111
Bottom Soils 116
Native Vegetation 117
Culture 119
Recommendations 135
Water Supply 139

BLUFF HILLS REGION 139
Boundaries and Topography 139
Soils and Native Vegetation 140
Culture 142
Recommendations 142
Water Supply 142

JACKSON PRAIRIE REGION 142
Soils 145
Native Vegetation 147
Culture 147
Water Supply 150

LONG LEAF PINE HILLS 150
Boundaries and Topography 150
Character and Distribution of Soils 152
Native Vegetation 167

LONG LEAF PINE HILLS—*Continued.* PAGE
Culture ... 168
Recommendations ... 176
Water Supply ... 180

YAZOO-MISSISSIPPI DELTA ... 181
Area and Topography ... 181
Character and Distribution of Soils ... 182
Native Vegetation ... 187
Culture ... 187
Water Supply ... 194

APPENDIX A ... 195
SOIL EROSION ... 195

CONDITIONS FAVORING EROSION ... 196
Slopes ... 196
Deforestation ... 196
Loose Shallow Soils ... 197
Heavy Rainfall ... 197

WHERE MOST ACTIVE ... 197

RESULTING DAMAGES ... 198
Loss of Soils ... 198
Cutting up of Surface ... 199
Covering Bottoms with sand ... 199
Loss of underground water ... 199
Filling of navigable streams ... 199

REMEDIES ... 200
Old Field Pine ... 201
Black Locust ... 202
Lespedeza ... 202
Bermuda Grass ... 203
Wild Honeysuckle ... 203
Old Field Plum ... 203
Artificial Means ... 204

APPENDIX B ... 206
Analyses of Soils ... 206

SOILS OF MISSISSIPPI.

CONSTITUTION OF THE EARTH.

The body of the earth consists of matter in three forms—solid, liquid and gaseous. These are arranged in concentric spheres—the solid sphere being the rock or lithosphere, the liquid being the water or hydrosphere, the gaseous being the air or atmosphere. Water at ordinary temperature is liquid, at 32° F. it becomes solid, at 212° F. it becomes a gas; so the solid rock at high temperatures may become liquid and gaseous, while the air at low temperature may become liquid and even solid.

These concentric layers are not equally responsive to gravity; air, the lightest, responds least to gravity; rock, the heaviest, responds most to gravity—it is heavy because of its ready response to gravity. The lithosphere, on account of its greater gravity, forms the central mass of the earth upon which the other two rest; the hydrosphere is the comparatively thin shell of water that rests upon the lithosphere; the atmosphere is the tenuous gaseous envelope that rests upon the water or hydrosphere over most of the earth's surface; so that we see these three shells arranged one upon the other in the order of their gravity.

They are constantly in motion and continuously intermingled. Both water and air penetrate the lithosphere, rock and air mingle with the hydrosphere, and rock dust and water vapor float in the atmosphere. These facts are of vast importance in the economy of nature. The interaction of atmosphere, hydrosphere and lithosphere produces conditions necessary to form soil, and renders life upon the globe possible.

CONSIDERATION OF SOILS IN GENERAL.

Definition.—The word *soil* has been used with two distinct meanings according as the user is a geologist or an agriculturist. To the geologist soil is any natural unconsolidated deposit of comminuted rock matter, to the agriculturist it means that surface layer of finely divided and decaying rock material in which plants bury their roots and with which varying quantities of decaying vegetable matter is mixed. To the geologist a bed of clay, sand or gravel is soil; to the agriculturist none of these constitutes a soil until it is mellowed and decayed by long exposure to the atmosphere and has received a further addition from the decay of vegetable matter. The double meaning of the word is confusing, but fortunately the geologists are adopting a new and better term, *mantle rock*, or regolith, and leaving soil to be used only in its agricultural sense.

Origin.—All soils are derived from rock, either by the decay of the rock *in situ*, or by its disaggregation through the action of various agencies, and subsequent transportation and deposition elsewhere. Over a very large portion of the earth's surface the soil overlies a layer of mantle rock which varies in thickness from nothing to hundreds of feet. This consists of beds of clay, silt, sand, gravel, shingle, boulders, glacial deposits, talus slopes, land and rock slides, all derived from the solid rock lying beneath, or brought from points elsewhere where it is exposed. The foundations of the earth are of solid rock. Borings through the loose surface material anywhere will strike at greater or less depth the solid rock beneath. Over large areas of the earth's surface, especially in elevated mountainous regions, the rock comes to the surface. Wherever it does it is exposed to the various processes of the weather which break it up into mantle rock and prepare it for conversion into soil.

Chemistry of Rock.—The rocks of the lithosphere (the solid rock crust of the earth) are composed of twenty-one chemical elements, eight of which make up 99% of the whole. These eight with their relative proportions are given below:

Oxygen	47.02%
Silicon	28.06%
Aluminum	8.16%
Iron	4.64%
Calcium	3.50%
Magnesium	2.62%
Sodium	2.63%
Potassium	2.32%

Oxygen unites in definite proportion with each of the others to form one or more oxides. The oxide of Silicon ($Si O_2$) unites with Aluminum Oxide ($Al_2 O_3$) to form Aluminum Silicate, which is clay. Iron is not as frequently found combined with silica to form silicate, but a combined Iron-Aluminum Silicate occurs in Glauconite, a greenish mineral formed on the sea bottom. Calcium silicate, magnesium silicate, potassium silicate and sodium silicates result from the combination of silica with the oxides of these elements. All these elements form other compounds besides silicates which occur in the rocks of the earth. Some very familiar and abundant minerals are the oxides, carbonates, chlorides, sulphides, sulphates, phosphates, etc. In many cases several silicates of complex composition enter into the formation of a rock. A rock so constituted, on exposure to the weather, crumbles and falls to decay more readily than rocks of simple composition.

Rocks.—The earth's rocks are grouped into three great classes—Igneous, Metamorphic and Sedimentary or Fragmental, the classification being based upon the conditions under which each is formed.

Igneous rocks are those like granite, diorite and syenite, which are crystalline in texture and usually complex in composition, consisting of minerals aggregated together. Rocks of this class have solidified from a state of fusion. All the original rocks of the earth were igneous, though by no means are all the igneous rocks primeval, since rocks of the other types subjected to high temperatures, especially in the presence of superheated water, may fuse, and afterwards re-solidify in the form of crystalline rock.

Sedimentary or *Fragmental* rocks are those that have been derived from the breaking up and decomposition of other and older rocks by the ordinary erosional processes. These rocks are not crystalline in texture, but the constituent particles are usually rounded and water worn, of varying degrees of fineness from the finest clay and silt to cobble stones and boulders, sorted by the selective action of water currents and deposited in horizontal layers. Such bedded structure is called stratification, and true stratification is confined to rocks of this class. Igneous rocks are often broken by horizontal fissures or joint planes, and metamorphic rocks frequently exhibit a false lamination, both of which simulate somewhat the bedding of sedimentary rocks, but true stratification does not occur in either of these classes. Stratified rocks occupy nine-tenths of the solid surface of the earth. Examples are such familiar forms as shales, sandstones, conglomerates and limestones.

Metamorphic rocks are those which have become profoundly altered from their original texture and even from their original chemical and mineral constitution by great pressure at considerable depths beneath the surface in the presence of mineral gases and heat sufficient to soften but not to fuse the rock. Either Igneous or Sedimentary rocks may suffer this metamorphism, since either may be subjected to the conditions required. Rocks of this class are crystalline in texture and the larger portion show banding, simulating stratification. Well known examples of Metamorphic Rocks are Gneiss, altered from the igneous rock, granite; Mica Schist, derived from alteration of the sedimentary rock shale or mud stone; marble, formed from limestone, another sedimentary rock.

From what has been said, it will be evident that in tracing back the genesis of soils, the first step in the progress for about nine-tenths of the earth's land surface brings us to its source in some sedimentary deposit, either unconsolidated mantle rock, consisting of clay beds, mud beds, sand beds, gravel beds, sea-bottom ooze, or their consolidated representatives,—shales, corresponding to clay and mud beds; sandstones, to sand beds; conglomerates, to gravel beds; limestones, to calcareous oozes. The whole class of sedimentary rocks, however, are derivative from pre-existing rocks, as we have seen, and since the metamorphic class are formed from either igneous or sedimentary rocks, we are thrown back upon the igneous class of rocks as the original source of all other rocks.

By far the largest part of the earth's mass is igneous rock, though compared with the sedimentaries but little of it shows at the surface. The bedded rocks are in places many thousands of feet thick, yet beneath them, wherever penetrated, is found the igneous rocks, which extend to unknown depths—perhaps even to the center of the earth.

As contrasted with the sedimentaries, igneous rocks are complex both in mineral and chemical constitution. Since the sedimentaries are derived from them, we would expect both groups to be of closely similar composition. The reasons why they are not are given below in the discussion of Weathering. Suffice it to say, briefly, that in the process of change the soluble parts of the igneous rock are removed in solution and only the insoluble remain to make up the great mass of the resultant sedimentary rock.

How Sediments become rock.—All sedimentary rocks are at first unconsolidated mantle rock, and inquiry may be made briefly as to how consolidation has been effected. The bottom of the sea is the great arena of sedimentation and probably has been in all past times. Far out from shore muds and calcareous oozes are being deposited, slowly but surely building up the sea bottom. In the shallower waters, nearer in towards the shore-line, coarse materials, fine sands, coarse sands, gravel, shingle and cobblestones are filling in more rapidly. As these accumulate in successive layers, the layers first deposited become more and more pressed upon by those lying above, until a superincumbent load of hundreds or even thousands of feet of thickness of such deposits, exert a powerfully consolidating force. To vertical pressure may be added lateral compression in most cases, for the surface crust of the earth is constantly undergoing compression in an effort to accommodate itself to a shrinking interior globe.

Heat is an undoubted factor in the consolidation of most sedimentary deposits of great thickness. It is a well known fact that high pressure will cause a rise of temperature in the body compressed. In addition to the heat of compression is to be considered the interior heat of the earth which rises at the rate of 1° for every 60 or 70 feet of vertical depth. At a depth of a few thousand feet the heat from this cause alone would be very appreciable. The chief influence of heat in promoting consolidation of rock is to be explained in its effect on the mineral content of the waters permeating the rock mass. This is intimately blended with the consideration of the next and most important factor.

All sediments under ground contain more or less water occupying the spaces between their constitutent particles. If the materials are loose and coarse-grained, as in the case of sand beds, the water is in considerable quantity and moves readily through the rock, the flow being in the direction of least resistance. This water is atmospheric in origin. Rain falling upon the earth sinks into it and passes downward permeating all the rocks. The water on passing through the atmosphere takes in solution certain gases which are found there—oxygen and carbon dioxide, and carries them down into the fissures and pores of the rock. Armed with these and other acids it attacks the rocks through which it passes and dissolves out some of their ingredients. As the mineral charged water descends to greater depths the solution becomes more concentrated by continuous additions. Finally, because of over-charging or of changed conditions, the mineral in solution begins to deposit, forming films coating the rock grains, or even partially filling the pore spaces, the result being a cementation or gluing together of the rock grains. By this process unconsolidated beds of sand may become firmly cemented into a solid sandstone, beds of mud into shale, beds of marine oozes into limestone or chalk.

The most common cementing materials in rock are (a) Silica or Quartz (Sio_2), (b) Brown Iron Oxide ($Fe_2 O_3 H_2 O$) (c) Calcium Carbonate or Lime ($Ca\ Co_3$). Everyone is familiar with sandstone in some of its forms; it is nothing different from a sand bed solidified by cementation chiefly, but partly also by the two processes mentioned above. Everyone knows also that sandstones differ materially in color, hardness and durability. The differences are due to the cementing material. A sandstone with a cement of lime will yield quickly to atmospheric influences and disintegrate, because the cement so readily dissolves away and allows the grains of sand to fall apart. Where the cement is silica the rock becomes quartzite, the most durable of stones, because the cement is practically indestructible by atmospheric agencies. Where Iron Oxide cements the grains of sandstone the rock is very durable and the color brown, a kind used very largely in the building of the handsome Brownstone Fronts on Fifth Avenue, New York.

The character of the cementing material of rocks, especially of sandstones, exerts an important influence in determining both the physical and chemical constitution of the soils derived from them.

Cementation of rock has been described as taking place at considerable depths beneath the surface. The zone of cementation is recognized by the best authorities as being deeply located, and that rock solidifies there chiefly must be so, because there cementation is most active, and there pressure and heat are greatest. Cementation, however, may occur at the surface, of which we have abundant evidence.

WEATHERING.

Weathering is the sum of those changes produced by atmospheric agencies, which result in the conversion of rock into soil. It is a process of vast importance to the inhabitants of the earth, since upon it depends the very life of the earth. Weathering does not take place with equal rapidity everywhere, two very important factors influencing its rate being climate and character of rock. It is a complex and composite process, operating under two distinct and in some respects opposing phases. Below is shown a synopsis of weathering:

- WEATHERING
  - Physical Phase. Rock-Breaking.
    - Change of Temperature.
    - Wedge Work of Frost.
    - Organisms
      - Animals.
      - Plants.
    - Wind.
    - Rain.
    - Gravity.
  - Chemical Phase. Rock Decay.
    - Oxidation.
    - Carbonation.
    - Hydration and Solution.

As will be seen, the first phase or step in the process is a mechanical breaking up or comminution of the rock, brought about by several agencies. The second phase is a chemical decay or decomposition of the rock. Conditions favorable to the first are unfavorable to the second and vice versa. Considered as a whole, however, weathering is most favored by conditions that obtain in warm, moist climates. In Brazil, for example, soil formed *in situ* occurs in the Amazon Valley to a depth of three hundred feet.

All soil and mantle rock are moving slowly down to the sea, because all land surfaces slope towards the oceans. The agencies of this transportation are rain, rivers, wind, ocean waves, organisms and ice. The processes of weathering act so slowly as to escape notice, and yet they supply loose material more rapidly than all the agencies of transportation can convey it to the sea. The Mississippi in flood, with its muddy waters, spread many miles across the country, carrying along sand and silt by the thousands of tons, and floating to the Gulf timbers, trees and wreckage from the flooded lands, impresses us profoundly with the magnitude of its work. Yet, but for the work of weathering preparing its load of material, the mighty river would flow clear to the sea. Conversely, should it carry its greatest flood load every day of the year, it would still be unable to keep pace with work of the weather preparing soils in its drainage basin. Weathering, like a myriad-handed Midas, touches every square foot of land above the sea and forces it to yield its harvest of gold in rich and productive soils.

In order to simplify the discussion of weathering, we will consider the two phases separately. It will be well, too, to apply the discussion to an imaginary mountain slope where the operation of all the agencies can be made plain, and then apply the principles brought out to other and more familiar cases.

Physical Phase of Weathering.—Let us imagine then a lofty mountain rising above the surrounding country. Its rocky summit reaches well into the region of frost. Day by day the sun warms, night by night an icy chill enwraps its rocky cliffs. Besides the daily vicissitudes, it must bear the brunt of winter snows and summer storms.

Change of Temperature.—In low altitudes and moist climates the atmosphere is dense and holds a considerable quantity of moisture in the form of invisible vapor. The density of the atmosphere and the water which it contains cause it to act as a blanket to the earth's surface. The heat from the sun by day passes through the blanket to the earth, but its intensity is mellowed in doing so. After the sun has gone down the earth tends to give up the heat which it has received during the day, but the blanket of dense moist air holds the heat and prevents its rapid loss. Though the night is cool, owing to loss of heat, the protecting atmosphere prevents the extremes of temperature.

Such is not the case on high mountain tops. Here the enveloping air is quite thin and usually holds less water vapor than is the case in the lowlands. The blanket here is too thin to protect against either extreme of temperature. By day the sun blazes down in full intensity upon the bare rocks, which grow hot. In the high mountains of the deserts of South Africa, Livingston reports temperatures as high as 130° F. Rock, as compared with metals, is a poor conductor of heat; so that, while the surface may be hot, not many inches below the surface the rock is still comparatively cold. Rock, like most other substances, expands on heating and contracts on cooling. Here we have an exterior shell of hot rock trying to expand on a cold interior. Strains are set up within the mass. After the sun's heat is withdrawn, the rarity and dryness of the atmosphere permit the rapid radiation of heat from the surface of the rocks, with the result that it begins to cool. Anyone familiar with mountains knows how cold the mountain air grows after nightfall. The rock surfaces lose heat more rapidly than the interior parts, which have become somewhat warmed during the day, and since in cooling rock contracts, we again have stresses set up in the rock, but in the opposite direction—a cool outer shell trying to contract upon an unresponsive interior.

Day after day, season after season, year after year, these changes are in operation, with the result that the rocks begin to crack and shell off in pieces, varying from a few grains to hundreds and even thousands of pounds in weight. But the process does not stop here. The new surface exposed is subjected to the same conditions, resulting, sooner or later, in further disruption of the rock. And so the work goes on through the centuries; the mountain crags crumbling down become literally buried in their own wreckage.

Wedge Work of Forest.—What has been said in the above paragraphs refers to simple changes of temperature, but if the right temperature drops to a point below the freezing point of water, and if there is sufficient water in the rock, as there would be during much of the year, another potent factor comes into play—the wedge work of ice. All rocks are broken by cracks or joint planes into blocks of varying sizes. These joint planes are usually so small as to be scarcely if at all visible, but not too small for water to penetrate. Water from melting snow or from summer showers passes down into these fissures and freezes at night when the temperature falls below 32° F. Water expands 1-11 its bulk in freezing, exerting an irresistible force in doing so. Hence it is as if a steel wedge were driven gradually with great force between the blocks—the fissure widens. This process is repeated again and again, and year after year, the crack growing wider gradually. Rock fragments and particles fall in from above and prevent its closing. This debris will hold more water, and on freezing the pressure is greater. Finally the block becomes loosened and dislodged, falling from the cliff. It bounds down the mountain side, breaking off fragments of rock here, dislodging loosened boulders there, and perhaps bursting into a score of fragments before it finally comes to rest at the base of the mountain. Sometimes, when spring thaws are relaxing the grip of winter, the starting of one boulder may set in motion an avalanche of thousands of tons of rock. No sooner is a fresh surface of rock exposed by the dislodgment of a loosened block than the same process begins upon the new surface. Through the centuries the work goes on. If Time is the sculptor of mountains, then Ice is his most potent chisel with which he carves relentlessly and unceasingly.

Through the action of the two factors just discussed, change of temperature and wedge work of ice, the lofty mountains become scarred, transformed, lowered. Among the Rocky Mountains some peaks are literally buried in their own wreckage. But these agencies of destruction not only renew their attack upon the cliff's face as soon as a new surface is exposed, but continue work upon the fragments dislodged, breaking them into smaller and smaller pieces, so that loosened masses of rock matter, great and fine, lie beneath the cliffs in great talus slopes, hundreds of feet in thickness.

Organisms.—Burrowing animals loosen a considerable quantity of the smaller rock fragments in sinking their burrows, and open passage ways for water and air beneath the surface, thus promoting more rapid weathering of the rock. Large animals traveling over the ledges dislodge loosened fragments which tumble down the slopes, loosening and breaking up other fragments. These are not as important as the agents already discussed, but are by no means insignificant when we remember that their work is measured in centuries and thousands of years. Trees growing upon the higher mountain slopes and cliffs are often blown down by severe winds, and as they fall they carry with them not infrequently thousands of pounds of rock fragments entangled in their roots.

Wind.—Besides the indirect action of the wind in dislodging trees, as just described, it acts directly in removing small, loose particles as fast as they form. On high mountain peaks the wind is usually strong enough to carry away dust and fine rock particles, and so keep the the rocks swept clean, depositing elsewhere the materials picked up. In desert regions the wind finds most favorable conditions for action, drifting the dry sand into hillocks or dunes and carrying the fine dust to great distances in the upper currents of air.

Rain.—Moisture falling upon the mountain in the form of rain gathers up and washes off all the finer rock matter not removed by wind, and, as the water collects in furrows and gorges on the mountain side, it rushes downward with great force, carrying large quantities of loosened rock matter to the gentle slopes and valleys. If it fall as snow, on melting in the spring it rushes down to the streams, which become muddy torrents. If, instead of melting directly, the snow forms glaciers, these frozen masses, rockshod, creep down the valleys, tearing off, grinding up, and carrying along many tons of rock from the mountain above. In all cases the mechanical work of atmospheric water is to remove rock waste to lower levels and expose fresh surfaces of rock to the weather.

Gravity.—The work of all these agencies is reinforced by gravity. Every particle of matter of the globe feels the unremitting pull of gravity drawing it toward the center of the earth. Whether loosened by temperature changes, by frost, by organisms, wind or rain, gravity co-operates and draws the mass down to lower levels. The ocean basins are the lowest levels on the earth, hence all rock waste travels toward the oceans—from the mountains and hills to the plains, from the plains to the river valleys, from the valleys to the seas. The wind carries dust high above the lands, seeming to offer an exception to this rule, but it is only apparent. Sooner or later gravity gets the better, the dust settles upon the land, the rain washes it into the valleys and thence the streams carry it to the sea.

Weathering in Arid Regions.—What has been described as taking place on high mountain peaks finds its counterpart in deserts and other arid regions of the globe. The absence of moisture in the atmosphere permits the sun to blaze with untempered vigor upon the exposed rocks during the day, while from the same cause the heat is rapidly radiated by night and the rocks grow cold. Owing to the lack of rainfall the surface is unprotected by a coat of vegetation from these sudden and excessive changes of temperature, which result in the disruption, crumbling and gradual comminution of the rock. The winds sweeping over these regions carry up the dust in great quantities and transport it to distant parts where it settles. The great loess deposits of Northern China, several hundred feet deep and spread like a blanket over many thousand square miles of plains and mountain sides, have been regarded as wind-blown materials. The coarse material, as sand, is carried along near the ground and heaped in ridges or dunes.

CHEMICAL PHASE OF WEATHERING.

So far the changes noted have been entirely physical—a mechanical breaking up of the rock. But, while this is the prominent phase of weathering on mountain tops and in desert areas, it is but the first step in a series of changes by which soils are formed. The next step is chemical, which brings about a decay of the rock, a change in its composition.

Not Prominent on Mountain Tops or in Deserts.—We have noticed that the conditions most favorable to breaking up of rock are those of cold dry climates. Just the reverse conditions of moisture and warmth favor chemical decay of rock. However, chemical decay of rock does take place in deserts and on cold mountain tops, as seen in the stained and discolored surfaces after exposure to the weather. It is not prominent because the physical changes are so much more rapid that they over-shadow the chemical.

Conditions.—The atmosphere is a mechanical mixture of gases. Its principle constitutents are Nitrogen, 79%, Oxygen, 21%, Carbon Dioxide, about 3 parts in 10,000 of the atmosphere. These are practically invariable in amount. A fourth important ingredient is water vapor, which is very variable at different times and in different localities. Of these constitutents nitrogen is inert, while the other three play important parts in rock decay.

A new steel ax will remain bright indefinitely in a perfectly dry air, but if the air be moist the ax will rust within a very short time. In this case the water and oxygen of the air have united with the steel forming a yellowish brown coat of iron rust, which is a hydrated oxide of iron. In the same way rock in a perfectly dry atmosphere would undergo little if any chemical change, but placed in a moist air would slowly undergo decay, the nature of the change taking place depending upon the composition of the rock. Moisture then is a necessary condition of rock decay. This moisture is furnished by the rain falling upon and sinking into the rock. Rainwater always absorbs oxygen and carbon dioxide in falling through the atmosphere, so that some one, or perhaps all three, of these agents attack the rock on coming in contact with it.

Why More Active in Valleys than on Mountain Tops.—We can readily see now why the exposed rocks of mountain tops undergo chemical changes slowly. The rocks being bare hold but little moisture, most of that falling upon them flowing away; the wind and the sun soon dissipate by evaporation what remains and the surface of the rock quickly becomes dry, before the agents have had time to attack effectively. After the rock has been broken up and dislodged from the parent ledges by the agents already discussed and lie in blocks of large size as talus slopes against the base and sides of the mountain, the surface exposed to the atmosphere is much greater than before and the attack of the chemical elements in the water of the atmosphere becomes more active, the greater activity being due to two causes: First, on account of the greatly increased surface; second, because the blocks lying in a heap will retain more moisture than the same rock in an exposed ledge. All rocks absorb some moisture when exposed to rainfall and the larger the surface the greater the absorption in the same kind of rock. A solid block of rock three feet square presents a surface of fifty-four square feet; the same mass broken into blocks one foot square will present a surface of three hundred and twenty-four square feet. The absorption increases even in a greater ratio, as will be explained presently, and since atmospheric water always contains oxygen, carbon dioxide, and minute quantities of nitric acid, with the water the rock absorbs into itself the elements that promote decay.

From what has already been said it is evident that the finer the division of the rock the greater will be the surface exposure, and the greater the absorption and consequent chemical decay. But another factor enters into the problem here. Large blocks, loosely thrown together in the manner seen in talus slopes, have open spaces and cavities between them that allow free circulation of air, and since the air of mountain tops and of arid regions where the talus slopes occur most commonly, is usually dry, even though rain should fall and moisten the exposed rock surfaces, the ready passage of drying air soon evaporates the moisture and leaves the surfaces dry. Hence chemical activity, which is dependent on moisture, is comparatively insignificant in its results. We have seen that the tendency is for the larger blocks to break into smaller ones and these crack and shell off still smaller fragments, with the result that the pieces lie more closely together and the little fragments fall into the interspaces, clogging and finally filling them. As a consequence the water that falls finds large absorptive surfaces as it percolates among the small close-lying particles, and the drying air circulates with such difficulty that before it has time to dry the rock chemical decay sets in actively.

As the rock matter of mountains moves farther and farther down the slopes, it is broken into finer and finer particles, and at the base of the slopes and spreading into the valley flats the material has become so finely divided and the particles lie so closely together that the moisture is perennial, that of one rain not being entirely dissipated before the next renews the supply. The rock particles being therefore subjected to continuous chemical action, crumble and decay into soil. Materials from the slopes are constantly being added by the heavy showers which wash down the finer loose particles and spread them out on the flats.

Hydration.—One of the processes of rock decay is the union of water chemically with certain mineral constituents of the rock. This is called hydration, and by it the mineral usually becomes softer and more soluble. Limestone becomes soluble because of a union of its elements with water containing carbon dioxide. Most of the potash and alkalies contained in the true soils result from the solution of certain hydrated minerals called zeolites.

Oxidation.—Atmospheric water always contains in solution oxygen gas with which it attacks everything oxidizable. Iron is a very abundant element in most rocks and is readily attacked by oxygen; so also to a somewhat less extent is magnesia. Most igneous rocks are very complex in constitution and are generally quite readily attacked by these chemical changes, the changes resulting in some of their constitutents being reduced to solubility and the whole mass crumbling to soil.

Carbonation.—In the case is igneous rocks, while oxygen attacks some compounds, as above noted, carbon dioxide unites with others producing carbonates which are dissolved out. A ferro-magnesian silicate with lime, as diorite, may on weathering become coated with a white film of calcium carbonate. It seems possible that primarily all the calcium carbonate of the earth may have been derived from the decay of igneous rocks.

We have made thus distinct the two prominent steps involved in soil formation, the first being physical, the second chemical. By the first the rock is broken up and comminuted to a degree of fineness to hold water; by the second this water holding in solution the active elements of the atmosphere attacks the large surface exposed by the particles collectively, reducing some of the rock matter to solution, the rest crumbling to fine soil. While we have discussed the two steps separately, and used the mountain to illustrate the distinctness of the two phases of weathering, and how the chemical is largely dependent on the mechanical process, let it be borne in mind that both processes go on all the time and everywhere. We seldom see the two so well differentiated as on the slopes of a high mountain. On the bare ledges of rock where the chemical phase is not apparent, it is feebly active but masked by the much more active physical phase. At the base where the particles are very small the physical phase is not entirely quiescent, but here the chemical finds its best conditions and over-shadows the other. In desert regions conditions akin to those on the mountain top exist, and physical weathering is dominant; the reverse is true in warm, moist climates, as at the base of the mountain, the chemical activities being far more apparent than the physical.

Vegetation and Humus.—A true soil consists of more than finely divided rock matter in a process of decay; humus, or decaying vegetable matter, is also present. When the rock particles, as at the base of the mountain, are fine enough to hold moisture, chemical decay becomes active and the mass will hold in its pore spaces water having in solution not only the atmospheric gases but also soluble rock matter. The seeds of plants find lodgment, absorb the moisture and germinate; the root penetrates the mass absorbing the water and mineral solutions, the stem shoots up and spreads the leaf into the air. Plant life is established. Other forms invade the area, and the usual struggle for possession begins. Year by year and century by century the remains of plants living and dying upon the spot become mingled with the rock particles. In course of time the surface for several inches or feet in depth become darkened and mellowed by this addition and the more complete decay of the rock. The water contains, besides the mineral matters in soluti n, humus derived from the decaying vegetation. This mass has now become a true soil and should man take possession of it for his own crops he would find it strong and productive.

How Soils are formed on Level Surfaces.—So far this discussion of soil formation has described the process as it occurs on a mountain side. But most of the soils of the earth have not been formed on mountains, but upon low and comparatively level lands; and this is especially true of Mississippi, where no mountains exist. What then is the difference in the process acting here rather than on mountain sides? The two phases of weathering—physical and chemical—are active here as there, but very unequally, the physical or mechanical breaking up of the rock being inconspicuous, while the chemical decay is prominent. Joint cracks and fissures in the rock allow the frosts to get in and increase the spaces for water to enter and work the destruction of the rock. Changes of temperature assist. But, altogether the changes are silent and inconspicuous, the processes of rock decay progressing deeper and deeper, a section presenting every step in the transition from perfect soil at the surface through imperfect soil and rotten rock to perfect rock several feet below.

How Vegetation took Possession of the Rock.—If we imagine the original surface to have been solid rock these changes must have come about very slowly. Long exposure to sun and storm and frost would cause some less resistant parts to crumble slightly. The wind would sweep away, or the rain would wash the loosened grains of rock dust, and wherever a slight depression occurred, even though not larger than a thimble, some of it would be deposited. This little pit would conserve moisture to a slight extent after all the other rock surface was dry, so that rock decay would progress there more rapidly and the quantity of loose particles would increase. Soon the spores of some low plants, as lichens and mosses, would take possession of these little spots and germinate. A growth of these plants would further conserve moisture, their rhizoids would penetrate some little depth into the rock, and their bodies would, year by year, contribute some decaying vegetable matter; all of which would further promote the decay of the rock and would produce a beginning soil.

These colonies of low plants would gradually spread from the original foci, and, little by little, as the years and even centuries passed, would eventually take possession of the whole surface, make a deeper and more perfect soil, and so prepare the surface for a higher growth of vegetation. Conditions necessary for the higher types of plants are more moisture, greater depth of soil and more humus. When the pioneer mosses and lichens have prepared a soil suitable for higher types these latter gradually supplant them in a great measure, driving them to the least favored spots. Ordinary low herbaceous plants succeed the lichens and mosses and further prepare the soil by adding depth, moisture and humus for a growth of shrubs, and these in turn for trees.

Trees require the greatest depth of soil in order that the roots may give the trunk firm and safe support. Until such depth of soil is attained under the action of lower forms, trees cannot exist. Hence the trees, especially trees in a forest, represent the highest type of plant covering for the soil. Under the forest cover maximum of moisture is conserved, maximum of humus is supplied, and maximum rate of rock decay results. We may be sure that forests did not first possess the land, but came after a long period of preparation of the soil.

Undoubtedly in much of the southern part of Mississippi, the gradually emerging sea bottom was an expanse of unconsolidated sand beds—they are yet only partly consolidated—and the earliest vegetation perhaps underwent a somewhat different development. Pure sand is always a sterile and usually a dry soil, so that the first plants, while perhaps not lichens were drouth-loving herbaceous species, capable of subsisting upon a minimum supply of water and plant food. These, by the addition of humus, prepared the way for shrubs and later for trees.

The cone-bearing trees are the great xerophyte or drouth-enduring group of trees, hence the trees to take first possession would naturally be pines and related conifers. In such a soil evolutionary changes would progress slowly. The whole region is still in the pine stage, but had conditions remained undisturbed, after long periods of time the pine forests would have added humus until the soil would have been enriched with sufficient plant food and moisture to support hardwood trees, which would have eventually supplanted the pines. In fact, we have much reason to believe that the northern parts of the State have passed through the pine stage at an earlier period, the invasion of hardwoods having proceeded from the older lands to the north.

Soils Differ as to Water Content.—It is a well known fact that soils differ very materially in texture, some being fine, some coarse. As a rule rocks that weather easily produce fine or Pelogenous soils, those that weather with difficulty produce coarse or Psammogenous soils. The first retain moisture readily and usually support a dense growth of vegetation, the last are dry soils, and support scant vegetation of distinct desert or Xerophytic type. Hence sandy soils have pines, clay soils beech, maples and oak.

Transported Soils.—So far our discussion has referred only to residual soils—those derived from the decay of the rocks *in situ*. There is another important class known as transported soils, which occur extensively in Mississippi. These consist of materials, the product of rock decay, which have been carried to a greater or less distance from their place of origin and redeposited. They differ very much in character and fertility according to the agent carrying them.

Wind in dry regions and on exposed coasts carries along and deposits sand in ridges and hillocks called dunes, which gradually shift to leeward, to be followed by others from the same source. Their agricultural importance lies in the fact that they sometime invade and destroy the fertility of fields. In some regions wind has lifted and transported to great distances in the upper currents of air large quantities of fine dust, which on redeposition have enveloped thousands of square miles of territory with a mantle of tawny impalpable material from scores to hundreds of feet in thickness. Such is the loess of northern China. The bluff formation bordering the Mississippi River flood plain is possibly a wind deposit made during a recent geological epoch.

Ice in the form of great continental ice sheets, has left extensive deposits of fertile soil in the moraines found in most of the northern States. Ice deposits, however, do not occur in Mississippi. Water is the most important agent for transporting soils. Lakes sometimes exhibit wide flats bordering them; or a former lake may have entirely disappeared leaving a broad flat in its place. The flats in both cases represent transported soils brought in by rivers and deposited upon the bottoms of the lakes, after which the lakes subsided or disappeared, leaving the bottoms exposed. These soils are usually very fertile.

Deposits by the sea are usually beaches, bars and spits of sand or coarse material, and are not fertile. In certain restricted spots, however, as in the Bay of Fundy, mud flats are deposited by the tides, and prove fertile and useful.

River deposits are the flood-plains and deltas of streams. The Yazoo-Mississippi flood-plain, constituting nearly one-fifth the area of the State, and the flood-plains of all the streams of Mississippi, are examples of this type of soil deposit. These embrace the richest soils in the world. Besides the delta of the Mississippi, the flood-plains of the Amazon, of the Ganges, of the great Yellow River in China, and of the Nile, are world famous for their inexhaustible fertility. Flood-plain soils are especially rich in humus. This is due both to the decay of vegetable matter annually brought down by freshets and to the dense forests that usually occupy these soils.

Relative Importance of Chemical and Physical Properties of Soils.—For a long time the study of soils was chiefly an investigation of their chemical properties, but of recent years much attention has been given to the physics of soils, until now the physical properties are regarded as of supreme importance. Since sufficient water is an indispensible condition for plant life, an adequate water content of a soil under normal conditions is far more essential than the holding of any particular chemical ingredient. We have already learned that soils are the insoluble residue of rocks which have undergone decay by weathering. The most insoluble ingredients of rocks are Silica (sand) and Silicate of Alumnium (clay), hence, as nearly all ordinary rocks have some of these two, the soils to which they give rise are very largely sandy or clayey, as mentioned in a previous paragraph. Limestone usually has enough clay to give rise to distinctly clayey soils. Sand holds water poorly, so that a pure sand soil is a very dry soil. The reverse is true of clay; it holds water too tenaciously, so that a pure clay soil is very liable to be too wet. A proper mixture of the two, forming a loam, possesses the objections of neither, and is an ideal soil. Such a soil in a moist climate nearly always supports a dense native growth of vegetation, and under cultivation will produce a greater variety of farm crops than any other. Furthermore, if not improperly used, it nearly always contains all the essential chemical elements of plant food.

The distribution of plants in any given locality is determined very largely by water supply, and since the texture of soils control as the chief factor the available water content, this distribution will be found to conform closely to the different soil types. Certain plant associations will be found to occupy the sandy areas, certain others the wet clayey soils, and still a different assemblage will be found on the loam. Under certain extreme conditions the chemical content of a soil may supersede the physical influence and impress upon its vegetation a peculiar facies or aspect. This is true of the so-called Halophytes, or salt water plants. In these cases the soil is saturated with the salt water of the sea, such as only specially adapted plants can endure. We have a similar case in the alkali plants of the West. But these are rare cases, apparent exceptions to the rule. Even here, however, the problem is in part, at least, a physical one, the osmotic currents setting out from the dilute sell sap of the plant roots towards the concentrated solutions bathing them, tending to impoverish the plant of its water, force it to develop protective structures such as are usually found in plants of dry soils.

PREPARATION AND TREATMENT OF SOILS.

Having outlined in some detail the nature and origin of soils and discussed the steps of the process by which they have been developed, it will be in place here, before entering upon a description of the soils of the State, to briefly consider the methods of preparing and treating soils for crop production. Let it be remembered that under natural conditions undisturbed by man soils tend to become more and more fitted for higher vegetation. As already stated, when the soil has reached proper depth and retentive power for water, trees take possession of it in those regions where the rainfall is sufficient to support tree growth. There are seeming exceptions to this, but, perhaps only seeming—given sufficient time and complete withdrawal of man's influence, and the rule just stated would almost surely apply.

Trees in a forest are the highest natural assemblage of plants that can occupy a soil, and so far from exhausting the soil of those elements which constitute plant food, the persistence of the forest ensures the perpetuation of a good soil. In fact, a forest is the best natural soil-maker, supplying year by year a larger proportion of humus which furnishes nitrates and potash and renders soluble and therefore available phosphates contained in the soil.

Plant Food.—The roots of trees reach far and wide and penetrate deeply into the subsoil, taking up and elaborating into the tissues of trunk, branches and leaves the minute quantities of plant food found there. The tree in its growth must have certain proportions of iron, lime and magnesia. These in minute quantities and in very dilute solution its roots search out and take up from the soil and subsoil. More important even than these it needs phosphoric acid, nitrates and potash, else new growth in the spring could not take place, and fruit could not be produced to perpetuate the species. All these are obtained from the soil, and are eventually returned to the soil. The annual fall of the leaf and twigs and eventually the death and decay of the tree itself returns what for centuries, perhaps, it has taken from the ground and air, with this difference, however, that what was brought up from considerable depths is deposited at the surface. And so, successive crops of trees growing and dying upon the same spot for many centuries prepares and enriches the soil for any crops man may later desire to plant.

Soil Bacteria.—The soil is swarming with minute vegetable organisms which promote decay. But for them the bodies of plants and animals that have long since disappeared and become incorporated with the soil would still cumber the earth. They are microscopic in size and occur in countless millions everywhere in the surface soil. They particularly abound in the first few inches of dark soil, rich in vegetable matter, and are not found at any great depth beneath the surface. Nitrification is one of the most important soil processes to the agriculturist, and is directly due to the action of these bacteria. By it is meant the series of changes by which the nitrogen of organic tissues in decay, first converted into ammoniacal compounds, is then reduced to the condition of nitrates. It is only as nitrates that nitrogen is available as plant food, and since nitrates form the most needed element of plant food, the importance of the process will be readily understood.

The first act of man in reclaiming an area to cultivation is to remove the forest and so destroy the factor most potent in enriching the soil. This, however, must be done in order that his crops may grow. None of the staple farm products will grow among the trees of a forest. The ground must be prepared for them and care taken of them during growth until maturity, in order to get full returns.

Corn, oats, wheat, rice, cotton, are none of them natural growths, but might appropriately be called pampered monstrosities. Found growing in a natural condition at some remote period, man found them useful for his purposes as food and clothing. In the wild state he used them, and undoubtedly soon learned to gather a store for winter use, when the usual supply was gone. Some of these seeds, dropping by accident about his primitive dwelling, perhaps suggested to him the idea of planting a supply conveniently near. Perhaps cutting out or pulling up undesirable weeds and the other growth to prevent the choking out of his favorites taught him the benefits of cultivation.

Most primitive people have learned at least the first lessons of agriculture and have their crops which they cultivate in some rude fashion. The Indians of this country had their patches of corn and beans. They had learned not only the necessity of tillage, but had discovered that a fish placed beneath each hill of corn would insure a better yield; thus, without knowing why, they had come to appreciate the benefits of fertilization.

Thus the usual crops of man have been bred up by a process of selection through countless generations from a stock that grew naturally, as any other wild plant, and made a small yield, to a refined product requiring careful cultivation and fertilization (i. e., supplying artificially certain chemical elements which the growing plants exhausted from the soil), yielding a hundredfold more abundantly a better quality of the desired fruit. But, in order to do this, the land must be thoroughly prepared and cultivated and in many cases fertilized.

Clearing the Land—Most of the lands of Mississippi were originally covered with forests that had to be removed before the soil could be cultivated. In much of the prairies of the eastern counties the land was open and only required the turning of the prairie sod to prepare it for cultivation. This is also true to a limited extent of the Jackson Prairie Belt, extending southeastward across the State from Jackson and Canton.

In the forest areas the bottom lands offered more impediment to clearing than the hills because of greater density of growth, in places the undergrowth being excessive and intricately matted together with various species of grape, and other vines. In clearing these lands the custom has been in many places to cut out the undergrowth and smaller trees, and, owing to difficulty of separating them, felling them all in one direction in windrows. This is generally done in the fall and winter when other farm work is suspended. The larger trees are girdled, except such as are sawed down and used for building or fencing. In the following spring the fallen brush is burned off and the land plowed with a small turning plow, to the beam of which a coulter or blade is attached to cut the roots.

The hill lands are treated in the same way, except that the smaller trees and brush are piled in heaps and burned in the spring.

This is rather the custom that has been followed in the past than present practice. The girdled trees, of course, are killed by the treatment received, and, unless cut down, eventually rot and are blown down, when their remains are piled around trunks still standing, and the whole burned. Now, however, trees are too valuable to destroy in this way and the practice is to sell the merchantable trees before clearing, except in localities inaccessible to the mills.

About one-third of Mississippi is embraced in the Long Leaf Pine Belt. What has been said above does not apply in this region. The whole region is, or has been until recently, covered with a forest of almost pure pine, mostly the long leaf species. Farming has been rather sparsely practiced in this region in the past, and then for the most part along the stream bottoms. For the past twenty years lumbering has been the chief interest, and the increasing demand, coupled with the very evident approaching exhaustion of the timber supply, has awakened the people to the value of their timber, though much of it slipped from them before a realization of its importance came to them. There had never been much clearing of the pine lands until the advent of the lumberman.

Now, however, very large areas of these lands have been denuded of timber and are being reduced to cultivation. The stumps stand so thick on the ground that their removal must precede satisfactory cultivation, and has become a serious problem. Very rich in pitch, they resist decay indefinitely, and possessing a deep tap-root they are difficult to remove with stump lifters. They

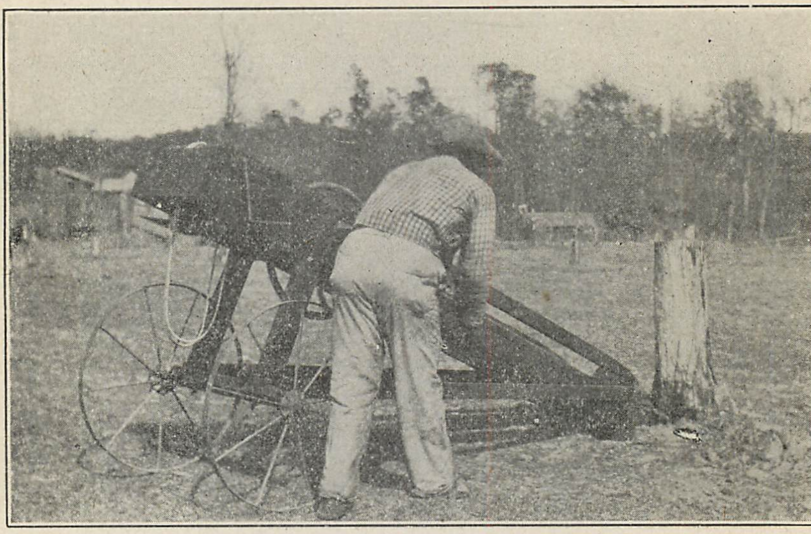


Fig. 1. The Day Boring Machine.

have been blasted out with fair success. Burning, however, has proved the most satisfactory way of getting rid of them. J. W. Day of Crystal Springs, Mississippi, has invented a contrivance by which a two-inch auger hole is made slanting down through the stump coming out below the surface of the ground on the opposite side from point of entrance. An excavation a foot deep is made at this opening, serving as a sort of furnace. Some pitch splinters and knots are put into it and ignited. The flames are drawn up through the hole as through a chimney flue, and the stump is readily burned out.

At the McNeil Experiment Station this method has proved the most satisfactory and least expensive of any tried. Mr. Ferris calculates the expense at $8.00 per acre.

It has long been a custom in Mississippi to farm new grounds among the stumps until they finally rot away, or by piling brush around them burn them away, a few each year. There is no economy in this method of farming. The stumps should all be removed as quickly as possible so that the land can receive thorough tillage, and to do this some such method as that described above, or the use of stump pullers, should be resorted to. No crop can be satisfactorily cultivated among stumps and tree trunks. Labor saving machinery and improved methods of culture cannot be employed, and the farmer who denies himself these is depriving himself of the best fruits of his land and will surely be distanced by his more thrifty neighbor who does use them.

Drainage.—While a sufficiency of water is absolutely necessary for all farm crops, an excess of water in the soil is hardly less harmful than not enough. Under two conditions the soil may remain permanently saturated with water. An area may lie so much lower than surrounding regions that ground water comes to the surface, giving rise to a marsh or a swamp; or an area may lie so level that surface water fails to run off readily, and the underlying soil is dense and tenacious, preventing its sinking. Typical bogs, such as occur so abundantly in the glaciated regions of the North, do not occur in Mississippi.

Soils so saturated with water are said to be cold and produce very poorly. Most usually they are sticky and clayey, generally dark gray or bluish in color, and acid in reaction. The color and acidity are due to the imperfectly decayed organic matter and to the protoxide condition of the iron content of the soil, both of which conditions may be removed by drainage. While iron is essential to plants, in the protoxide state it is distinctly harmful.

The roots of plants require oxygen which is contained in the air that circulates in a properly drained soil. If the soil is saturated with water, however, the air cannot reach the roots to supply them the needed oxygen. Conditions are unfavorable to the growth and development of those bacteria that promote decay of organic matter, mellow the soil and supply the fertilizing nitrates.

Such a soil must be drained before it can be successfully farmed. Once drained the blue acid iron protoxide becomes oxidized into the yellow peroxide which plants can use; the peaty condition of the contained vegetable matter becomes changed into available humus, a valuable plant food; the nitrifying bacteria take possession and begin busily to prepare a rich mellow soil. The physical properties of the soil change entirely; from an acid, blue, heavy cold soil, it becomes loamy, brownish in color, warm and living, capable of supporting abundant life.

Contrary to the impression obtaining in most parts of the country, Mississippi is not a low-lying flat, swampy region. The topography of the State is, with the exception of the Mississippi flood plain, rolling or hilly and the natural drainage is perfect. There are, indeed, in nearly every county some low wet stream bottoms that require drainage, but in these cases the problem is a very simple one. Ditches are constructed of sufficient size and at close enough intervals to carry away the excess of water. These should be deep enough so that the water will drain from the soil to a depth of two or three feet, or even more. Tile drainage is, as yet, practiced to a very limited extent in the State, but will undoubtedly gradually supplant the open ditch. The first cost of laying tile is considerably greater than that of digging ditches, but in the long run tile will prove more economic. In the first place there is a saving of land; this has not been an item of importance in the past, but will be in the future. The amount of land taken up by open ditches and the fringe of weeds and shrubs that are usually allowed to grow up for several feet on either side, will, in the near future, be accounted as too much of a waste of land. The tile once properly laid, requires no further attention for a life time, whereas the open ditch must be cleaned out and brush cut at least once a year to be effective.

The real drainage problems of the State are those of the Yazoo-Mississippi Delta. This is a vast alluvial plain of about 5,500,000 acres, the fertility of which is not surpassed by that of any region of the globe. About one-third is now in cultivation and most of the other two-thirds can be brought to cultivation by proper drainage. This has been one of the most tardy sections of the State to develop, owing to the fact that up till within comparatively a few years occurrence of periodical inundations of the Mississippi River discouraged settlers. Since 1887 a complete system of levees has been built, and overflows no longer occur, with the result that the region has developed rapidly along all lines, and is now one of the richest sections of the State. Owing to the overflows of several large tributaries, however, large areas still lie unoccupied and unproductive.

In 1906 the Mississippi Legislature passed the Alcorn Act, which authorized the creation of the Tallahatchie Drainage District. This was an epoch-making piece of legislation, and already several other drainage districts have been formed under acts copied after this law. The district is established by a vote of the land-holders within the prescribed area, its boundaries are surveyed, and its organization is effected through an elected drainage commission. This body has a topographical survey made of the district, the streams gauged, rainfall measured, and a great mass of detailed information upon which a very accurate and detailed map of the area is made. Their engineers plan the proposed system of mains and laterals. The people of the district vote bonds to raise funds for construction and the commission float the bonds and let contracts for the work.

The Tallahatchie Drainage District embraces seven counties (or parts of counties) in the Northern part of the delta. Its area is about 1,900 square miles. The drainage plans first proposed by the engineers of the commission involved the clearing of present stream channels and construction of new channels, with a view to facilitate the flow down the Yazoo and Tallahatchie Rivers so as to prevent overflow. The estimated cost of carrying out their plans was $5,287,000. Strenuous objection was raised to the plans, both on account of the heavy cost and because of the fear of the land-holders on the lower Yazoo and Tallahatchie that the floods hurried through the upper streams would be precipitated upon them to their harm instead of benefit.

New plans were finally submitted by which the flood waters of the Coldwater, a tributary of the Tallahatchie, were to be diverted northward into Horn Lake and thence into the Mississippi. Since about one-third of the flood waters flowing down the Tallahatchie were from the Coldwater, this change would remove the dangers found under the previous plan, besides which the cost as estimated would be about $2,000,000 less, removing the other objection.

Under both plans the details were to be worked in units of smaller areas—several in each county, by which the drainage of each unit was to be concentrated by numerous smaller channels and emptied into the mains.

The estimated cost per acre of these drainage plans is $4.50, a sum very small indeed compared with the benefits which will be received, and it is to be hoped that matters will be adjusted so as to permit the carrying out of these, or some other general drainage plans.

Undoubtedly most of the detail work of draining the delta lands will be by tile drainage. In certain localities conditions favor a method of underdrainage that has not a very wide application. When sand beds lie a few feet beneath a dense sticky clay surface, as in some of the lower swamp lands, and the streams of the area flow considerably below the surface level, wells might be bored through the clay and the swamp water drained away through the underlying sand beds. "The Indiana Station (Experiment Station) has shown that in case of the black soils of that State, which are probably representative of a class, tile drainage is effective only when the sand and gravel, which underlie such soils, are tapped. By sinking into this underlying layer of sand, or gravel, a series of wells which are connected with tile at the depth of which it is desired to maintain the water level, the soils may probably be thoroughly drained without difficulty."

Tile drainage is now practiced in the delta much more extensively than anywhere else in the State, but with the development of the great drainage schemes it will come very much more into use. "Will it pay?" may be asked. The nature of the soil will determine the distance apart of drains. If the land is already partly drained, the drainage may be completed at a cost of $5 to $8 per acre. If the drainage must be entirely by tile, the lines being placed 100 feet apart, the cost will be about $12 to $15 per acre; if the soil is more clayey, requiring drains 33 feet apart, the cost will be $22 to $30 per acre When it is remembered that the result of this will be to reclaim a useless swamp into a field worth $100 per acre and producing 75 bushels of corn or one and half bales of cotton to the acre, it becomes evident that the investment will pay. It should be remembered, too, that the tile once properly laid will last for a lifetime.

C. G. Elliott, drainage expert, U. S. Department of Agriculture, in "Drainage of Farm Lands," says: "The writer has known of many thousands of acres of land that have been drained, and has never known of an instance in which the money spent for drainage, when thoroughly done, did not pay a large return on the investment. An annual profit of 25 per cent is not at all uncommon.

"A 20-acre field, which usually yielded only 25 bushels of corn per acre, was tile-drained at a cost of $10 per acre. The yield after drainage was not less than 60 bushels of corn per acre, and the yield of the other crops in the rotation was in proportion. This gain of 35 bushels, at 30 cents per bushel, the selling price of corn at that time, paid for the entire cost of drainage the first year." Many examples like the above could be cited showing the practical value of drainage.

Fertilizing.—Cultivated crops make heavy drafts upon the plant foods contained in the soils. It is a matter of common knowledge that with long cultivation of one crop a soil becomes impoverished of certain elements of plant food used by that crop, and though all the others may be present in the soil in sufficient quantity, yet the crop fails because of the lack or insufficient amount of that one.

Of the plant foods, nitrogen, phosphoric acid, potash and lime are those liable to be exhausted—the others are nearly always present in sufficient amount. Soils in the virgin state may be deficient in some one or more of these. Sandy soils, for example, are very liable to be deficient in all four, and are ordinarily considered sterile soils, though notable exceptions occur. The sandy soils of Mississippi are especially deficient in phosphoric acid, but have potash enough, and in some of the southern counties are remarkably high in humus, and hence of nitrates. Clayey soils, especially of swampy areas, are liable to be acid, lacking lime, and the organic matter is acid and unavailable.

As has been stated in previous paragraphs, a swamp or muck soil must first be drained properly as a preliminary to other treatment reclaiming it to cultivation. These soils are usually peaty, too high in organic matter and deficient in mineral matter, especially phosphoric acid and potash, and the organic matter is in unavailable condition. Hence, while drainage will promote aeration and nitrification, lime must be added to correct this acidity and to assist in these changes. Application of wood ashes and stable manure will add the other desired elements and improve the physical condition of the soil. These should be incorporated with the soil by turning in with a plow, and the land allowed to stand for a while before planting, then oats, corn or potatoes had better be the first crop.

When soils have been depleted of these plant foods by long and continuous cultivation, the remedy must be in fertilization—that is, supplying artificially the nitrogen, phosphoric acid and potash in such a form as to be available to crops. It may happen that these elements exist in the soil, but if they are not in available form, the crops cannot profit by them. For example, swamp and muck soils contain abundance of organic matter, but in an unavailable form until drainage permits the air to penetrate and warm it, and promote the growth of nitrifying bacteria which make it available humus.

Nitrogen is the most expensive of these three essential elements, and is supplied in artificial fertilizers in three forms—organic nitrogen, ammonia and nitrates. The value of nitrogen lies in its promoting a rapid and vigorous growth of vegetation. Under its application stem and branches become tall and robust and the leaves become dark green and luxuriant.

Organic nitrogen is that of animal or plant origin. Dried blood, tankage, fish scrap and guano are the chief animal sources. Dried blood and tankage are the products of slaughter houses; fish scrap is the dried residue after expression of fish oil; guano is the excrement of sea birds or bats. These are all not only rich in nitrogen, but contain a considerable proportion of phosphates. Cottonseed meal and castor bean pomace are the vegetable products most frequently used for their contained nitrogen.

These are not all equally available, but all have to undergo the nitrification changes in the soil before they can be used by the crops. In the transformation considerable waste occurs, especially during rainy seasons. Since the nitrifying changes do not occur all at once, but gradually, the effects of fertilization by then are prolonged beyond one season.

Ammonia Nitrogen, where found naturally in the soil, is derived from the decay of organic matter. In commercial fertilizers it occurs as sulphate or chloride and is a by-product of gas manufacture. It contains 20 per cent of nitrogen and is the most concentrated of ammonia compounds used in fertilizers. Like those mentioned above, it, for the most part, undergoes the processes of nitrification before becoming available to crops, but is very quickly soluble. When used in larger quantities an acid condition of the soil is produced, owing to the excess of sulphuric acid in the sulphate. This condition is less liable to occur in clay soils than in sandy soils.

Nitrogen in the form of nitrates exists in commercial fertilizers as Nitrate of Soda or Potash. Its chief source is Nitrate of Soda, known as Chili Saltpetre, derived from the arid plateaus of South America. Next to the Sulphate of Ammonia, it is the richest in nitrogen, containing about 15.5 per cent of that element. Both the nitrates are extremely soluble and directly available without change, so that crops show within a very few days the result of an application. Owing to their ready solubility, they are easily leached from the soil, especially in rainy weather. To avoid this loss it is best to apply it in small repeated applications rather than all in one large one. Ammonia, while also very soluble as a nitrate, before nitrification forms insoluble compounds in the soil which prevents leaching.

Nitrogen as *nitrates* is usually exhausted within a very short time; as ammonia it may last through a season, while the effects of application of the others will persist still longer. Owing to its immediate effect, the nitrate is extensively used in truck farming, applied at the time when most needed by the crop. Where a continuous effect throughout the season is sought, the other forms are better used.

Phosphoric Acid of artificial fertilizers is of mineral or organic origin, and exists as phosphates. It occurs in three forms: (1) Water soluble, (2) "Reverted," that is, slightly soluble in water, but readily available to plants, (3) insoluble, and therefore not available to plants without undergoing a chemical change in the presence of decaying organic matter.

The *Mineral Phosphates* are lime phosphate occurring as rock phosphate, pebble, boulder and soft phosphates of South Carolina, Florida and Tennessee. These are not soluble in the natural state, though when finely ground and mixed with a soil rich in humus, they may become available to plants. Before use, however, they are generally ground and treated with sulphuric acid by which they are changed to the soluble phosphate, acid phosphate, or super-phosphate. This contains 14 per cent of available phosphate. On application to the soil, soluble phosphoric acid unites with certain compounds by which it becomes fixed, and so is prevented from leaching out. In the presence of decaying organic matter it is reconverted to the soluble form and made available.

Organic Phosphates are derived from bone, tankage, guano and hardwood ashes. Raw bone contains 22 per cent of phosphoric acid, while the steamed bone has as much as 28 per cent. The phosphoric acid of steamed bone is more readily available than that of raw bone, the former becoming all available within two years, while that of the latter is not all available under four years. The solubility and hence availability is greatly increased by treatment with sulphuric acid. Tankage is very variable in composition, containing anywhere from 3 to 18 per cent of phosphoric acid, with which is always associated more or less of nitrogen, that richer in phosphorus being poorer in nitrogen.

Where crops show abundant and healthy growth, with little or no fruit, phosphate is indicated; where early maturity is desired, as in truck farming, phosphate should be used. Phosphoric acid encourages early maturing of fruit and increases the yield. The light warm soils of the southern counties of Mississippi are deficient in phosphoric acid, but with it added they become ideal trucking soils for the early markets.

Potash of fertilizers is chiefly derived from Kainit, a potash salt obtained from the mines of Germany, or the sulphate or chloride of potash derived from the natural salt. Kainit contains about 12½ per cent of potash, while the other two manufactured from it have as high as 50 per cent. Kainit is quite extensively used as such in fertilizers, though the sulphate is perhaps more generally useful. Kainit should not be used on tobacco lands, because of its contained sodium chloride, which injures the leaf. Usually potash is well applied on sandy lands where a sufficiency of lime exists in the soil. Clay soils respond less freely to its use. Numerous experiments seem to prove that the soils of Mississippi generally have sufficient potash for ordinary crops.

Potash increases the yield by protracting the growing and fruiting season.

The farmer in buying fertilizer for his land should know what he is buying. Unless he knows the composition of the fertilizer, he is in the dark as to whether he is getting his money's worth. Below is appended a method of computing values of complete fertilizers:

	Pounds per hundred.	*Pounds per ton.*	*Value per pound of constituents.*	*Value of constituents per ton of fertilizer.*
Nitrogen			*cents*	
As Nitrate	1	20	17.0	$3.40
As ammonia salts	1	20	17.5	3.50
As organic matter	1	20	18.5	3.70
Phosphoric Acid				
Soluble	8	160	4.5	7.20
Reverted	1	20	4.5	.90
Insoluble	1	20	2.0	.40
Potash				
Muriate	5	100	4.25	4.25
Sulphate	5	100	5.0	5.00
Total value per ton				$28.35

"The first figure column shows the per cent (pounds per hundred) of the constitutents contained in the fertilizer; the per cent multiplied by 20 gives the pounds per ton in the second column; the figures in the latter, multiplied by the schedule prices per pound in the third column, give the valuation per ton, as shown in the fourth column."

Until comparatively recent years, farmers of Mississippi refused to see the benefit of commercial fertilizers, the claim being made that they would "burn up the soil." Now the tendency is in the opposite direction of relying upon them too exclusively. Neither position is the correct one. While these fertilizers are invaluable adjuncts to our farming processes, it should be remembered that no soil can maintain its productiveness indefinitely on them alone, while an improper use of them may do actual harm.

Humus, or decaying vegetable matter, is essential to continual successful cropping of any soil. Commercial fertilizers do not supply this, while continuous cultivation, especially of clean crops, as cotton, rapidly exhausts it. Aside from the fact that humus is a rich source of nitrogen, it conserves moisture and improves the physical condition of a soil. Heavy clay soils are rendered mellow and friable, while sandy soils are made loamy. In the first case, the increased porosity of the soil facilitates natural drainage of excess of moisture, in the last retention of moisture is promoted, and both soils are better by the change.

While commercial fertilizers are indispensible, they should be used to supplement other processes by which a supply of vegetable matter is kept in the soil. One of the best ways to do this is by plowing under from time to time some green crop grown on the soil. The best crops for this purpose are some of the legumes, as clovers, vetch, cow-peas, or velvet beans. These furnish abundant vegetable matter which quickly becomes incorporated with the soil, and add large quantities of nitrogen as well.

Barnyard manure applied to the soil is one of the best methods of adding vegetable matter; but it does more than that, for stable manure contains all the elements of a complete fertilizer. It is undoubtedly one of the best of fertilizers, and its good effects persist for several years after application.

It has been estimated that the value of barnyard manure in the United States each year, if collected and properly utilized, would aggregate $27 for each horse or mule, $20 for each head of cattle, $8 for each hog, and $2 for each sheep. These values are obtained by estimating the quantities of nitrogen, phosphoric acid and potash at market prices, no allowance being made for the valuable humus added to the soil from this source.

No farmer can afford to buy what he can supply on his own place. Fertilizers are costly, and yet in barnyard manure we have one of the best of fertilizers that need cost nothing, but on the contrary is a valuable by-product of a most remunerative phase of farm activity—stock raising. No farm should be without its goodly stock of horses, mules, cattle and hogs. At present prices for all these, the attention Mississippi farmers have given to stock raising is surprisingly small. Stock should be penned, or even stalled, at night and the manure collected and preserved under sheds that will prevent its fertilizing elements from being leached out by rains. It should be kept moist to prevent fire fang, a fungous growth, and stirred occasionally.

When thus rotted it may be spread on the land and plowed under immediately before the planting. If put upon the ground fresh, it should be plowed under some time before planting so that it will have time to rot and mellow the ground before the seed is put in.

Crop Rotation.—The farmers of Mississippi, as well as of other Southern States, have so long devoted their attention to the growing of but one crop—cotton—with, until recently, a feeble pretense at raising corn, that a proper rotation of crops has been impossible. No land can be permantly maintained upon which but two crops are continuously raised. Each crop draws from the soil certain elements of fertility, and to prevent the exhaustion of these the crop must be changed. No crop should occupy the same ground for more than two years, and should not be returned to that ground until several other crops have occupied it. Another reason why one crop should not occupy the soil too long, is the increased liability to diseases of that crop. Insect and fungous diseases, especially, may multiply in the soil occupied by the same crop year after year, until that crop can no longer be raised with profit. It is believed further that the continuous growing of the same crop on soil gives rise to certain toxic substances in the soil that are deleterious to the crop.

It is evident, then, that a proper rotation of crops is imperative, and in order to have proper rotation several different crops will be necessary. In other words, our soils demand a diversification of crops, which is the only perfectly safe farming. As a part of our farming processes, it is absolutely essential to grow winter crops. It not only puts money in the pocket of the farmer, but utilizes soil fertility that otherwise would go to waste. In southern climates the soil does not become locked in the tight grip of ice, as further north; unfrozen practically all winter, and warm most of the time, the nitrification changes mentioned on a previous page, go on unchecked throughout the whole year. Nitrates are being formed all the time, and, being very soluble, are leached out by the winter rains unless the soil is occupied by a growing crop to utilize them as they are formed.

A proper rotation would depend upon several factors, the most important being soil and climatic conditions, as well as the particular line of farming which it is desired to emphasize—cotton raising, truck farming, fruit growing or stock raising. For a discussion of these the reader is referred to the bulletins of the various Experiment Stations in the State.

GEOLOGIC STRUCTURE OF MISSISSIPPI.

Devonian.—The oldest geologic formation known to outcrop in the State is the Devonian of the Paleozoic System. In the extreme northeast corner of Tishomingo County occurs a series of dark blue limestones overlaid by black shales, which are exposed in the gorges of small streams tributary to the Tennessee. These have been determined to be equivalent to the New Scotland beds of New York, and represent the base of the Devonian. Since they are exposed only toward the bases of the deepest ravines and form no part of the land surface, they have no significance as soil formers.

Mississippian, or Lower Carboniferous.—This overlies the last in the same region, but outcrops more extensively. It consists at the base of beds of siliceous chert, crushed and highly jointed by pressure.

Resting upon this is a series of blue and gray limestones, more or less fossiliferous, the outcrop extending farther south. At the top of the Carboniferous is a massive sandstone outcropping along Bear Creek, Bull Mountain Creek and the headwaters of the Tombigbee.

The Carboniferous, like the Devonian, is exposed chiefly along the stream channels of Tishomingo and

Itawamba counties, the intervening divides being covered by later deposits.

Cretaceous.—(1) Tuscaloosa. A decided break occurs between the rocks of the Carboniferous and those of the Cretaceous which lie upon them. The record is not complete; a long period intervened between the deposition of the two groups.

The Tuscaloosa lies upon the Carboniferious, hiding it from view except in very limited areas, as just stated. This formation enters into the making of soils over a considerable part of the Tennessee River Hills, which embrace all of Tishomingo and Itawamba counties, and parts of Alcorn, Prentiss, Monroe and Lowndes.

The materials of the Tuscaloosa consist of clays and lignites in the lower part and unconsolidated sands and gravels in the upper part.

(2) Eutaw. Overlying the Tuscaloosa are the Eutaw sands variegated in color and micaceous, becoming in the upper part greenish and decidedly calcareous. They enter into soil formation in the western part of the Tennessee Hills, extending to the Tombigbee.

All these formations dip or incline westward and southward, so that the outcrop or surface exposure of each newer formation must lie farther west and south than the next older one. Since they all dip in the same direction, a boring through the Eutaw would strike first the Tuscaloosa and then the Carboniferous and finally the Devonian.

The outcrop of the four formations described has undergone extensive erosion, and constitutes a region of high rough hills, of sandy soils for the most part, which lies in the northeast part of the State and called the Tennessee River Hills.

(3) Selma Chalk. This was formerly known as the Rotten Limestone. It is a soft white to bluish gray lime rock, which rests upon the Eutaw sands. The lower portion of the formation is decidedly sandy; the middle part is known as "blue rock" and contains a very con-

siderable quantity of clay. The upper part is nearly white and has a high per cent of lime. This, like the other formations, dips gently toward the west and south. It is several hundred feet in thickness and hence its outcrop is broad, constituting the Black Prairie Belt of northeast Mississippi. The black prairie soil is a residual soil from the limestone. Topographically the region has slight relief and lies considerably lower than the more sandy formations east and west.

(4) Ripley. This, the uppermost group of the Cretaceous outcrops, as would be expected, along the western border of the Black Prairies from the line of Tennessee to the town of Houston in Chickasaw County, where it disappears beneath younger formations.

The material of the Ripley consists of beds of sandstone and sandy limestone toward the base of the formation, above which lie blue micaceous marls, which are highly fossiliferous, and outcrop typically on Owl Creek near Ripley in Tippah County. In places micaceous, limey sandstone forms the top of the formation.

The outcrop of the Ripley constitutes a very distinct and prominent topographic feature of the northeast part of the State. It is a range of high, rugged hills, known as the Pontotoc Ridge, the soils of which are for the most part intensely red and sandy. This characteristic is particularly noticeable around the town of Pontotoc.

Tertiary—(1) Midway. The lowest member of the Midway formation consists of 10 to 15 feet of hard limestone studded with a species of spiral shell called Turritella Mortoni; whence the rock is known as the Turritella limestone. Lying above this is a variable thickness of micaceous yellowish sands. Both these enter into the western edge of the Pontotoc Ridge.

The Porter's Creek Clay is a tough gray joint clay, which overlies the formation just described and constitutes the chief member of the Midway. Its outcrop is a low flat region skirting the Pontotoc Ridge on the west, thence passes south along the western border of the Selma Chalk, then passes eastward out of the State in Noxubee and Kemper counties.

This outcrops in a narrow belt, 3 to 6 miles wide, occasionally expanding to 12, and is known as the Flatwoods Region.

(2) Wilcox. Occupying all the broad areas of north central Mississippi is the Wilcox Formation. It is broadest at the Tennessee line, extending across three counties, and gradually narrows southward, bounded on the east by the Flatwoods and on the west by the Bluff Hills overlooking the lowlands of the Delta. About midway its length it is crossed by the Southern Railroad, Maben and Winona being approximately on the east and west borders. Thence it curves slightly eastward and passes out of the State through Kemper and Lauderdale counties, having here about half its width at the northern boundary.

The Wilcox is the thickest of the Tertiary Formations of Mississippi, as is indicated by the width of its outcrop, being 800 or 900 feet thick. The materials of the formation are alternating beds of sand, clays and lignite, the sands being variously colored and cross-bedded, the clays, white pottery clays or dark lignitic clays. Lignite occurs at numerous points in workable thickness and good quality.

The region is one of mature erosion. The original surface was that of a gently rolling plateau of 500 or 600 feet elevation, but has been cut up into a region of hilly, rough topography. This is called the Northern Lignitic Plateau.

(3) Claiborne. This formation lies next to the Wilcox on the southwest, and, unlike that formation, passes only as far north as Grenada, so that its direction is nearly northwest and southeast.

The lower portion of the Claiborne is decidedly sandy, passing into a very hard quartzitic rock called buhrstone. Certain horizons in the lower Claiborne are highly ferruginous, giving rise, on weathering, to deeply colored soils.

The upper division of the Claiborne consists of calcareous sands and clays, and the outcrop is not so broad as that of the lower division.

The topography of the Claiborne is rough and hilly like that of the Wilcox, and may properly be included in the same topographic unit, though the upper division passes imperceptibly into the next formation to be considered.

(4) Jackson. Immediately overlying the Claiborne is a series of calcareous clays and marls belonging to the Jackson Formation. The outcrop in its widest part is more than forty miles and rapidly narrows eastward. It extends across the State in a direction almost east and west, and gives rise to the topographic unit known as the Jackson Prairie Belt.

(5) Vicksburg. A narrow band of alternating limestones and marls, highly fossiliferous, outcrops in ledges on the Southern border of the Jackson, and is called from its type locality, the Vicksburg. Topographically it forms the southern rougher and more elevated margin of the Jackson Prairies.

(6) Grand Gulf. South of the Jackson Prairies is an extensive region embracing practically the whole southern half of the State, which is a topographic unit. In general surface configuration it resembles the Northern Lignitic Plateau. The soil is sandy or loamy and the region maturely eroded.

The whole region is underlaid by the Grand Gulf Formation, which consists of gray sandstones, in places quartzitic in hardness, unconsolidated sands, gray and lignitic clays and lignite. Unlike that of the more northern region, the lignite is of inferior quality and small quantity. Topographically the Grand Gulf outcrop is known as the Long Leaf Pine Hills, because of the vast forests of Long Leaf pine in this region.

(7) Lafayette. So far, the formations described outcrop successively farther and farther westward and southward, so that those that lie nearest the Gulf Coast on

the one hand and the Bluff Hills on the other are the youngest. The Lafayette Formation differs from them in this respect, that it laps over all others, like a blanket, but does not materially increase the area of the State.

The Lafayette consists of a problematical deposit of highly ferruginous sands and gravels, overspreading the eroded edges of all the older formations, and varying in thickness from 50 to 60 feet to a foot or two. The sands are irregularly stratified and cross-bedded, showing the action of swift and varying currents at time of deposition.

The origin of these deposits is in doubt, some geologists believing them to be of fresh water origin—deposits of flooded streams overloaded with detritus from the older lands; others believe them to have been the result of wave action along a shallow coast. Whatever the origin, they at one time undoubtedly covered the whole State, but have since been almost entirely removed by erosion from the Black Prairie Belt of northeast Mississippi, and largely form the similar Jackson Prairie region. Its greatest thickness is near the Delta hills and toward the Gulf Coast.

With the possible exception of a formation which will be considered later, the Lafayette forms the surface soil over a larger area of the State than any other geological unit. The older formations, as has been stated, are very largely covered by it. Hence, in a study of the State's soils, it is one of the most important.

Quarternary.—Loess. Following the line of the Delta Bluffs, capping all the hills and spreading eastward to a distance of 5 to 15 miles in a layer that thins rapidly to a feather edge, is the Bluff Formation, or loess. This is a yellowish gray calcareous silt, 30 to 40 feet thick on the face of the Bluffs, very uniform in character from top to bottom, weathering in vertical walls and thickly studded with fossil snail shells. It shows little evidence of stratification. The elevation of this loess region above the drainage of the adjacent delta into which all the hill streams pour, and the tendency of the material to erode in vertical walls, have caused the development of a strikingly rough topography over the outcrop of the loess, which is universally known as the bluffs.

Except on the hill slopes the whole region is covered by a brownish silt loam, which is perhaps a weathered phase of the loess. This loam forms the soil of the level uplands, but that of the slopes is an admixture of the loam and loess. The soils of the region are very fertile and easily worked, and even after long years of exhaustive cultivation are still among the most productive soils in the State.

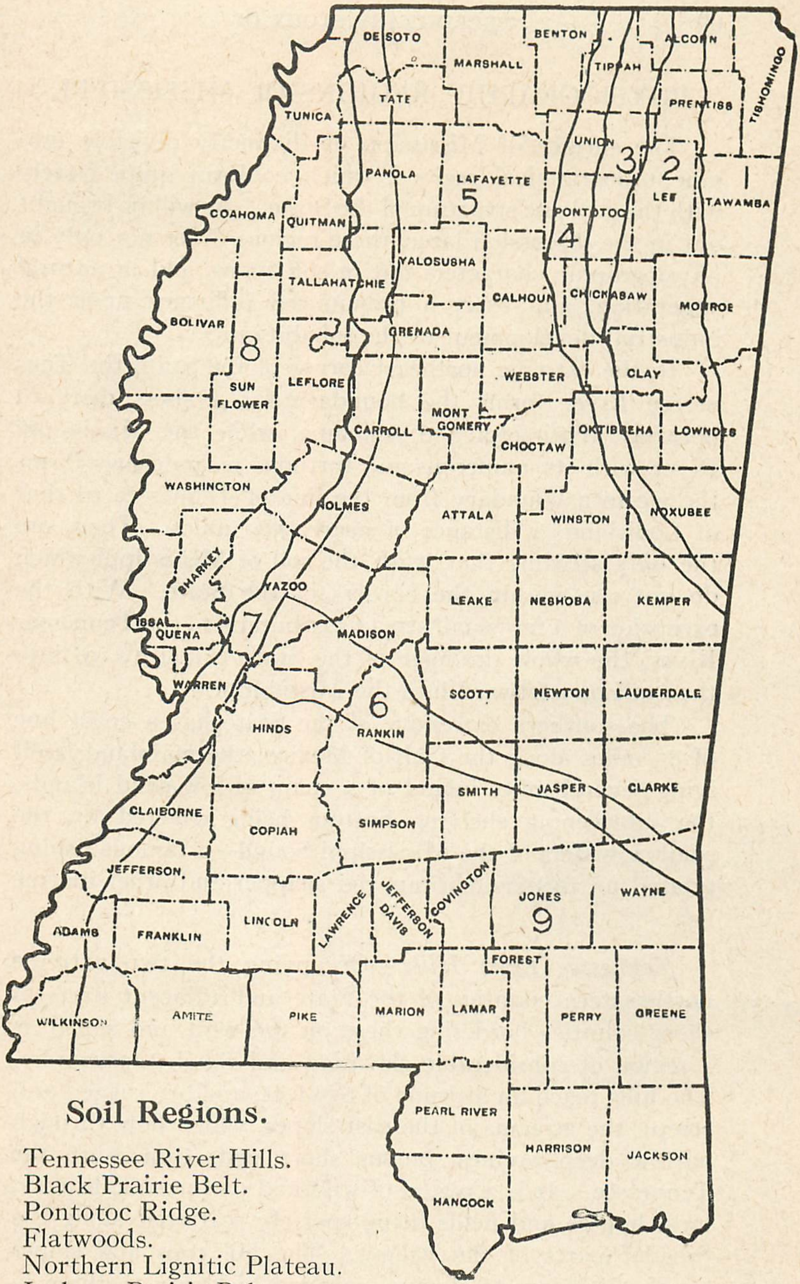
Brown Loam. This is a very thin mantle of yellowish brown silt loam, supposed to be of Columbian age, which forms the surface soil over perhaps the largest part of the State. It is only a few feet in average thickness, and, as has already been said, covers the Loess region but spreads far beyond it, so that there are few, if any, counties in the State, excepting the Delta, where it does not occur. Wherever it occurs, it forms or enters into the formation of the soil. In the bluff region it rests upon the Loess, but over the State generally it rests usually upon the Lafayette. It overlies the Lafayette throughout the Northern Lignitic Plateau, and the arrangement furnishes conditions most favorable to rapid erosion.

The Brown Loam is generally assumed to be only a weathered phase of the Loess which it immediately overlies and often seems to shade into. Hilgard did not hold this view, and there are some good reasons for regarding it as a distinct formation. Some of these may be stated. 1. The Loam has very much more clay in its composition than the Loess silt. 2. The proportion of iron is much greater than in the Loess. 3. The Loam has an average thickness near the Mississippi of 12 to 15 feet, thinning eastward to 3 or 4 feet, thus following the rule of the Loess itself. There is no apparent reason why the Loess should weather deeper near the Mississippi than farther east, which would have to be explained should the two formations be considered identical. 4. Snail shells are abundant in the Loess; they are never found in the Loam. 5. Lime is abundant in the Loess within a few inches of the Loam, but very little even in the basal part of the

Loam itself—no more than is found where it overlies other calcareous formations. 6. While the Loam in places seems to shade into the Loess, it also in many places seems to shade into the Lafayette, which need not create a doubt as to the distinctness of the two formations. 7. The two weather differently, so that the line of separation between them can be seen at long distances. The Loess weathers in smooth vertical faces, the Loam presents a trenched and buttressed wall above the smooth wall of the Loess. 8. On exposed faces the Loam will erode back faster, often presenting the aspect of a buttressed wall set several feet back on a terrace above the higher Loess wall. This can be seen in many places. Further, places can be found where the Loam has been eroded partly or entirely away from a Loess surface which shows decided irregularities, suggesting an unconformity between the two.

Recent Alluvium. The most recent of the geological formations is the alluvium or flood plain deposits of the streams of the State. These consist of unconsolidated, horizontal beds of clay, silt and sand and gravel more or less mixed, or in successive layers and containing decaying vegetable matter.

These deposits follow the courses of the streams as flats of varying width, that of the Mississippi being the most extensive. It is known as the Yazoo-Mississippi Delta, and is remarkable for its fertile soil. While alluvial deposits generally possess considerable uniformity of character, owing to similarity of conditions of deposition, they may and usually do consist of materials derived from widely diverse sources. This is especially true of the flood plains of large streams like the Mississippi.



Soil Regions.

1. Tennessee River Hills.
2. Black Prairie Belt.
3. Pontotoc Ridge.
4. Flatwoods.
5. Northern Lignitic Plateau.
6. Jackson Prairie Belt.
7. Loess or Bluff Hills.
8. Yazoo-Mississippi Delta.
9. Long Leaf Pine Hills.

PHYSIOGRAPHIC REGIONS OF MISSISSIPPI.

The surface of Mississippi is distinctly divisible into nine topographical regions, which conform quite closely with the geologic structure of the State. As will be brought out in the discussion later, these regions differ not only in physiographic characters but in soil types, and in natural vegetation, and exert a pronounced influence upon the industrial development of the inhabitants.

In the extreme northeast corner of the State the Tennessee River forms the boundary for a short distance between Mississippi and Alabama, while the Mississippi River with its numerous and tortuous meanderings forms the western boundary from the line of Tennessee to that of Louisiana, a distance of nearly 500 miles. These are the only streams that wash the soil of Mississippi which do not rise within the borders of the State. With the exception of a few small streams tributary to the Tennessee River, the whole drainage of the State is southward into the Gulf or westward into the Mississippi.

The southern extremity of the State has a coast line of 85 miles along the Gulf of Mexico, the mainland itself lying several miles inland of a chain of low sand islands, the intervening shelving bottom being covered by the shallow waters of the Mississippi Sound—a famous fishing ground for oysters, shrimp, red snapper and other marine fish.

Tennessee River Hills.—Occupying the two extreme northeastern counties of the State and adjacent parts of those counties bordering these on the west and south, is a region of considerable elevation and rough topography. The hills reach an altitude of 650 feet, and are rugged and steep; the streams of the east slopes, which flow through narrow deep ravines, pursue short swift courses to the Tennessee. It is a region of wild and picturesque beauty, farm houses and fields being sparsely scattered along the broader parts of the valleys. The hill tops and slopes bristle with forests of pine, oak and hickory; to these in the valley are added black walnut and sycamore, with an occasional umbrella magnolia where the soil is rich and shaded. Alder fringes the borders of the streams in the low wet flats.

The soils of the hills are thin, red sandy and pebbly loams; those of the bottoms are rich black sandy loams.

Toward the South the region loses some of its ruggedness and numerous productive farms may be seen. The western slopes of these hills are less precipitous and the creeks flow more leisurely toward the Tombigbee.

The geological formations of this region are the indurated limestones, sandstones and chert beds of the Paleozoic Era, overlapping whose western and southern borders are the loose sands, clays and gravels of the Tuscaloosa and Eutaw of the Cretaceous.

Black Prairie Belt.—Lying immediately to the west of the region of hills just described is a broad low-lying belt of land of slight relief. In all its characters this region is the antipode of the other. Its surface is not only nearly level, but consists of open prairies almost devoid of tree growth, but having a rich herbaceous flora of prairie-loving species, like the prairie clovers, mellilotus, compass plants and milk weed, besides abundance of good grasses.

The soils are black calcareous clay loams, that do not, in the flatter areas, drain perfectly, but are very strong and productive. Throughout the region are areas of gentle elevation. Though the eye could scarcely detect the elevation these areas can be easily noted miles away because of the stunted growth of black jack and post oak that usually crown them. The soil is an infertile red or yellowish clay or gravelly loam, entirely different from the characteristic soil of the region.

The Black Prairies lie at a considerably lower level than the eastern hills, the altitude in the northern part being upwards of 400 feet. The surface slopes southward, giving an altitude at Macon of 179 feet. The region is a broad belt running from the northern border of the State southward and turning slightly eastward, touching the eastern line of the State in Noxubee and the north half of

Kemper counties. Less than ten miles wide in the northern part it broadens southward, reaching its greatest width west of Aberdeen where it is more than twenty-five miles wide.

This whole region marks the outcrop of the Selma Chalk, or Rotten Limestone of the Cretaceuos, which forms the bedrock from which the black prairie soils are derived. The region is one of fine farms, prosperous towns and rapidly growing wealth.

By referring to the accompanying sketch map of the State all these regions now under discussion may be noted and their boundaries traced.

Pontotoc Ridge.—As the name would indicate, this is another region of high lands, bordering upon the west side the northern half of the Black Prairies. It is a small wedge-shaped region, broadest where it enters the State in Tippah and Alcorn counties, runs southward and comes to a point at Houston in Chickasaw County.

This ridge is a backbone averaging more than 500 feet high and parts the waters that flow into the Tombigbee on the east from those that feed the Pearl River and the westward flowing tributaries of the Mississippi. Bordering the main crest on either side are rugged broken hills that drop suddenly to the lowlands of the Prairies on the one hand and those of the Flatwoods on the other.

The region is not one of inviting aspect to the stranger. The surface looks too broken and the soil too red and sterile to suggest successful agriculture. And yet this is a region of prosperous homes and farms. The town of Pontotoc is a lively business point.

The soil is on the whole a red sandy loam derived from the weathering of the glauconitic sands and marls of the Ripley formation, and from the Lafayette sand which overlies much of the older formation. It is peculiarly well adapted to the growth of the Elberta peach, and is very much more productive of general farm crops than its appearance would indicate.

Flatwoods.—A narrow band of low flat land borders the Pontotoc Ridge on the west and sweeps in an open crescent around the western and southern margin of the Black Prairies. It is nowhere very wide, varying from two to fifteen miles. It is so conspicuously lower than bordering areas, is so distinctly marked off and its surface is so nearly featureless, that it has been universally called the Flatwoods by the settlers, and was likened by Crider to a broad river bottom.

The soil is quite uniformly a gray and sticky clay that is very retentive of water and on drying cracks and becomes of stcny hardness. It is very difficult to cultivate and on the whole is not very productive. Most of it needs drainage badly. The region is not extensively farmed, but was originally densely covered with forests of post oaks, spanish oak and loblolly pine. In many parts the forests are now being cut for lumber.

The geologic formation underlying the Flatwoods is the Flatwoods or Porter's Creek Clay, a tenaceous gray joint clay, differing but little from the soil to which it gives rise.

Northern Lignitic Plateau.—This region embraces all of that portion of North-Central Mississippi lying between the Flatwoods on the east and the bluffs overlooking the Delta on the west, and extending from the border of Tennessee south to a line drawn approximately from Canton to Meridian. It includes the greater part of sixteen counties. As the name suggests, the surface was originally that of a plateau sloping gently southward and westward. The highest railroad point is on the Illinois Central Railroad near Holly Springs, the altitude being 625 feet, though neighboring points reach above 700.

In the more northern part of the region where it passes into Tennessee, the original level expanse of the old plateau is still quite evident, but over most of the area the drainage channels have been cut so deeply and intricately that the topography is decidedly rough.

The characteristic soil over the whole area is a yellowish brown loam containing considerable proportions of silt and clay. This is spread like a blanket over many counties of the State and varies in thickness from fifteen to two or three feet. Lying just beneath this loam, over almost the whole area, is a variable thickness of the Lafayette sand. The prevailing sloping surfaces of the land, the yielding mellowness of the soil and the treacherous support of sand beneath, which outcrops on the hill slopes so as to be easily attacked by the weather, render this region one peculiarly susceptible to erosion. Marked evidences of rapid erosion are to be seen in many places. When the soil is properly handled erosion may, in a large measure, be prevented.

Productively this brown loam is perhaps the most generally useful soil in the State, being well adapted to almost any crop. The geologic formations underlying this region are the Lignitic or Wilcox and the Claiborne. These are prevailing sands and clays, but over most of the area they contribute little to the soil, which is either the brown loam alone or mixed with the red sands of the Lafayette.

The region was originally forested with a mixed growth of pine, spanish, black jack and white oaks, chestnut and hickory. The merchantable timber has now been largely cut away in the northern parts, though considerable timbered areas exist farther south.

Jackson Prairie Belt.—Immediately south of the last is a region of gently rolling lands with numerous small prairies interspersed through it. Much of the surface, however, is, or originally was, covered with forests of pine, oak and hickory.

The area of this Prairie Belt is not very extensive. It reaches across the State from the bluffs of the Mississippi to the line of Alabama in a narrow belt running a little south of east, the extreme width of about 40 miles being in Yazoo and Madison counties, but the average is not more than half that. The city of Jackson lies in the southern edge and gives name to the region.

The characteristic soil is a black calcareous prairie soil, very similar to that of the Cretaceous prairies, though the prevailing soil of the area in the western part is the brown loam already described. The soils are very rich and the region is one of the most prosperous in the State.

The geological formation underlying this region is the Jackson, consisting of calcareous clays, marls and soft limestones.

Long Leaf Pine Hills.—The whole southern half of Mississippi south of the Jackson Prairies to the Gulf is very easily and naturally described as a topographic unit. It resembles quite closely the Northern Lignitic Plateau in surface features and in soils.

It slopes gently from an altitude of more than 400 feet at its northern border to sea level at the Gulf. That part lying west of Pearl River is more elevated than farther east, some of the hills rising to 500 feet near the Mississippi Bluffs.

While the general surface of this region, like that of its prototype farther north, is maturely dissected, giving it an uneven topography, there are large areas of gently rolling or nearly level land. The one striking feature of the whole region is the forests of long leaf pine, which originally covered its surface in one unbroken expanse.

The soils of this region are red and yellow sandy loams derived from the Lafayette Formation, which is the prevailing surface formation east of the Pearl River. In the higher regions farther west the brown loam replaces the Lafayette to a great extent. As a result, the pine forests are not so pure as eastward, but show a decided sprinkling of hardwood species.

Loess or Bluff Hills.—Skirting the eastern margin of the Yazoo Delta is a range of rugged precipitous hills known as the Loess or Bluff Hills. All streams flowing through them have cut deep narrow gorges, whose sides in many places stand in vertical walls. This region of hills varies in width from 5 to 15 miles, follows the eastward curve of the Delta margin from Memphis to Vicksburg, thence southward hugs the east bank of the Mississippi River to the Louisiana line.

While the Bluff Hills might not properly be considered a distinct topographic unit, since topographically they represent merely the intricately and deeply dissected margin of the plateau lands to the east, considered with reference to their soils, they constitute an easily recognized soil region. This is all the more noticeable since it maintains its unity of character from the line of Tennessee to that of Louisiana, though it overlaps in this distance several very different geological formations.

The Bluffs stand 150 to 200 feet above the Delta; the hill slopes are so steep as to be difficult of cultivation, and the valleys are too narrow and inaccessible to afford very extensive farming. Still on account of the extremely fertile soil, the region is one of the most productive in the State, and in spite of its rough topography is very generally farmed throughout its extent.

The soil of this region is the brown loam, though somewhat more silty than farther east, and it is here underlaid by a yellowish calcareous silt, the Loess, which varies in depth, being 60 feet at the edge of the bluff, thinning eastward, to the east margin of the region, where it feathers out. On the hill slopes the mixture of the loam and loess silt makes a very fertile soil, with characteristics entirely distinct. The tree growth where it has not been cut over is magnificent in proportions and of the finest grades of white oak, yellow poplar, basswood, red gum, ash and beech.

Yazoo Delta.—This region embraces all that great flood plain deposit of the Mississippi River and its tributaries lying on the east side of the great river between Memphis and Vicksburg. It is a low-lying featureless expanse, sloping gently southward. Its altitude at the Tennessee line is 217 feet and at Vicksburg 94. The whole region was originally heavily timbered with forests of red, white and overcup oak, elm, ash, cypress, red and tupelo gum, pecan, hickory, cottonwood, maple, magnolia, beech, basswood and hackberry. The two species of gum formed more than 50 per cent of the whole. Large forests still remain, but, on account of the valuable hardwood, are being rapidly cut over and the lands prepared for cultivation.

While the average relief of this region is but slight, the higher lands lie adjacent to the streams, the interstream areas being low and more or less swampy. The whole region would profit greatly by drainage.

The soils are all alluvial and among the most fertile on earth. Two general types are found, the distribution of which maintains rather a definite relation to the topography. A dark, mellow sandy loam generally occurs on the higher grounds near the streams, while a dark, tough, sticky clay occupies the lower areas back from the drainage courses. Both are very productive under proper conditions, but the black mud or "buckshot" must be drained to make it produce well.

Until the completion of the levee, the annual overflows of the Mississippi retarded very much the development of the Delta. Since then development has been rapid, and with the completion of drainage schemes now being pushed in most parts of this region, about two-thirds of the lands now unused will be reclaimed.

SOIL CLASSIFICATION.

Within recent years the scientific study of soils has resulted in sufficiently detailed and accurate knowledge of them to lead to a systematic classification of soils.

Soil Types.—"The fundamental unit in mapping and classifying the soils is the type. In the determination of a type of soil there are many factors to be considered. Among the most important are the texture, which deals with the size of the particles, the structure, which deals with the arrangement, the organic-matter content, origin, color, depth, drainage, topography, native vegetation, and natural productiveness." While classification is thus based primarily upon physical characters, other properties of the soil which influence its productiveness or adaptibility to particular crops, are considered in the classification. In naming a soil type two terms are used, one the name of some locality where it occurs typically, followed by the second, descriptive of the texture of the material. Thus, Sharkey Clay, is a type, the name of which indicates that it is a clay soil having certain definite characters that were first observed in Sharkey County.

Soil Class—Water does not sort perfectly materials which it drops, neither are the minerals entering into the composition of rocks all reduced to particles of the same size in weathering; hence all soils consist of particles of different sizes mixed in varying proportions. These particles, according to size, are called stones, gravel, sand, silt and clay. A classification of a soil based upon the size of particles is called a soil class. The soil classes recognized by the U. S. Soil Bureau are the following:

			Sandy Loam.		
	Coarse Sand.		Fine Sandy Loam.		Sandy Clay.
Sand -------	Medium Sand.	Loam ---	Loam ------------	Clay.	Silt Clay.
	Fine Sand.		Silt Loam.		Clay.
			Clay Loam.		

Scheme of soil classification, based upon the mechanical composition of soils.

Class	1 *Fine gravel* 2–1 *mm.*	2 *Coarse sand* 1–.5 *mm.*	3 *Medium sand* .5–.25 *mm.*	4 *Fine sand* .25–.1 *mm.*	5 *Very fine sand* .1–.05 *mm.*	6 *Silt* .05–.005 *mm.*	7 *Clay* .005-0 *mm.*
Coarse sand.	More than 25 per cent of 1+2.					0–15	0–10
	More than 50 per cent of 1+2+3.					Less than 20 per cent of 6+7.	
Medium sand.	Less than 25 per cent of 1+2.					0–15	0–10
	More than 20 per cent of 1+2+3.					Less than 20 per cent of 6+7.	
Fine sand.	Less than 20 per cent of 1+2+3.					0–15	0–10
						Less than 20 per cent of 6+7.	
Sandy loam.	More than 20 per cent of 1+2+3.					10–35	5–15
						More than 20 per cent and less than 50 per cent of 6+7.	
Fine sandy loam.	Less than 20 per cent of 1+2+3.					10–35	5–15
						More than 20 per cent and less than 50 per cent of 6+7.	

Scheme of soil classification, based upon the mechanical composition of soils—Continued.

Class	1 *Fine gravel* 2–1	2 *Coarse sand* 1–.5	3 *Medium sand* .5–.25	4 *Fine sand* .25–.1	5 *Very fine sand* .1–.05	6 *Silt* .05–.005	7 *Clay* .005–0
Loam.							15–25
						Less than 55 per cent of 6.	
						More than 50 per cent of 6+7.	
Silt loam.						More than 55 per cent of 6.	Less than 25 per cent of 7.
Clay loam.						25–55	25–35
						More than 60 per cent of 6+7.	
Sandy clay.						Less than 25 per cent of 6.	More than 20 per cent of 7.
						Less than 60 per cent of 6+7.	
Silt clay.						More than 55 per cent of 6.	25–35 per cent of 7.
Clay.							More than 35 per cent of 7.
						More than 60 per cent of 6+7.	

A careful examination of the above table from the U. S. Soil Survey Field Book, will make plain the basis of classification according to texture.

Soil Series.—Soil classes that have origin from the same source, of the same formation, topographic position and coloration, and hence of similar composition, is referred to the same series. In other words, a soil series is a group of soil classes. "On account of the very different processes of their formation, residual and recent alluvial soils should not be included in the same series."

Before entering upon a discussion of the individual soil regions, a few of the principal soil types occurring widely in the State will be tabulated to show the geological formations from which they are directly derived.

Geological Formation.	*Soil Type.*
Tuscaloosa Eutaw	Orangeburg.
Selma Chalk	Houston Clay. Houston Chalk.
Ripley	Pontotoc Ridge phase of Orangeburg Series.
Flatwoods	Lufkin Clay. Lufkin Silt Loam.
Wilcox Inseparable from Lafayette.	
Claiborne gives rise to deep red phase of	Orangeburg Series.
Jackson and Vicksburg	Houston Clay. Montrose Clay. Susquehanna Clay.
Grand Gulf not distinguishable from Lafayette.	
Lafayette	Orangeburg Series. Norfolk Series.
Loess and Brown Loam	Memphis Silt Loam. Richland Silt Loam. Oktibbeha Series in the Black Prairie Region.
Alluvial	Yazoo Loam. Sharkey Clay. Wabash Clay. Oklocknee Clay. Oklocknee Loam.
Terrace	Kalmia. Cahaba.

TENNESSEE RIVER PINE HILLS.

Boundaries of the Region.—This topographic region of Mississippi occupies a comparatively small area in the northeast part of the State. It is co-extensive with the outcrop of the formations of the Paleozoic and of the Tuscaloosa and Eutaw of the Cretaceous. By referring to the map it will be seen to embrace all of the counties of Tishomingo and Itawamba, the east third of Alcorn and Prentiss, the east half of Monroe and the northeast corner of Lowndes.

Topography.—The Tennessee River flows along the northeast border of the region at an elevation of about 400 feet above sea level. It has but little bottom-land on the Mississippi side, the hills rising rather abruptly to an elevation of more than 600 feet. In the immediate vicinity of the river the aspect presented is that of precipitous broken hills, separated by narrow deep gorges through which flow swift streams. Farther back the region assumes more the character of an old plateau maturely dissected. The surface rises westward and southward to an elevation of 650 feet a few miles back from the Tennessee River, and there slopes gradually westward.

The surface of the plateau is very rough, having been deeply and intricately gashed by several streams of considerable size and their tributaries. Yellow Creek, a tributary of the Tennessee, has cut a deep gorge back into it from the north side. The lower portion of its channel is carved deep into the hard rocks of the Paleozoics, but its several heads have encountered only the softer materials of the Cretaceous and have developed wide valleys with fertile alluvial bottoms.

The drainage of the west and southwest slope is into the Tuscumbia and Tombigbee rivers. Bear Creek, rising in Alabama, flows through the eastern part of Tishomingo County and drains that section. Passing southward from Burnsville and Iuka the topography becomes less rough and some gently rolling country is encountered about Tishomingo City and eastward.

Southward through Itawamba and the east half of Monroe counties continues the extension of the plateau, very much broken and eroded, as farther north, though some comparatively level areas occur. This is especially true of the main dividing ridge between the Tombigbee and the Buttahatchie northeast of Aberdeen, where large tracts of level lands are found.

The drainage in this southern part of the region under discussion is all into the Tombigbee River. The Tombigbee itself has cut a deep trench in the plateau of Itawamba from north to south a little west of the center, while Bull Mountain Creek has cut a similar trough through the eastern part of the county, and flows into the Tombigbee just north of the county line. The Tombigbee continues its course through the center of Monroe, receiving tributaries from east and west, those of chief importance being Old Town Creek and Mattibbee Creek from the west and Buttahatchie from the east.

The larger streams in the Southern part of the area have wide fertile bottoms. The Valley of the Bear Creek is not so wide, but the soil is fertile and the hills slope gently down to the valley, and represent the better class of hill soils. The bottoms of Bull Mountain, Hurricane and Buttahatchie Creeks are wide and fertile and where not farmed have been heavily timbered, though much of it has been cut over for many years. The bottom lands of the Sipsie and Buttahatchie are rather light, sandy loam soils.

The valley of the Tombigbee in Itawamba is wide and subject to overflow. South of the confluence of Bull Mountain Creek with the Tombigbee a wide flat two to six miles across borders the Tombigbee on the east side, which lies above the level of the present flood plain. It slopes gently toward the river. This is the second bottom, or hummock lands that border most of the larger streams of the State, and represent the flood plain of an earlier stage of the river's history.

On the west side of the Tombigbee, in Itawamba, Monroe and northern Lowndes, is a region of sandy hills that narrows to two or three miles in Lowndes, and shades westward into rolling loam lands that border the limestone prairies as far north as the State Line.

Character of Soils.—Upland Soils. By far the greater part of these soils is derived from two geologic formations—the Lafayette and the Brown Loam, though undoubtedly a considerable proportion are derived from the sands and gravels of the Tuscaloosa and Eutaw. Since these sands weather red and yellow, a doubt may be expressed as to how much of the so-called Lafayette of this region may really be Cretaceous. Whatever their origin, the sands are sufficiently alike to give rise to two series of soils, usually referrable to the Lafayette—the Orangeburg series and the Norfolk series. The Brown Loam soil is classed as Memphis Silt Loam.

The hills bordering the Tennessee River are too precipitous to be of much agricultural importance. The soils are formed by a mixture of the weathered materials of the surface loams, Lafayette sands and gravel, influenced to some extent by the underlying formations. Those in the immediate vicinity of the river, in spite of their steepness of slope and their stony and gravelly character, possess unexpected productivity, influenced doubtless by the underlying limestone. As a class, however, they are not extensively farmed but remain covered with timber, the best of which has been cut and marketed.

From the Tennessee River south to the Southern railroad, the broken hills show the same sandy and gravelly, and in some places, stony slopes, the soil possessing little fertility. Usually, the sandy slopes show the intense red color and the perceptible admixture of ferruginated clay characteristic of the Orangeburg soils. The topography becomes less broken southward, and a corresponding improvement of the soil conditions is noticeable.

Dismembered segments of the old plateau surface appear scattered here and there among these hills, and where such is the case, the soil is brown, underlaid by the yellowish brown clay subsoil of the Memphis silt loam (Brown Loam). The texture is very much finer than that of the Lafayette soils, and the proportion of sand is very much less—usually scarcely perceptible. It is darker and mellower near the surface than deeper.

This Loam originally covered the whole surface of the plateau overlying the Lafayette to a depth of two to four feet. Most of the formation has been carried away by erosion, only scattered outliers remaining capping the leveler highlands, separated by intricately dissected slopes of the red Lafayette. This soil is good for a great variety of crops. It is usually deficient in humus, but with this supplied and with proper cultivation, it can be made very productive. Much of the loam in this part lies on the uplands between Bear Creek and Yellow Creek, though large areas occur farther west—beyond Yellow Creek and about the headwaters of Tuscumbia, Mackay's and Little Brown creeks. South of Iuka the lands are less broken and largely of the Loam type.

The plateau of Itawamba and east Monroe, extending into Northern Lowndes was all at one time of the Brown Loam type, and while erosion has removed the loam from most of the surface, which is now very rough, in some of the leveler parts, notable areas still exist. Such an area occurs in the space between Bull Mountain and Tombigbee. South of Bull Mountain Creek and around Smithville is one, and the divide between the Tombigbee and the Buttahatchie is another, both of large proportions and supporting prosperous farming communities. Large areas of gently rolling lands lie between the Buttahatchie and Sipsey, in northeastern Lowndes, the soil being a yellowish silty loam and supporting prosperous farms.

The hills that lie west of the Tombigbee in this region are for the most part of the red sandy Orangeburg type of soils, though perhaps not derived entirely from the Lafayette. These pass into a gently rolling region of loam soils bordering the Black Prairies.

(2.) Bottom Soils. Though the Tennessee River has but a very limited bottom on the Mississippi side, it is a rich, sandy loam, dark with humus and deriving some lime from the underlying blue limestone.

The soils of the Bear Creek bottom are rich sandy loams, producing good crops of corn and cotton. On the west side of the creek, in southern Tishomingo, is a bordering terrace 30 to 40 feet above the river level, and having a dark, fertile, loam soil, supporting a growth of mixed oaks of various species, sweet gums, yellow poplar, dogwood and pine.

Yellow Creek has little bottom land in its lower courses, but the valley widens into broad flats at the head of the stream, with a clay loam soil that is very fertile, though in parts needing drainage. It possesses the remnants of what was once a fine growth of white, water, willow and chestnut white oak, yellow poplar, red gum, birch and cypress—a tree growth which is a sufficient witness of the fertility of the soil.

The Tombigbee has developed a broad bottom through Itawamba and Monroe, the soil of which is a fertile loam, but subject to overflow. South of the Itawamba line, the

Tombigbee has, on the east side, the broad second bottom, already mentioned, which persists to the Alabama line. The soil is a light sandy loam, with a pale yellow loam subsoil, which passes into yellow sand and gravel at a few feet depth. This soil is quite fertile, though too sandy in places for the staple crops.

It is usually well drained, in spite of its level surface, because of the underlying sands and gravel, though in some parts the surface soil is sufficiently compact to prevent the ready sinking of water. At intervals, in this level surface, islands of Lafayette red sands are conspicuously prominent.

Bull Mountain and Hurricane creeks in Itawamba and Buttahatchie in Monroe have wide fertile bottoms, with some good timber still standing. The soils of Bull Mountain and Hurricane show the presence of a good deal of black gravel or iron concretions, indicative of need of drainage.

On the whole, the soils of this region are remarkably well drained. The steep slopes and sandy nature of most of the hill soils insure perfect surface and under-drainage of those parts. and most of the bottom lands are sufficiently sandy, with a few exceptions, to drain satisfactorily.

Native Vegetation.—The hills and slopes of this region were originally clothed with forests of large timber; much of the more broken parts still remain in forest though the large trees have been mostly removed. The most abundant trees of the hills are short leaf and old field pines (*Pinus mitis and taeda*), mostly second growth. Mixed with these are various species of oak, black jack (*Quercus nigra*), post Oak (*Q. stellata*), Spanish oak (*Q. falcata*), scarlet oak (*Q. coccinea tinctoria*), dogwood (*cornus florida*), hickory (*Carya tomentosa*), chestnut (*Castanea dentata*), and on the highest points the more northern Jersey pine (*Pinus inops*).

Growing beneath these are several species of shrubs of the Heath family—the dwarf inedible deerberry (*Vaccinium stamineum*) is common in low, thick copses, together with other species of huckleberries (*V. arboreum, corymbosum* and *vacillans*). the brilliantly colored mountain laurel (*Kalmia latifolia*) and bush honeysuckle (*Azalea nudiflora*) adorn the slopes in the spring season. Numerous interesting herbaceous species carpet the ground, saxifrages (*Saxifraga virginiensis*, *Heuchera americana*) in the open rocky woods, buttercups (*Ranunculus*), larkspurs (*Delphinium*), bird-foot violet (*Viola pedata*), Indian pink (*Silene virginica*), and numerous others, in the more shaded parts.

Along the spring brooks, of which there are many, grow the red maple (*Acer rubrum*), crab-apple (*Pyrus angustifolia*), and red bud (*circis canadensis*); beneath these wild hydrangea (*hydrangea quercifolia*), spring beauty (*Claytonia virginica*), anemone (*Anemonella thalictroides*), Phlox (*Phlox*, several species), with the woodbine (*Lonicera sempervirens*), trailing over the trees and shrubs. In low, wet places, thickets of alder and willow grow in impenetrable masses.

Old abandoned fields have been taken by thickets of the blackberry, or by young growth of old field pine or broom sedge, with occasional patches of old field plum (*Prunus Chicasa*).

On the lower slopes of the larger valleys white and red oak, dogwood and yellow poplar or tulip tree (*Liriodendron tulipifera*) are prominent in the tree growth.

The bottoms of Tombigbee and Tuscumbia Rivers support a growth of white, willow and water oak (*Q. alba*, *Q. phellos*, *Q. aquaticus*), basket oak (*Q. mechauxii*), sycamore (*Platanus occidentalis*), river maple (*Acer dasycarpum*), red gum (*Liquidamber styraciflua*) and cypress (*Taxodium distichum*). In addition to these, in the higher grounds in the valleys are black locust (*Robinia pseudacacia*), hackberry (*Celtic mississippiensis*), sassafras (*sassafras officianale*) and ash (*Fraxinus Americana*).

In the valley of the Tombigbee much of the lands have been cut over and the loblolly pine is taking possession. On the bottoms of Bull Mountain Creek some virgin tracts of timber still remain. The trees here are chiefly beech, yellow poplar, sweet gum, black gum, shell bark hickory (*Carya alba*), and others.

All the larger valleys support a similar forest growth to those described, but much of the land is cleared, and where overflows occur, even though not farmed, the timber has been closely culled where accessible. The timber of these valleys was originally of the finest quality and grew in vast forests.

The flora of this northeastern hill region has been dwelt upon somewhat fully for the reason that this part of the State represents both in its topography and its geological structures, a transition between the Appalachian uplift and the Costal Plain, and a natural inference would be that the flora partakes of the same transitional character. Such is found to be the case. In the tree growth this is not very evident, though one species of more northern and especially mountain distribution reaches Mississippi in this region, and so far as known, has no other distribution in the State. The tree referred to is *pinus inops*. On the other hand, the large-leaved magnolia (*Magnolia auriculata*); which is common in the State south of the Vicksburg and Meridian Road and rare farther north, is found sparingly in the low lands of this region.

Among shrubs and herbs, however, are a number of species of more northern distribution that find their way into the State in this last faint suggestion of the Appalachian fold. The mountain laurel, azalia, and trailing arbutus are distinctly northern, so also are *Saxifraga virginiensis* and *Heuchera americana* and coral berry (*Symphoricarpus*), and yet all are found in this region of Mississippi, and are not widely distributed south of it.

It was thought advisable to give some study to both the tree growth and the herbaceous plants, because while the latter are rooted entirely in the soil, and so give a very good index to the character and quality of the soil, they give no intimation as to the character of the subsoil, for their roots do not reach down to it. On the other hand, trees are rooted deeply in the subsoil, and though they are not thoroughly reliable as indices of the character of the soil, they do point unerringly to the kind and conditions of the subsoil. The combined evidence of both ought to furnish valuable information of practical use in the selection of soils for agricultural purposes.

State of cultivation and kinds of crops raised.—Much of this region is not cultivated, owing to the broken character of the surface and the comparative sterility of the soil. In those parts, however, where the slopes are gentle, and especially where the Brown Loam soils prevail, farming is carried on with good results. The bottom lands are fertile, and where not annually overflowed, produce abundant crops.

The gravelly hill soils are not generally farmed, but support a growth of second growth short-leaf and loblolly pine.

The chief crops are cotton and corn, potatoes, peas, pumpkins and melons. Some excellent fruit is grown on a small scale.

Fig. 2. Wheat Field in Mississippi.

The methods of cultivation are still antiquated, for the most part. The small one-horse plow is used and the soil stirred to a depth of but 3 or 4 inches. The harrow and cultivator is not used as much as they should be, and cultivation is not frequent enough to produce best results. Much of the washing of the soil is due to shallow plowing, careless cultivation and lack of a winter crop.

The farms in this section are mostly small and worked by the owners, who live upon the land—a much more hopeful condition for improvement, in some respects, than were the reverse true.

Recommendations.—That farming in this region can be made more remunerative there can be no question. How can it be done? In the first place, the method of farming should be modified materially. The acreage to the hand should be cut down nearly one-half. This may seem impossible advice where the farmer finds it so hard to make both ends meet with the present acreage. But it is the first and essential step to a better condition of the farm.

Having reduced the acreage, substitute a large two-horse plow for the small one, hitch two strong horses or mules to it, and plow deep. The plowing for a spring crop should be done in the fall where the surface is not too rolling. If the soil does not readily pulverize, the harrow should be run over it, and, after the winter rains, it will be found to have in the spring much more available moisture than if plowed fresh in the spring. Furthermore, the exchange of gases, essential to the liberation of plant food, will have taken place more freely than if the land had been cold and packed all winter. As a result of this treatment, the soil is warmer, and actually possessed of more fertility. The spring plowing then should be shallow, and the surface thoroughly pulverized with the harrow. The harrow is a very essential farm implement, and should be run over and over the land until it is thoroughly mellow, like a garden spot.

A careful selection of seed for planting is essential to successful farming. No farmer can afford to nelgect it.

The cultivation of the crop should begin early and be rapid throughout the growing season. Keeping down weeds and grass is not the only purpose of cultivation, but constant stirring of the soil promotes those changes in it by which plant food is made more rapidly available to the crop. Cultivation should not be deep enough to disturb the roots of the growing crop, one of the best implements for the purpose being some one of the various styles of cultitors.

The hill soils of the area, as stated before, are of two general types, the Brown Loam and the red Lafayette or Orangeburg soils, in both of which humus or organic matter is usually deficient, unless freshly cleared. The Orangeburg type is also nearly always lacking in phosphoric acid. To supply humus, stable manure is one of the best applications to either, if it can be had in sufficient quantity, but as this is not often the case on Mississippi farms, the best procedure is to plow under some green crop from time to time. The best for this purpose is one of the legumes, and of all the legumes, none surpass the cow-pea. The cow-pea should form part of every farm rotation where humus is desired; it furnishes not only humus, but rich supplies of nitrogen as well to the soil on being plowed under and allowed to rot. Nitrogen is the highest priced element of commercial fertilizers, and where it can be supplied to the soil naturally, in the way suggested, no farmer can afford to buy it.

On the sandy Orangeburg soils, deficient in phosphates, peas will not thrive well, and in order to get a good growth it will be necessary to supply acid phosphate to the soil (which it needs, anyway, for other crops), and when the peas have begun to bear, they should be plowed under and incorporated with the soil. By such methods, followed by proper rotation of crops, the least promising of these soils can be made very productive.

Rotation of crops is necessary to prevent exhaustion of even the richest soils. Every system of rotation should include cow-peas or other legumes for the restoration of humus and nitrogen to the soil, without which no soil can produce. The farmer can himself work out a system of rotation by which he can get one crop each year for use and yet have one in every three or four years to plow into the soil.

Soil washing is very prevalent in the region under discussion, and attention may be called to the chapter on that subject. In addition to what is said there one or two more points should be mentioned. Careful terracing or circling the land is absolutely necessary to prevent washing on the hill farms. Where terraces are established, their integrity must be carefully maintained. If a break occurs anywhere in the margin, it should be at once repaired, otherwise they will soon fail to protect.

Perhaps the most important protection against erosion of cultivated fields is to keep the field constantly occupied by some crop. This necessitates a winter crop, a feature of farming that has received little attention in Mississippi. The winter in our climate is a season of heavy rains, and as the soil is not frozen and not occupied by a protective crop, on slopes it is extremely liable to wash. Every hill farm should have a winter crop, not only for the protection against soil washing, but because of its money value, and for the still further reason that it utilizes the plant food that otherwise would be washed out by winter rains and lost to the farmer. One of the best winter crops is hairy vetch, which makes a fine crop of hay, and, being a legume, adds nitrogen to the soil. Vetch will yield a ton and a half of hay of the best quality to each acre, and through its nitrogen-fixing tubercles, enriches the soil. Rye is also a good winter crop.

The soils of this region are adapted to a number of crops besides cotton and corn, the staples now raised almost exclusively. Sweet potatoes, sorghum, wheat, peanuts and fruit can be raised profitably. The loam soil of this region is identical with that of some of the best fruit lands in Tennessee; apples of fine quality have been grown near Iuka, and may be grown successfully wherever the loam soil occurs, by spraying, pruning and otherwise caring for the trees.

The Orangeburg soils are practically identical with the soils of the Pontotoc Ridge, that are especially well adapted to the raising of peaches.

These soils will grow satisfactorily lespedeza and bermuda grass, and in pastured areas they should be encouraged. The pasturage would be all the better by sowing burr clover and the bermuda together. The clover is a winter growing plant, and will furnish pasturage during the time when the bermuda is dormant, the two furnishing green pasturage practically every month of the year.

The successful farmer will buy nothing that he can make his farm produce, and in Mississippi there are few things he cannot produce. He can, and should, raise his own horses and mules, besides which he can raise them for market much cheaper than his northern brother, who has to feed five or six months of the year; he should raise his own pork and lard, his own corn and wheat for bread and for feed, his own hay, both to use on his farm and to sell, his fruit, potatoes, peas, peanuts, pecans, wool and cotton. By the use of stable manure and legumes plowed into his soil, he can make his farm rich without buying much of the costly fertilizers, and almost any of his crops, besides supplying his own wants, can be made a money crop.

The bottom lands will produce abundant crops of the staples, cotton and corn and oats, besides being the finest hay lands. The heavier lands, when well drained, will probably be found to produce alfalfa successfully, especially in the more western parts of the area.

Water Supply.—All over the northeastern hill region, the water supply is from springs and shallow wells, which furnish abundance of pure, freestone water. The smaller streams are clear and swift, and most of them supply wholesome water.

BLACK PRAIRIE BELT.

Boundaries of the Region.—For simplicity of discussion this region is made to embrace all that part of the State where the Selma Chalk (rotten limestone of Hilgard) outcrops. It is practically co-extensive with the Selma area as shown on geological maps. As a matter of fact, however, by no means all the surface possesses the prairie type of soil, whole counties in this region merely showing it in scattered patches. The region consists of a broad band running almost north and south, the southern half curving slightly eastward, through a number of the northeast counties of the State. It is about six miles wide in its narrowest part towards the northern end, and widens southward, reaching its greatest extent between Houston and Aberdeen, where it is about twenty-five miles wide. South of that point its width does not vary much to the State line in Noxubee County.

This belt enters Alcorn County on the north and passes a little west of the center in a band six miles wide, occupies the west third of Prentiss County and the southeast corner of Tippah, practically all of Lee, and a narrow strip on the eastern border of Union and Pontotoc, east half of Chickasaw and west third of Monroe, all of Clay except a little of the western part, the northeast third of Oktibbeha and the west two-thirds of Lowndes, practically all of Noxubee except a belt of the Flatwoods in the western part, and the extreme northeast corner of Kemper.

Topography and Drainage.—The surface of the northeast Prairie Region is a broad depression which slopes toward the south, rapidly at first, then more gently. At Corinth, near its northern edge, the altitude is 456 feet; at Tupelo, 50 miles south, it has fallen to 270 feet; at West Point to 241, and at Macon, near the southern border of the region, to 214. The depression of the area is accentuated by the adjacent Tennessee River hills, and Pontotoc Ridge which border it east and west for about half its length. Moreover, the surface is so much less uneven than the bordering formations, that it is usually described as level, or nearly so. This is true of the prairies proper, their surfaces being nearly level stretches, devoid of tree growth, except an occasional clump of crab-apple or wild plum. The area is by no means all prairies, however; these are especially developed in the central region of the belt, in Monroe, Chickasaw, Lowndes, Clay, and parts of Oktibbeha and Noxubee.

In the northern and southern parts of the area and along the margins where it shades into the bordering hilly formations, the topography becomes rolling, some of the ridges rising quite conspicuously above the general surface. Even in the prairie region proper, the level stretches of open prairies are interrupted by occasional knolls and ridges clothed with a growth of under-size oaks of several species. Coincident with this difference in topography is an equally distinct difference in soil types, the consideration of which will be taken up later.

That part of Alcorn County falling within this region is all of a rolling character. This is also true of Prentiss, with the exception of a few small areas west and northwest of Booneville, where the soil and topography take on the prairie character. Lee is largely rolling, as are those parts of Union and Pontotoc falling within this region. In southern Lee and in the "Chickasaw Old Fields" in southeast Pontotoc, the true prairies become a prominent feature of the landscape, and through Chickasaw, Monroe and Clay counties become the prevailing character of topography. Knolls, occurring here and there throughout the area, are usually the sites of towns, as, for instance: Tupelo, Shannon, West Point, and farther south, of Artesia and Macon.

On the east and west the prairies pass by a marginal fringe several miles wide into the more rolling wooded lands which merge into the sand hills. South of the Pontotoc Ridge, on the west side, they pass into the more heavily timbered flatwoods. The western part of the Oktibbeha area is rolling and shows little of the prairie type of soil. Western Lowndes and eastern Noxubee are mostly of the prairie type, the western half of Noxubee being largely rolling. The distribution of these prairies is for the most part in belts, having roughly, a north and south trend, separated by ridges and knolls of higher land, which usually show a different character of soil.

The drainage of the whole prairie region is toward the Tombigbee, with the exception of that part of Alcorn County which drains into the Tuscumbia River. Prentiss County is drained through Twenty-mile and Big and Little Brown Creeks. Old Town Creek drains Lee, Pontotoc and northwest Monroe. Chookaonchie Creek, with its tributaries, drains Chickasaw and part of Clay Counties, the western part of Clay contributing to Sun Creek, which, with the waters of Trim Cane Creek from northwestern Oktibbeha, form Line Creek, a tributary of the Tombigbee. The southern part of the region, consisting of southern Oktibbeha and Noxubee counties, is drained by Oaknoxubee River and its numerous tributaries.

All the streams mentioned are tributaries of the Tombigbee, the drainage being southeasterly in direction. Their channels are cut down into the limestone, so that the streams flow twenty to thirty feet below the surface of the country, the larger streams flowing at the lower level. Level bottoms border the streams, from one to three miles wide, that of the Tombigbee being three miles wide at Columbus.

Character and Distribution of Soils.—Upland Soils. These show a greater variety than is ordinarily supposed. The characteristic soil of the region is the black soil of the prairies, which shows potential differences sufficiently marked to influence crop yield materially, but not apparent to the eye. Besides this type, several others characterized by lighter colors and usually lighter texture, occur throughout the region. The black prairie soil is derived directly from the underlying Selma Chalk, while the lighter types originated from the later formations, Lafayette or Brown Loam, or a mixture of these with residuum from the Selma limestone.

The black prairie soil is classed by the U. S. Soil Bureau as Houston Clay. It is heavy, tenacious, calcareous loamy clay, black when wet, dark gray when dry. It is quite rich in lime, which is often found as shells and concretions distributed through the soil. It is very sticky when wet, and plows unsatisfactorily, but when sufficiently dry can be put in good tilth. Humus is usually present in abundance, except in old fields that have been cultivated for many years. On drying, this soil possesses the property of cracking and crumbling down into minute fragments, not unlike the "buckshot" soils of the Delta, which will be studied later. This quality facilitates cultivation.

The soil has a depth, usually, of 10 to 20 inches, and passes into a subsoil of lighter color and higher in lime, which merges insensibly into the rotten limestone. It is very retentive of moisture, and since the areas where this type is found are often low and flat, drainage is of importance to secure full crop returns. All the leveler areas should be tile-drained, whether they seem to need it or not. The soil would be mellowed, and would resist better both wet and dry seasons, and the increased yield per acre would within one or two years pay for the tiling.

This distribution of the Houston Clay has been intimated in noting the distribution of prairies. In Alcorn and Prentiss Counties this type has very limited distribution in small patches, the largest being northwest of Booneville, of about 5,000 acres, and in the whole county it constitutes scarcely more than two per cent of the surface. In Lee County it is more frequent, especially south of Tupelo, where the prairies become larger. In southeast Pontotoc it occurs in the Chickasaw Old Fields. Chickasaw, western Monroe and Clay show this type widely distributed; in eastern Oktibbeha it is not very extensive, the largest body being around Osborne, another near Oktoc, of smaller extent. Western Lowndes has large areas, especially southward, passing into Noxubee around Brookville. Another large belt stretches through the eastern part of Noxubee around Cliftonville, Prairie Point and southward.

At one time the Lafayette and Brown Loam formations overspread the whole Prairie Region, from much of which they have since been swept away by erosion. Large surfaces of soils still remain, however, that are derived from one or the other of these, or a mixture of them.

Occupying a large territory in Alcorn, Prentiss and western Itawamba, along the border of the Prairie Region, is a gray or brownish fine sandy loam called the Guin fine sandy loam, of rolling topography and passing gradually into the sand hills of the Tennessee River Hills. The soil is eight to ten inches deep and rests upon a brownish red clay loam subsoil. It is derived from the Lafayette. It is a very productive soil, is easily worked on account of its sandy nature, and, owing to the heavier subsoil, retains moisture well.

Mechanical analyses of Guin fine sandy loam.

Description.	*Fine gravel.* %	*Coarse sand.* %	*Medium sand.* %	*Fine sand.* %	*Very fine sand.* %	*Silt.* %	*Clay.* %
Soil	0.2	2.0	3.0	23.1	4.9	58.7	7.6
Subsoil	.1	1.2	2.0	24.4	3.7	49.5	18.8

Oktibbeha clay is a heavy yellowish brown loam soil several inches deep upon a mottled clayey subsoil. This, with a closely related type, Oktibbeha fine sandy loam, is derived from the Brown Loam formation, and has a wide distribution in this region. It differs somewhat from the typical Brown Loam, being modified by the underlying Selma Chalk. These soils, as might be inferred, occupy the higher lands in the region and are conspicuous not only because of the rougher topography, but because of the reddish color of the ground and the growth of trees, which is a constant accompaniment. So characteristic is it that the red soils may be accurately guessed miles away by the groves of trees.

Most of the surface of this region found in Alcorn and western Prentiss and a large part of Lee, show the reddish soils of the Oktibbeha Series. They are prevalent in all the country south and west of Corinth. The soils around Tupelo are mostly of the same character and distinctly rolling. The margins of the Prairie Region east and west are largely of this and the Orangeburg types. West Point sits upon a prominence of Lafayette sands, with a clayey, reddish soil capping the neighboring ridges, while the lower lands are of the black prairie type. In Oktibbeha County, just east of the Flatwoods belt, is a broad band, the surface of which is nearly all of this series. With the exception of the stream bottoms and a few prairie spots, the east half of the county is almost entirely covered by this series of soils. A region about Macon, and most of the west half of the county of Noxubee, shows this type of soil. Wherever it occurs it is characterized by the same scrubby growth of highland oaks, the reddish or yellowish brown soil and by the marks of erosion that are in places very conspicuous. The Oktibbeha clay is regarded as an erosion type resulting from the denudation of the covering of Oktibbeha fine sandy loam. The absence of an absorbing coating of soil and the dense nature of the clay cause this type to erode rapidly. This result is intensified by the fact that much of it has been cultivated in fields for many years until the soil has become sterile, since when it has been thrown out and given up to extensive erosion.

Mechanical analyses of Oktibbeha clay.

Description.	Fine gravel. %	Coarse sand. %	Medium sand. %	Fine sand. %	Very fine sand. %	Silt. %	Clay. %
Soil	0.0	1.3	0.6	5.4	7.3	42.9	42.2
Subsoil	.1	1.0	.5	5.4	10.5	46.2	36.2

Sufficiently detailed study has not been made over this region to limit definitely all the soil types, and no attempt will be made to do so. However, the Norfolk and Orangeburg Series occur sufficiently often to demand a word. It will be remembered, these are both derivatives of the Lafayette and distinctly sandy with some admixture of clay. In the Norfolk Series the subsoil is yellowish, clayey sands, though the soil may be grayish; in the Orangeburg series the subsoil is orange red, the soil being usually red, though humus may give it a dark gray or brown color. When these occur in the Prairie Region, they always occupy the higher lands and are usually closely associated with the Oktibbeha Series discussed above. Where the latter are found capping the hills, the Lafayette derivatives, if present, will be found skirting the slopes lower down, not unfrequently, however, this relation is reversed, owing to the removal by denudation of the capping of loam and its redeposition on slopes below the level of the Lafayette, in which case, however, the redeposited loam would partake somewhat of the character of both materials.

Bottom Soils. The larger streams of the area have bordering flats, one to three miles wide, those of smaller size, from half a mile to one mile wide. In all the soils are fertile, though some overflow annually. These alluvial soils vary in different streams, and even in the same stream, in different parts of its course, according to the principal source of materials entering into their constitution.

They have been classified under several types which will not be discussed in detail here, further than to mention that such as the Ocklocknee loam, catalpa silt loam and congaree loam are the lighter types, loamy and friable in nature on account of the contained sand, and from gray to brown in color. These pass by easy gradations into the heavier clay types, as the Ocklocknee clay. It is needless to state that these lighter soils of brownish and grayish colors are derived chiefly from areas of Lafayette or loam exposures, and hence all streams flowing out of such areas into the Prairie Belt will have soils of those types where they enter, though these types may be replaced by others lower down.

Streams that originate wholly within the Prairie Region and those that receive their principal contribution from the Houston Clay will have a much heavier and darker soil than those enumerated above. The Wabash Clay is of this type.

The bottom soils of this region, then, are of two general phases, the lighter loamy and sandy soils, and the heavy, dark, clayey soils. Both usually contain lime, but the heavy type has the larger proportion, because derived chiefly from the residuum of the limestone. Both types contain a larger proportion of sand than the Houston Clay, and work more easily. The heavier types often need drainage. Humus is abundant in all the alluvial soils of the region in their primitive condition.

Mechanical analyses of Ocklocknee clay loam. Heavy bottom soil.

Description.	*Fine gravel.* %	*Coarse sand.* %	*Medium sand.* %	*Fine sand.* %	*Very fine sand.* %	*Silt.* %	*Clay.* %
Soil	0.1	1.9	2.1	23.2	9.1	38.1	25.2
Subsoil	.0	.4	1.4	27.6	11.6	26.1	32.5

About 50% of these heavy soils imperatively need drainage in order to yield satisfactorily.

Mechanical analyses of Cahaba silt loam.

Description.	*Fine gravel.* %	*Coarse sand.* %	*Medium sand.* %	*Fine sand.* %	*Very fine sand.* %	*Silt.* %	*Clay.* %
Soil	0.2	0.8	2.2	13.9	5.4	67.0	10.6
Subsoil	.3	.4	2.4	16.0	9.8	49.8	20.9

A lighter second bottom or terrace soil usually well drained.

Native Vegetation.—As already stated, the black prairie soils are practically devoid of tree growth, scattered clumps of crab-apple, honey locust (*Pyrus augustifolia*) (*Gleditschia triacanthos*), and wild plum (*Prums chicasa*) dotting the surface where not reduced to cultivation. Along the bluffs of streams a more varied tree growth occurs. In these places are found hackberry (*Celtis Mississippiensis*) very commonly, red bud (*Cercis canadensis*), rock maple (*Acer saccharinum*), chestnut (*Castanea vesca*), and red cedar (*Juniperus Virginiana*) where the limestone is exposed or lies near the surface. Common creepers in the same localities are wistaria (*Wistaria fruticosa*), Virginia creeper (*Ampelopsis quinque-folia*), poison oak (*Rhus toxicodendron*), cissus bipennata and supple jack (*Berchemia volubilis*.)

Shrubs and herbaceous species grow in profusion beneath the trees. The arrow-leaved violet (*Viola sagittata*), (*Coreopsis lanceolata*), self heal (*Brunella vulgaris*), *Dichondra repens*, purple houstonia (*Houstonia purpurea*), wild sage (*Salvia lyrata*), wild onions (*Allium mutabile*), lead plant (*Amorpha fruticosa*), skull cap (*Scutellaria parvula*), crow foot (*Ranunculus abortivus*), polygala boykinii, red buckeye (*Aesculus pavia*), and many others, occupy the ground.

In the edges of the fields are such familiar species as little humility (*Apogon humilis*), wild geranium (*Geranium carolinianum*), *Valerianella radiata*, may weed (*Anthemis cotula*), and yellow wood sorrell (*Oxalis Stricta*). On the open lands are those typical prairie species, the compass plants (*Silphium laciniatum* and *S. terebenthenum*), prairie clover (*Petalostemon dandidus*), several species of milkweed (*Asclepias*, *Asclepiodora viridis*), Indian potato (*Cacalia tuberosa*), and Indian pink (*Silene Virginica*). Everywhere in the greatest abundance in the prairie pastures of Noxubee, the pink evening primrose (*Oenothera rosea*) tints the landscape with its colors.

On the higher red soils, an entirely different assemblage occurs. These areas support a rather dwarfish growth of trees of a few species, chiefly oaks. The commonest are post oak (*Quercus stellata*), black jack (*Q. nigra*), Spanish oak (*Q. falcata*), and black oak (*Q. coccinea tinctoria*); shell bark hickory (*Carya alba*), and in the old fields, persimmon (*Diospyrus Virginiana*) is also common.

Characteristic herbaceous species are wild rose (*Rosa humilis*), wild indigo (*Baptisia lencautha*), spiderwort (*Tradescantia Virginica*), wild phlox (*Phlox pilosa*), (*Psoralea mellilotoides*), goats' rhue (*Tephrosia Virginica*), pink root (*Spigelia Marilandica*) and plantain (*Plantago aristata*).

Where the red sandy Orangeburg soils of the Lafayette are distinctly developed, a different assemblage still is to be found. A series of hills near the Tombigbee bottom, north of Cliftonville, Noxubee County, rise to an elevation of 40 or 50 feet above the surrounding country, and present some interesting features. At the base is the Selma limestone covered with soil; above this for ten to twelve feet is a yellowish gray laminated sandstone, most probably of the Ripley formation; twenty-five feet of red Lafayette caps the hill, with a thin covering of Brown Loam, four or five feet thick on top—both of which formations undoubtedly once covered the whole area. The flora of the hill suggests that of the sandy loam regions of North Mississippi. The tree and shrub growth is identical with that of the Lafayette in Lafayette County. For example, the commonest tree is pine (*Pinus mitis* and *P. taeda*), with which occur persimmon, winged elm (*Ulmus alatus*), sweet gum (*Liquidamber styraciflua*), sassafras (*Sassafras officinale*), huckleberry (*Vaccinium aboreum*), sumach (*Rhus typhina* and *R. glabra*) and muscadine (*Vitus rotundifolia*). The herbs are hardly less striking in their relationship to the sandy loam flora of the northern counties. A few are: purple aster (*Aster paludosus*), ground cherry (*Physalis viscosa*), chickweed (*Cerastium viscosum*), everlasting (*Gnaphalium purpureum*), sensitive brier (*Shraukia sp.*), *Krigia Virginica* and *Stylosanthes elatior*.

The floras of the different stream bottoms present slight differences, but the general character can be considered as a whole. Trees of common occurrence are as follows: oaks of several species, black oak (*Q. coccinea tinctoria*), white oak (*Q. alba*), willow oak (*Q. phellos*), water oak (*Q. aquaticus*), black locust (*Robinia pseudacacia*), honey locust (*Gleditschia triacanthos*), sycamore (*Platanus occidentalis*), yellow poplar (*Liriodendron tulipifera*), ash (*Fraxinus Americanus*), chestnut white oak (*Q. Michauxii*) and mulberry

(*Morus rubra*). These are sufficiently indicative of the character of the soil, and the herbaceous species will be omitted.

Cultivation and Crops.—Diversity of soils fits the Prairie Region for a variety of agricultural pursuits, but until recently the agricultural history of that region has been essentially the history of two crops—cotton and corn. Under the slavery system of ante-bellum days the lands were held in large estates and worked by the slaves. Up till comparatively recently there was little tendency to reduce the size of the plantations. The owners rented their lands in small pieces of twenty to forty acres to negro tenants, who paid for the use of it in cotton. This has been the staple crop throughout the region to the practical exclusion of all other crops except corn, which, while ranking second in importance, was not grown in sufficient quantity for home consumption.

In the early days the planters regarded the black prairie soil as not well adapted to cotton raising; the stalk and leaf grew luxuriantly but little fruit was produced. Hence these lands were planted in corn wherever practicable, and the higher, lighter soils were put in cotton. Later this system became reversed, and the black lands are found now to produce cotton more successfully than the lighter soils, a great deal of which is now very much run down. The former will yield from two-thirds to a bale of cotton per acre, or from forty to sixty bushels of corn. The yield of the lighter lands is much less. With improved methods of tillage, all these types of soil may be made to double their yield.

Of recent years, a distinct advance has been made in the agricultural processes of this region. More attention is being given to proper preparation of the soil, selection of seed and care of the crop when planted. Stock raising is commanding more attention than formerly, and the stock is being greatly improved. Increasing interest is being taken in the County Fairs, which are having a salutory effect, not only in this region, but throughout the State. The influence of the Corn Club movement throughout the State has spread to the farmers of this region, and more corn and better corn is being raised. Corn is being worked now instead of being allowed to take care of itself. Still, there is room for improvement.

The most important innovation has been the introduction of alfalfa as a permanent crop. Various wild grasses had received more or less attention as hays and for pasture. In 1903 Mr. B. H. Strong, of West Point, Miss., discovered that the prairie soil of Clay County was adapted to the growth of alfalfa. His first experiment consisted in sowing to alfalfa one-half acre of black land. The sowing was made in March and three cuttings were made by the middle

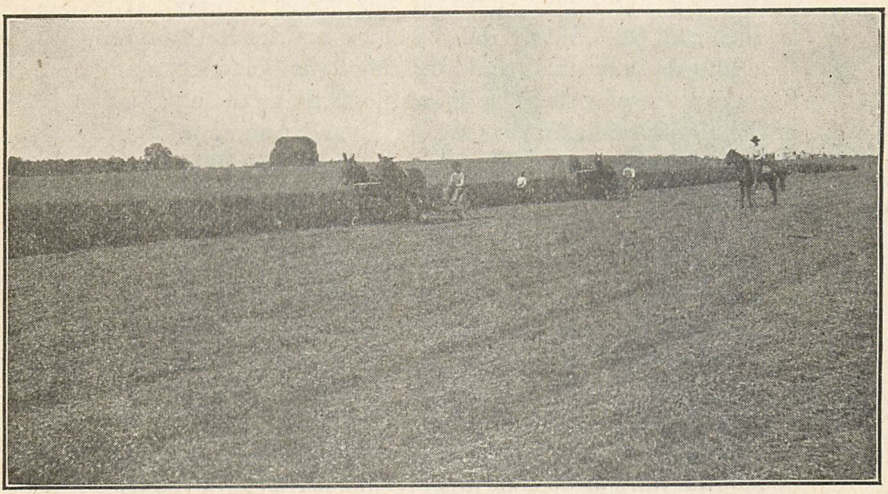


Fig. 3. B. H. Strong's Alfalfa Field, Near West Point, Miss.
Alfalfa Cut From Here Won Gold Medal at St. Louis Exposition.

of October, aggregating the first year two and one-half tons per acre. Alfalfa cut from the farm of Mr. Strong was awarded the Gold Medal prize over all competitors at the St. Louis exposition in 1904. Since then, alfalfa raising has spread rapidly over the Prairie Belt, and large acreage is now in cultivation in this most valuable forage plant. Undoubtedly the acreage in alfalfa would have increased even more rapidly but for the unprecedented high prices of cotton that have prevailed for a few years past.

On the markets alfalfa hay brings $15 to $20 per ton, and in the prairie lands of Mississippi four or five cuttings a year are made, aggregating as many tons to the acre. In Clay County, lands growing alfalfa have rented for $25 per acre, cash rental. On those lands adapted to its growth, it bids fair to become the banner crop of the State.

Present experience seems to indicate that to grow alfalfa successfully requires several necessary conditions: 1. Lime in the soil in appreciable quantities. 2. Humus must be present. 3. Drainage is absolutely necessary. Alfalfa roots will not grow in sobby soil. These requirements, except drainage, are met in the highest degree in the black prairie soil, and where such soil has proper drainage, it is an ideal soil for alfalfa. All the black prairies are adapted to alfalfa when drained, and, realizing its importance, many farmers possessing these lands are tile-draining them. Much of the alfalfa lands, during the spring and summer of 1909, suffered very seriously on account of the heavy rains, whereas, with tile-drainage, no harm would have been experienced.

The lighter colored soils are not as well adapted to alfalfa as the black soils, because of the insufficiency of lime and the absence, often, of humus. Of these, the sandy soils, as the Norfolk and Orangeburg series, are not adapted to alfalfa; the Oktibbeha Series of reddish brown loams and clays are better adapted to other crops, but may raise alfalfa if supplied with humus. Except where mellilotus has already inoculated the soil, all soils must be inoculated with the bacterium that is required by the alfalfa. Otherwise, failure results.

Besides corn, cotton and alfalfa, the black soils are adapted to all forage crops, especially legumes.

Mellilotus grows luxuriantly, as does lespedeza and bermuda grass. The vetches find in it a congenial soil. Wheat, oats, sorghum, timothy and Johnson grass thrive on this soil. Fruit and truck crops do better on the lighter soils. The soils of the stream bottoms are well adapted to corn, cotton, alfalfa and other forage crops.

Let it be emphasized that all the heavy prairie soils would be better adapted to all crops and the yield would be doubled if they were properly tile-drained. These are the natural alfalfa soils of the State, and yet on the lower lands wet years will absolutely drown out growing alfalfa.

The Oktibbeha Series of sandy loams and clays have long been farmed in the exhaustive way that has been practiced so generally all over the State. Much of these soils are exhausted and are used in pasture or have been thrown out, either to suffer destructive erosion or to grow up in old field pine. This is particularly true of the more sterile yellowish clays that perhaps should be allowed to grow up in trees. The loam soils, however, with proper rotation, and by plowing under green crops occasionally, can be brought to full productivity again. They are adapted to corn and cotton, though the yield per acre will not equal that of the richer black limey soils. Potatoes, sorghum, fruit and vegetables do well on these soils. Most forage crops do well, though alfalfa is much better in the heavier black lands.

The Norfolk and Orangeburg soils, which are the lightest soils of the region, are especially well adapted to fruit and vegetable crops. The red Orangeburg are the more productive, and with careful tillage can be made to produce the staples in remarkably good yields. Melons and sweet potatoes do well, but these soils are especially adapted to raising peaches, the Elberta making large yields of fruit of the finest quality. The yellow Norfolk soils are the best for early truck crops, though not producing the staples or forage crops especially well. These lighter soils are usually deficient in phosphoric acid, as well as humus, and are benefited by applications of phosphates.

Recommendations.—The Prairie Belt is one of the most fertile regions of the State, and in several respects, it is in advance of other sections in farming methods. This is largely due to the location of the Agricultural College in that part of the State. The region is so largely level, or gently rolling, and the fields free from trees and stumps, that it is especially well adapted to the use of the most improved farm machinery, and it is to be hoped, that a pace may be set for the rest of the State in strictly scientific farming. The general recommendations made under the discussion of the Tennessee River Hills embody certain principles of agriculture that will apply equally here; as, for example, the benefits of deep plowing, of thorough preparation of the ground, of careful selection of seed, of rapid and thorough cultivation during the growing and fruiting season, of proper rotation of crops and of diversification of farm interests.

Since the successful growing of alfalfa is limited by certain soil characteristics which are found pre-eminently in the prairie soils of this region, since no section of the country can grow it of such quality as grows here, and no crop on the same soil can compete with alfalfa as a money crop, and, since alfalfa stands at the head of the list of forage plants, the outlook of the Prairie Belt would seem largely to lie in the growing of this magnificent crop. We predict this with the more confidence when we witness the steady advance of the Mexican boll weevil, which threatens so seriously the growing of cotton. There need be no fear of overstocking the market. If all the available lands of the country were put in alfalfa, the demand would not be supplied. Markets accessible to the alfalfa grower of Mississippi are New Orleans, Memphis, Nashville, Chattanooga, Birmingham and Mobile, to say nothing of the numerous smaller cities of the State, as Meridian, Jackson, Vicksburg, Natchez, Hattiesburg and Columbus, all of which must be supplied. Besides, with the growing of alfalfa will naturally spring up the raising of fine stock, for which this region is especially well adapted. Dairying will, and should, become a prominent industry. War is being made upon the cattle tick, so that Texas fever will soon become unknown, and the best breeds of cattle can be introduced without fear.

There is no better pasturing for hogs than are alfalfa fields. The hog pasture may be divided by partition fences into four parts. When the hogs have grazed down the first part they are turned into the second and closed out of the first; when the second is grazed down they are turned into the third, and so on around. By the time they are ready to be again turned into number one, the alfalfa of that division has reached a height of five or six inches and is ready for them again.

Bee culture is very profitably carried on in connection with the growing of alfalfa. The alfalfa blossom, as well as that of the mellilotus, which is abundant in this region, imparts a delicious flavor to the honey, which is usually abundant and beautifully limpid. The honey from the alfalfa growing regions of the West commands the highest prices in the markets.

Alfalfa ground into meal finds a ready market at high prices, and made into flour is found to be a palatable and nutritious food for man. It is safe to say that not yet have all the manifold utilities of this valuable plant been discovered. Any region that makes it a staple crop must prosper, because of the numerous side lines of development that offer large returns.

Water Supply.—Springs and shallow wells are rare in this region. Where the Lafayette sands lie of considerable depth over the Selma limestone, these may be obtained, but such localities are not common. All over the region artesian water of good quality may be obtained by drilling through the Selma Chalk into the underlying Eutaw and Tuscaloosa sands. The Selma is 800 to 1,000 feet thick, and borings made at points toward the western border of the limestone outcrop must go through the whole thickness of about 1,000 feet to strike water; midway between the east and west borders, water will be struck at about 500 feet, and the depth will diminish as the eastern border is approached.

PONTOTOC RIDGE.

Boundaries.—A wedge of high lands known as the Pontotoc Ridge enters the State in a series of ridges twelve to fourteen miles wide, running through western Alcorn and eastern Tippah counties. The base of the wedge lies against the Tennessee line, widens somewhat as far as the north line of Union County, then gradually narrows through Pontotoc and Chickasaw, coming to a point at Houston, in the latter county. It forms a distinct topographic feature bordered on the east by the low, gently rolling Prairie Belt, and on the west by the valley-like depression of the Flatwoods.

It occupies the western third of Alcorn and the east half of Tippah, passes east of the center of Union in a strip somewhat less than two townships wide, the same through Pontotoc, though gradually narrowing, into central Chickasaw.

Topography and Drainage.—Pontotoc Ridge is a hilly, broken region, conspicuously elevated above the adjacent country. The altitude varies from more than 500 feet in Pontotoc County to considerably over 600 feet east and southeast of Ripley in Tippah County. Its surface consists roughly of a series of parallel ridges running north and south, but very much broken into hills. Along the crest is an area of level or rolling lands, in places cut into disconnected patches, usually not of large size. The northern portion of the area is drained by the two heads of the Hatchie, and is known as the Hatchie Hills. This part differs in character and in tree growth from the Pontotoc Ridge proper. Southward through Union and Pontotoc Counties the leveler lands become more extensive and the soils are a fertile loam.

Pontotoc Ridge forms a divide between the waters flowing east and west. The northern part is drained by the two forks of the Hatchie into the Tennessee; the tributaries of the Tombigbee have cut deeply into the Ridge on the east side, while the Tallahatchie and Schooner and their tributaries drain the western slopes into the Mississippi. Owing to the sandy nature of the materials and to the prevalence of slopes all parts are well drained. Surface run-off over this area is so rapid generally that erosion of the cultivated fields is quite extensive.

Soils of Pontotoc Ridge.—The hill soils are all of the Orangeburg Series, consisting of loams and clays of bright, orange red color. In the northern parts of Tippah and farther south between the heads of the Hatchie the country is very rough and hilly, the soil red and sandy, and not as productive as farther south in Union and Pontotoc Counties. The farms are small and scattered. Some of the hills rise 200 feet above the flood plain of the Hatchie; the Hatchie bottom and the slopes and tops of the hills in many places show good bodies of standing timber. Deer and turkey are still plentiful in the hills of Big Hatchie.

The bottom of Big Hatchie is a mile wide and very fertile. A specimen taken from the field of Dr. Dickerson, near Crum's Mill, is a fine sandy loam, dark gray in color, rich in humus, and easily worked. Unfortunately, much of this bottom overflows.

East and south of Ripley, and thence southward through Union County, the surface is less hilly and the soil becomes more loamy, showing less sand than the soils of the Hatchie. The same general character of soils continues through Pontotoc County, constituting the rich red loams of that section. These once supported a rich hardwood forest growth, pine, which was very common on the sandy soils of the Hatchie, being rather rare. The forests now exist as remnants, the leveler lands having been cleared and farmed for many years.

The origin of the intensely red soils of Pontotoc Ridge has usually been referred to the Lafayette Formation. Investigation, however, has proved that some of them, at least, are derived from the green sand marls of the Ripley, and since these are identical in characters with others supposed to be derived from the Lafayette, and since the distribution of the Ripley is limited to Pontotoc Ridge, it is probable that all these red soils are weathered Ripley materials.

In southern Pontotoc these soils become filled with "smooth, shining, brown pebbles," so as to look unpromising, but they prove to be very productive, equaling the best black alluvial soils. These have been called "Buncombs."

All the soils of this region are so mellow that they wash readily, and everywhere in the older cultivated lands, extensive erosion has scarred the slopes, rendering much of the lands worthless.

Most of the streams within this area have narrow bottoms, the soils being reddish brown clay loams derived from the washings of the surrounding hills.

Native Vegetation.—In the broken hills of the Hatchie, pines are the prevailing timber, with an admixture of post oak, black jacks, spanish oak and chestnut. On the richer loam soils farther south the timber is much less of pine, post oak and black jack, but more of the finer oaks, as red oak, and white oak, hickory, walnut and yellow poplar, black locust (*Robina pseudacacia*) and umbrella magnolia (*Magnolia auriculata*).

Cultivation and Crops.—The farms are usually small and a large proportion are worked by the land owners. The methods used on the farm are, like those used in so much of the State, antiquated and not entirely satisfactory. The land is broken to a depth of three or four inches with a one-horse plow, which is the chief implement used in cultivation. The staple crops are corn and cotton, which the red lands produce in good yields when fresh; however, much of the best lands have become run down and the yield has fallen off. Oats, sorghum and potatoes are produced for home consumption. Some fruit growing has lately been taken up with good promise.

Recommendations.—While, as the money crop, cotton holds first place, corn should be produced in larger quantity to supply in full the uses of the farm. This doubtless will come about within a few years because of the revived interest in corn raising due to the corn club movement. It would be well to grow some wheat, not for market, but for home consumption. It was at one time grown successfully on Pontotoc Ridge, and can be again. If the farmers would grow the wheat, with the facilities for water power along the streams, mills would soon be established to grind it. Will it pay? Let each farmer estimate how much he pays out in a year for corn and flour, and answer the question for himself.

Oats, hay, peas and potatoes should be grown in sufficient quantity to supply the farm. Stock is necessary to make farming successful. The soils of Pontotoc Ridge are especially well adapted to fruit growing. The Elberta peach finds its best soil in the Orangeburg red soils. Planted upon the higher lands, orchards would be comparatively safe against killing frosts. The usual advice is to locate orchards upon a south slope, but a north slope is better, especially if a neighboring forest protects it on the north side, as, for instance, a wooded ridge to the north of the orchard. The danger from frost arises from the too early warming of the soil about the roots of the tree, causing the sap to circulate and the buds to swell. Caught in this state, the buds are killed and the fruit crop lost. On a north slope the slanting rays of the sun impart little heat to the soil, which remains cold long after that on the south slope is warm. Hence, the buds swell later and stand a better chance to escape frost.

Since the conditions in this region favor rapid erosion of the soil, every possible step should be taken to prevent it. On slopes the land should be terraced or circled; lands already beginning to wash should be treated as indicated in the chapter on Soil Erosion.

The soil should be plowed deep. In addition to the benefits of increased yield following deep plowing, it makes a deep soil to absorb rain which otherwise would run off the surface, causing erosion. A winter crop of some such habit as vetch or crimson clover should occupy the ground during the winter months, which in our climate is usually a season of rains. The vetch covers the soil with a dense growth, and so protects it against washing. In orchards a winter cover crop is very desirable, because it prevents washing, keeps the soil mellow, uses the soluble plant food in the soil that otherwise would be lost, and for the nitrogen added to the soil if the cover crop be leguminous.

The soils of Pontotoc Ridge, unless freshly brought into cultivation, usually lack humus, which must be added in the form of barnyard manure, abundantly applied, either alone or supplemented from time to time by some green crop plowed into the ground. The older soils will also be found deficient in phosphoric acid, which must be supplied as acid phosphate or ground phosphate rock or bone meal, the last furnishing also abundant nitrogen. Deep plowing is always advisable, since it brings up the rich subsoil and mixes it with the impoverished soil.

Water Supply.—Abundant springs occur all over the region, furnishing good, pure water. Shallow wells can be obtained easily almost anywhere, and artesian water can be obtained at slight depth. Meneral waters are common.

FLATWOODS REGION.

Boundaries and Topography.—The name "Flatwoods" given to this region is descriptive. The surface lies distinctly lower than the regions bordering it, and is so level as to resemble the wide flat of a river. The whole area was originally covered with a growth of post oak, black jack and short-leaf pine, and the region is as yet but little opened to cultivation, though the timber is rapidly being cut away.

This region is a narrow belt, from three to fifteen miles wide, entering the State in western Tippah County and running south, occupying the greater part of R. 2 E., as far as southwestern Chickasaw County, thence trending slightly eastward, passing out of the State through northeast Kemper. It extends through western Tippah, west-central Union and Pontotoc, western Chickasaw and Clay, west-central Oktibbeha, northeastern Winston, southwestern Noxubee and northeastern Kemper.

The hills of the Central Plateau border the Flatwoods on the west and the Pontotoc Ridge borders it on the east as far south as Houston, south of which are the Black Prairies of the Selma. The abrupt hills and red soils of the Pontotoc Ridge are sharply contrasted with the whitish level lands of the Flatwoods. In Noxubee County abrupt hills as sharply define the western border, which is less distinct farther north. The margins of the Flatwoods are very irregular, broad embayments separating the hills here and there.

Soils of the Flatwoods.—The soils of this region are of two distinct types, exclusive of the soils of the stream bottoms. Both types are, when dry, a grayish, putty color; when wet, dark lead gray. The heavier type, known as Lufkin Clay, is a yellowish gray tenacious clay, derived directly from the underlying Midway clay of the lowest Tertiary. The soil differs little from the subsoil, both being more or less mottled with iron stains, and pass at 2 or 3 feet depth imperceptibly into the uniform gray joint clay of the Midway. Very little of this heavier type of soil is under cultivation. When wet it is very sticky, and when dry it cracks and becomes almost as hard as concrete, so that farm crops do poorly and the yield is very uncertain. The rolling areas bordering the streams have little soil and is generally dark brown in color and very tenacious.

Going west from Houston, the last settlement is passed one mile from town and following the Pittsboro road across the Flatwoods no settlements are reached for six or seven miles. No openings occur in the timber except such thinnings as result from cutting timber. The whole area is low, level and drains so poorly that in rainy weather water stands, converting it, for the time, into a swamp, and the roads become so boggy as to be almost impassible. This picture would represent pretty accurately conditions whereever the Lufkin Clay occurs in this region.

This soil is usually deficient in humus and lime, and while potash occurs in sufficient quantity, phosphorus is rather light and would be better added.

The lighter soil type, technically called Lufkin Silt Loam, is a gray, friable, very fine sandy or silt loam, lying upon a light gray mottled silt clay, and at a depth of several feet passes into a heavy gray clay. It is frequently streaked with iron stains, and contains iron concretions where drainage is poor. This soil becomes more sandy and the subsoil more highly colored with increasing elevation. Where this soil comes in contact with the Orangeburg soils, it becomes more silty and contains some coarse sand, due to washings from the hills of the Orangeburg. The topography of this type is more rolling and the surface drainage is therefore better than the heavier type.

This soil, as in the case of the Lufkin Clay, is usually very deficient in lime and humus, and is on the whole poorer in plant food than the gray clay soils, as may be seen from the tests made upon these soils. However, it varies with localities, in some places the yield being very light and uncertain, on others, especially the higher, better drained parts, the soil is more easily worked and the yield better. Wherever the surface is fairly rolling and the subsoil is yellow or red, the soil produces well, owing to better drainage.

The bottom soils of this area are found in flats one-fourth to one-half miles wide along the streams. They are seldom more than four to six feet above the streams, and are subject to overflow. These soils are usually dark sandy loams, but may be heavier materials, depending upon the sources of the constituents of the soil. It may be a sandy loam where the stream flows out of a region of sandy formations upon the Flatwoods, but becomes heavier as it receives contributions from the heavy soils of the Flatwoods.

The bottom soils are more fertile than the other types of this area and ordinarily produce good crops, though subject to overflow and much of it needing under drainage.

Native Growth.—The tree growth of the higher lands of the Flatwoods consists of post oak, black jack, spanish oak, pine—both short-leaf (*Pinis mitis*) and loblolly (*P. taeda*), black gum and hickory. On the bottoms are seen spanish oak, larger and taller, some post oak, abundant hickory of of several kinds, the shell-bark being plentiful, yellow poplar, sweet gum, willow oak and water oak. On the uplands the post oak and pine form the bulk of the timber, which is being rapidly cut away. Even the smaller trees are being extensively cut for cross-ties. Haws of several species are very common over the whole area.

Cultivation and Crops.—As a region, the Flatwoods is not extensively farmed, the topography and character of the soils combining to make the ground too wet to cultivate until late in the spring. In wet years failures in crops result on account of this condition of the soil. Aside from the lack of drainage, the lands are not generally as productive as in other regions, with the exception of the bottom soils, which are fairly fertile. Little of the tough, cold Lufkin Clay is farmed, for the obvious reason that the soil is too hard to handle and the yield not worth the trouble. The soil is cold and acid, and nitrification progresses slowly. Where farmed, corn and cotton are the crops grown, the yield being under most favorable conditions, about half a bale of cotton, or fifteen to twenty-five bushels of corn per acre. If the year proves too wet or too dry, the yield will be much reduced. Sugar cane is said to do well on this soil.

The Lufkin Silt Loam is more extensively farmed because more easily cultivated, and being on the whole better drained, crops are more certain. The yield, however, is light. Cotton will yield about half a bale to the acre, but the yield of corn is only twelve to fifteen bushels. Oats do very well dry years, but are liable to rust during wet seasons. The soil is well adapted to plums and grapes, but not good for peaches or pears. It affords good grazing in places.

Recommendations.—All the soils of this region are wet, cold and acid because of lack of drainage. The first and essential need is thorough drainage, tile drainage being best. Until this is accomplished, the exchange of gasses necessary to liberate plant food cannot take place. A water-logged soil will not permit the growth of nitrifying bacteria. Lacking lime and humus, as they do, these soils need a thorough dressing of barnyard manure and air-slacked lime; or green crops like cow-peas should be plowed under, and after they have had time to rot, a dressing of lime applied. This would result in improving the physical condition of the soil, would neutralize the acid and add essential plant foods, nitrogen and lime.

Experiments have proven that for the Lufkin Clay good results have been obtained by applying a mixture of nitrate of soda, acid phosphate and lime, but better results were had from cow-peas and lime, as just suggested.

For the Lufkin Silt Loam nitrate of soda gave good results; so also did a complete fertilizer, but the largest yields were obtained from a combination of the complete fertilizer and lime.

Hence, it will be seen that for both types of soil lime is distinctly needed.

There is no doubt that with effective drainage and applications, as suggested, supplemented with careful tillage, these soils may be made productive, and desirable homesteads.

Bordering the Flatwoods proper on the west through Lafayette and Calhoun Counties, is a rolling and hilly region several miles wide, having very much the characters of the heavy Flatwoods soils. Some of the ridges are capped with the red sandy Lafayette, but the slopes and depressions between show the gray clay. Owing to the overlying Lafayette, the heavy soils are rendered more friable by the admixture of sand. These soils, therefore, are more amenable to cultivation than those of the typical Flatwoods, and the yield is better and crops more certain. The bottom lands are loamy and very fertile.

Water Supply.—The water supply of this region is almost necessarily from artesian wells. There are no springs or shallow wells, as might be readily inferred from the nature of the material and the topography of the Flatwoods. The sandy strata of the Pontotoc Ridge dip under the Flatwoods and are water-bearing, so that a boring carried through the Midway will tap this water horizon in that portion of the Flatwoods lying west of Pontotoc Ridge. Striking the water stratum at about 50 feet at the eastern edge of the region, it dips about 25 to 30 feet to the mile westward. In Tippah County wells reach water at 300 feet, which rises to within 60 to 80 feet of the surface. In Calhoun County, on western edge of the Flatwoods, water was struck at 404 feet, and rose to within 80 feet of the surface. South of Houston the water-bearing sands are not found, and borings have to go through the Selma Chalk before reaching the water horizon of the Tuscaloosa and Eutaw Formations—a depth of 800 to 1,000 feet.

In the Lafayette-capped hills in the western edge of the Flatwoods, springs and shallow wells are obtainable where the Lafayette is of considerable thickness upon the Midway clay, but are liable to go dry in a protracted season of drouth.

NORTHERN LIGNITIC PLATEAU REGION.

Boundaries.—This, the next largest soil region in the State, has been called by Hilgard the Yellow Loam Region, which is the name given by him to the characteristic soil of the region. We prefer here to use the above name because it has already been used in the geological description of the State, because similar geologic structures and topographic conditions prevail over the whole region, and because several soil types are found distributed over it. At the same time it includes part of a geological formation (the lower Claiborne) other than the Lignitic of Hilgard, and, from the standpoint of soils, it comes nearer being a unit than any of the regions thus far studied. So that, while it will be called here as given in the caption above, the name Yellow Loam Region would be, perhaps, equally appropriate.

In late pleistocene time, a thin mantle of yellowish brown silty loam was spread clear across the State, from the Mississippi River Bluff to and beyond the Alabama line. This varied in thickness from 20 feet near the great river, to 2 or 3 feet in the eastern parts of the State. In all the regions thus far studied, this mantle of loam has been either entirely, or very largely, removed by erosion, the remnants, in many cases, being distinctly modified by the underlying formations. Over the large plateau of north-central Mississippi, however, it very largely remains, forming the predominating soil of the region, hence the propriety of Hilgard's name.

This region occupies all of North-Central Mississippi, as already stated, extending from the border of Tennessee southward to a line drawn approximately through Yazoo City, Canton and Quitman in Clarke County, and bordered on the east by the Flatwoods Belt, and on the west by a narrow range of rough hills 5 to 10 miles wide, skirting the eastern border of the Mississippi-Yazoo Delta. The region, as may be seen, embraces the whole or part of about twenty-five counties.

Topography and Drainage.—The surface of this region is that of a plateau of varying altitude, from less than 400 to more than 600 feet, the higher altitude being in the northern and eastern parts of the area. For the most part this plateau has been maturely dissected by erosion, many streams of large and small sizes trenching its surface. The larger valleys lie a hundred or more feet below the plateau surface, having broad fertile flats, consisting usually of two parts, the flood plain called the first bottom, which is bordered by terraces several feet high called the second bottom. The latter are usually drier and more easily cultivated than the first bottom, which is often subject to overflow. The upper portions of the streams may show little evidence of the second bottom, which, however, is an important feature lower down.

Across the state line in the adjoining parts of Tennessee the gently undulating surface of this Plateau is a striking feature, its broad expanse showing a region of beautiful and prosperous farms. This gently rolling surface of the original plateau passes into the northern parts of Mississippi in northern Marshall and parts of Benton Counties. Approaching the larger streams, however, the topography becomes more uneven, due to the greater erosion. Southern Marshall and Lafayette have a very uneven surface, though an occasional level-surfaced ridge here and there and a few isolated points indicate the original level of the plateau. Instances of the former are Woodson's Ridge, and the uplands of northwestern Lafayette and adjacent parts of Marshall and Tate Counties, while the latter are represented by Buncombe Mountain in southern Marshall and Thacker Mountain in southern Lafayette.

The eastern parts of Benton and Lafayette bordering the Flatwoods are very broken. In the western tier of counties, Desoto, Tate and Panola, the plateau character of the surface is maintained, though possessing considerable irregularities, which increase westward toward the Bluffs.

The larger streams, as the Coldwater, Tallahatchie, Yokena and the Otuckalofa have carved out wide bottoms of fertile lands.

The country lying in Yalobusha and parts of Grenada counties is less broken than farther north and east. East of Water Valley a beautiful farming region lies in Pine Valley country. The valley of Otuckalofa Creek is half a mile wide and very fertile, though subject to overflow and needing drainage. The level farming lands around Grenada, and extending along the Yalobusha River and the Bogue are second bottom lands, beyond which the country rises into broken hills, extending into Calhoun County. The same hilly topography occurs both east and west of Duckhill, and very largely characterizes the whole of Calhoun, Webster, Choctaw and Montgomery Counties, though the western portions of Montgomery are more rolling than hilly.

The eastern part of Holmes County is rolling, becoming nearly level around Durant, but the topography eastward in Attala is hilly, the hills being of an intensely red character. The topography changes little through Leake, Winston and Neshoba and northern Newton. Northern Madison partakes of the same character, though on the whole less rolling. In Kemper, the area covered by the region under discussion is largely one of sandy rolling and hilly lands. In Lauderdale both the soils and the topography are quite varied, the surface in the immediate vicinity of Meridian being fairly level, but a few miles south becomes very rough. In the vicinity of Lauderdale it becomes rolling rather than hilly, though, as a whole, the county is rather hilly.

An area as large, and possessing as much diversity of surface as that under discussion, and in a moist climate like that of Mississippi, must necessarily be dissected by numerous streams. With the exception of the Wolf River in the extreme north and the Sucarnoochee and its tributaries next to the Alabama line, the whole drainage of the region is westward into the Mississippi or directly southward into the Gulf. Wolf River drains northern Benton northward into the Tennessee, while the Sucarnoochee, receiving numerous tributaries from Kemper and Lauderdale, flow eastward into the Tombigbee.

The Coldwater River, rising in the tableland of northeastern Marshall, drains northern and western Marshall, Desota and Tate into the Mississippi. Tallahatchie River rises in the edge of the Flatwoods in southern Tippah, and, flowing southwestward through Union, Lafayette and Panola, drains those counties toward the Mississippi. Yokena River carries the waters of western Pontotoc, southern Lafayette, northern Yalobusha and southern Panola counties westward into the Tallahatchie, just west of the Delta border. The Yalobusha River heads in the Flatwoods, just west of Houston, and flowing westward to the Mississippi drains Calhoun, southern Yalobusha and Grenada counties. The Big Black carries the drainage of Webster and Chocktaw, Montgomery and the northern part of Attala, eastern Holmes, eastern Yazoo and Madison into the Mississippi. Winston, Neshoba, Leake and northern Scott drain into Pearl River, which empties into the Gulf of Mexico. That portion of Newton County lying within this region is drained by Chunkey Creek into Chickasawhay River, which, uniting with Leaf River to form the Pascagoula, flows south into Pascagoula Bay.

All the streams of this area, except the very smallest, have developed bottoms, varying in width from a fraction of a mile to two or three miles. The extent of these bottom lands has never been estimated for the whole region, but, considering their great number, the mileage must be large, and this, taken together with their fertility, makes them of prime agricultural importance.

The bottom of the Tallahatchie is from one to one and a half miles wide between Marshall and Lafayette, becoming somewhat wider below. It is considerably cut up with sloughs or old river beds, and largely subject to overflow. This stream has little second bottom lands, though some appear in Marshall and farther down the stream below Abbeville.

What has been said of the Tallahatchie will apply to the Yokena, which has a bottom of fertile lands two miles wide, but subject to overflow in excessive high water. There is no second bottom of importance.

The Yalobusha bottom is several miles in extent in Grenada County, most of this area being a broad and fertile second bottom. Its chief tributary, the Schooa River, flowing through northern Calhoun and southern Yalobusha Counties, has a bottom two to three miles wide, all of which is first bottom and subject to overflow.

The Big Black has extensive first and second bottoms. The first bottoms are subject to overflow, but their fertility is such that they are being farmed extensively and successfully. The second bottom is one mile wide in Choctaw

County, occurs as separate patches bordering the first bottom in southern Carroll, fringes the flood plain on one side or the other through Holmes County three-fourths of a mile wide, and becoming wider along the border of Yazoo and Madison.

The Pearl River has developed broad bottoms, two to three miles wide, through the region under discussion. As a rule, however, the first bottom is rather narrow, the second bottom being much more extensive. Opposite Jackson, the second bottom of the Pearl is two miles wide.

Character and Distribution of Soils.—Upland Soils. The prevailing soil of the uplands is the Yellow or Brown Loam, supposed to be of Columbian age. It was undoubtedly once continuous over the whole area, but owing to the extensive erosion that has taken place since its deposition, it is now more or less discontinuous or patchy eastward. In character, this soil is a light mellow loam, of yellowish brown color, possessing a large per cent of silt and clay. The soil is six to eight inches deep and passes into a subsoil two to fifteen feet deep, differing from the soil in being less mellow, slightly lighter in color, and having more clay. The proportion of humus is also less in the subsoil, though this soil, unless freshly cleared, is usually deficient in humus.

This Brown Loam is underlaid in most of the area by the red and yellow sands of the Lafayette, which is heavily developed in this region. In thickness, however, it is very variable, five or six feet to twenty-five or more. Along the western border of the area the Lafayette has a large intermixture of brownish chert pebbles. The surfaces of the broad flat plateaus and the level-topped ridges are always capped with the Loam, but where the surface is cut into slopes, as so much of the region has been, the sands of the underlying Lafayette enter largely into the formation of the soils. In the hilly regions bordering upon the Flatwoods the sands are lighter, have less clay, and are apparently derived from the Wilcox.

Technically, the typical Brown Loam soil is classed as Memphis Silt Loam, and a specimen from the Crystal

Springs area, analyzed by the U. S. Soil Bureau, gives the following:

Mechanical analyses of Memphis Silt Loam.

Description.	*Fine gravel.* %	*Coarse sand.* %	*Medium sand.* %	*Fine sand.* %	*Very fine sand.* %	*Silt.* %	*Clay.* %
Soil	0.3	1.6	1.2	1.6	2.3	75.7	16.9
Subsoil	Tr.	1.1	1.0	1.5	1.6	67.0	27.7

As will be seen, this type of soil has a low per cent of the coarser soil ingredients, and it will also be noticed that the subsoil contains a larger proportion of clay than the soil.

Chemical analysis of the same character of soil taken from Marshall County, is given below:

Insol. Matter	83.347	Brown Oxid Magnanese	0.760
Potash	0.544	Peroxide of Iron	4.798
Soda	0.082	Alumina	6.282
Lime	0.245	Phosphoric Acid	0.062
Magnesia	0.479	Water and Organic Matter	4.195
			100.033

(*Hilgard.*)

The corresponding subsoil shows the following analysis:

Insol. Matter (as above)	83.993	Brown Oxide Manganese	0.332
Potash	0.700	Peroxide of Iron	3.862
Soda	0.049	Alumina	7.279
Lime	0.139	Phosphoric Acid	0.236
Magnesia	0.579	Sulphuric Acid	0.054
		Organic Matter and Water	2.716
			100.399

(*Hilgard.*)

The analyses show that in the subsoil the important elements of plant food, Potash, Phosphoric Acid and Magnesia, exist in larger proportions than in the soil, while organic matter, which furnishes humus and which can be readily supplied, is greater in the soil.

The soil of the level tablelands of Marshall and Benton, and of the leveler lands in Lafayette, Desoto, Tate and Panola is of the same general character as that shown in the analysis. The variations in different localities are not sufficient to establish new types, the important differences being those arising from longer or shorter periods of cultivation with consequent exhaustion of the soil.

East of Hernando, Desoto County, on the Pleasant Hill

Road, the topography is rolling but not hilly, only in occasional places showing noticeable erosion, though the land, for the most part, has been long in cultivation. The soil is the Brown Loam, usually deep—in most places 10 to 18 feet. The farms are reported not to be fertilized, yet in most places looked to be above the average when seen in the summer of 1909. This was especially true of a large field of corn belonging to Mr. R. M. Banks, two miles east of Hernando. The stalks were large, dark and fresh in color and of uniform height, with two full ears to the stalk. The undoubted fertility of the soil is partly explained by the intelligent use of leguminous crops.

The quality of the soil deteriorates some along the high ridges in the vicinity of Pleasant Hill, and erosion is more noticeable.

Between Hernando and Sardis, especially around Senatobia, in Tate County, and Como, in Panola, and between these two points, the topography is more even or gently rolling. The soil is of the Brown Loam type and quite fertile, as in the lands around Hernando. In the vicinity of Sardis, however, the land becomes rolling and the soil badly washed in places, and only moderately fertile. The loam is here 8 to 10 feet deep, and the soil, by careful tillage, proper rotation and attention to leguminous crops can be made very productive.

In eastern Benton and Lafayette and adjacent parts of Pontotoc the land is much broken, the loam soil is very thin or entirely removed by erosion and the yellowish sands of the Wilcox form a thin, rather infertile soil, which produces well a few years after clearing, but soon washes away. The loam washed from the ridges accumulates on the lower slopes, making a productive soil.

Yalobusha and Grenada Counties present conditions quite similar to those farther north, the loam covering being widely distributed. The lands around Coffeeville are quite generally of this type. Around Water Valley the topography is hilly and the surface soil largely from Lafayette sands. Southeast of Water Valley on the Banner Road, the country is so rough and hilly that few farms are to be seen.

The loam is often absent and the soils are the red Lafayette sands, that wash badly. In the Pine Valley and vicinity, ten miles southeast of Water Valley, the land lies well and is fertile loam soil. East of Grenada the land soon becomes hilly, the surface being prevailingly red Lafayette and not much cultivated. The eastern parts of these counties and Calhoun are hilly and present the Loam and Lafayette intricately intermixed, as a rule, the broad ridges showing a capping of loam, but if the ridges are narrow, the loam, if present, will be found on the lower slopes, where it will form deep fertile soils.

The Brown Loam is quite generally distributed over Montgomery and Carroll counties, though in the former county west and northwest of Kilmichael and south of the Big Black River, it is largely replaced by the red Orangeburgh soils of the Lafayette.

The soils of Winston are mostly derived from the Lafayette and Wilcox sands, the soils of the northern and eastern parts being redder and heavier than those farther south and west, where they are shallow, yellowish sandy loams. The soils of Webster, Choctaw, Winston and Neshoba appear to be largely derived from the Wilcox. They are of the same yellowish sandy nature as just described. The loam, when present, is nearly always shallow. The red Orangeburg soils are in evidence south of Neshoba, in Neshoba and northern Newton, but north of there it is prevailingly of the yellowish sandy character to Ackerman in Choctaw County. Much of this type occurs in rolling and even nearly level stretches for several miles without break.

The surface of Attala is broken and the soil in the northern parts sandy, but that of the southern parts is intensely red sandy loam, derived from the underlying green sand marls of the Claiborne, and containing considerable clay in most places. Leake County resembles Attala very much in both topography and soils, the prevailing type being the red soils of the Claiborne. This soil is generally deficient in humus, but otherwise more fertile than its appearance would suggest. The humus can easily be supplied by the use of green crops or stable manure, if obtainable in sufficient quantity.

The northern parts of Madison present an undulating surface, with a good coating of brown loam, the land becoming more hilly and soil thinner towards the Big Black. Farther south the topography changes and conditions gradually merge into those of the Jackson Prairie Belt.

Holmes and Yazoo agree in having rolling topography and widely distributed brown loam soils. Northwest of Durant are small areas of the red sandy soils of the Orangeburg series. Near the southeastern border of the county, and passing into Yazoo, are considerable areas of Richland Silt Loam, a deeper and stronger phase of the Brown Loam, the surface of which is more nearly level than that of the main type, and erodes less rapidly. The depth of the loam near Richland is 15 to 20 feet and will produce a bale of cotton to the acre. The same conditions exist in Yazoo, though the surface becomes more rolling and the loam thinner. Further south, where the Big Black approaches the Bluffs, the calcareous loess silt underlies the loam and its influence becomes noticeable both upon the soil and the native vegetation, to the extent that in this discussion the Loess Hills constitute a distinct soil region.

The hilly region of southwestern Noxubee and adjoining parts of Kemper possesses a light yellow, very fine, sandy loam of moderate fertility but easily washed away. The same character of soil is found on the higher ridges of Kemper, but the lower hills possess sandy soils of less fertility, resembling those of Winston and Choctaw.

In northern Lauderdale County, near Daleville, and southward the soil is a stiff red clay loam, deficient in humus but quite productive. In the vicinity of Lauderdale the ridge soil has the characters of the typical Brown Loam, though, since the land is rolling, on the slopes there is an admixture of the red sands of the Lafayette. Occasionally the black lignitic soils of the underlying lignite beds appear in restricted areas, and are reported to produce poorly.

The soils south of Marion are yellow sandy loams, of fair productivity. At Meridian and southward the red sandy soils of the Lafayette, Wilcox and Claiborne are the prevailing types, though in restricted areas occur whitish sandy soils of low productivity.

The topography of the sandier parts of the county is very much broken and soil erosion is rapid.

Bottom Land Soils.—The bottom lands of the smaller streams vary with the character of the materials through which the streams cut. Where they cut through exclusively sandy formations their soils will be light and sandy, when through beds of clay the soils will be heavy clay loams. In either case, vegetable matter is added to the soil, giving it greater fertility than the corresponding hill soils. The soils of the larger stream bottoms show more uniformity because of the diverse sources from which they receive tribute, and yet considerable differences are noted among them.

Wolf River has a broad rich sandy loam second bottom where it flows through Benton County. This bottom lies chiefly on the south side of the river, in the vicinity of Ashland, and is a very prosperous farming section.

The Tallahatchie heads in the dense clay regions of the Flatwoods, and receives in its upper courses a large proportion of clay from numerous small tributaries from the Flatwoods. Hence its bottom soils are heavy and clayey in its upper course, and for a long distance after leaving the Flatwoods. As it passes through the sandy region of the Lignitic Plateau, the increasing proportion of sand deposited gradually changes the character of the soil, until in its lower valley, before reaching the Delta, the soil has become a comparatively light sandy loam soil.

The soils of the Yokena bottoms are rather heavy dark loams, becoming lighter from contributions from the Lafayette and Wilcox sands. Both these and the soils of the Tallahatchie are very fertile, forming some of the best farming lands.

The soils of the Yalobusha are rich, dark, sandy loams in Grenada County but become heavier towards its source in the Flatwoods, its principal tributary, the Schoona River being throughout bordered by heavy clay loam soils from the Flatwoods.

The Big Black has distinct first and second bottoms, the latter three or four feet above the former and usually of somewhat lighter soils. As a rule the first bottoms are light enough to work easily, are very fertile, and originally supported a dense growth of tall trees, much of which still stands. The second bottom varies in different localities, in Choctaw County being a chocolate-colored loam and very fertile; near Vaiden the soil is a dark sandy loam; still farther south, between Holmes and Yazoo, the soil becomes light in color, showing considerable "buckshot", or dark iron concretions, evidencing the need of drainage. In Hinds County, beyond the boundaries of the region now under discussion, the second bottom soils of the Big Black assume a reddish, loamy character, resembling the Brown Loam soils of the hills, with here and there small islands of Lafayette sands rising above the general level.

The second bottom of the Pearl River is several miles wide and uniformly presents light rather sandy soils, with yellowish clayey or pale sandy subsoils. The soils are not especially fertile, being usually deficient in humus, those with yellow clayey subsoils being better than the other type. The addition of humus would increase greatly productivity of these soils.

Native Vegetation.—Over the greater part of this region the most abundant treegrowth is pine, of two species—short-leafed yellow pine (*Pinus mitis*) and loblolly pine (*P. taeda*). The forests, however, are not usually pure pine forests, as occurs so extensively in the southern part of the State, but have a considerable growth of oaks and other species among them. The oaks of most frequent occurrence associated with the pines are black jack, post oak and Spanish oak. Others less frequent are red and black oak (*Q. rubra* and *tinctoria*), hickory (*Carya tomentosa*) and shell bark (*Carya alba*), elm (*Ulmus alata*), sweetgum, black gum, sassafras, sumac of several species (*Rhus copallina*, *R. glabra* and *R. typhina*), chestnut and persimmon. On the richer slopes are white oak, dogwood, beech, elm (*Ulmus Americana*) and yellow poplar. This last is usually regarded as a lime loving tree, and yet it is very common on the lower slopes of the hills and on the higher valleys not subject to overflow. Along the M. J. & K. C. Railroad, north of Newton, the seedlings of this species are very abundant in the narrow strip of open land bordering the railroad track, and even upon the slopes of the railroad embankments, where they seem to grow vigorously. We have never observed them so abundant in the forests. It would appear that the seedling poplar requires direct sunlight for its best growth—hence will reproduce best in clearings.

On the bottom lands of this region, black gum, red gum, beech, poplar, ash, white oak, water and willow oak, maple (*Acer rubrum, A. dasycarpum,* and *Saccharina*), black willow, red bud, black walnut, red birch are the prevailing species of trees. Common shrubs on the lowlands are swamp huckleberry (*Vaccinium corymbosum*), button bush (*Cephalanthus occidentalis*), alder (*Alnus serratula*), red buckeye (*Aesculus pavia*), strawberry bush (*Euonymus Americanus*), wild hydrangia (*H. arboreum* and *H. quercifolia*) and *Itea Virginica*.

Common herbaceous plants of the hill soils are wild phlox (*P. pilosa*), wild rose (*Rosa humilis*), spring beauty (*Claytonia Virginica*), several species of crowfoot, wild violet (*Viola palmata*), alum root (*Heuchera Americana*), skull cap (*Scutellaria parvula*), wild geranium (*Geranium carolinianum* and *maculatum*), Venus' looking glass (*Specularia perfoliata*), cone flower (*Rudbeckia hirta*), blazing star (*Liatris*), wood anemone (*Anemone Caroliniana*), purple aster (*Aster patens* and *A. paludosus*), goat's rhue (*Tephrosia Virginica*), and the shrubby St. Andrew's cross (*Ascryum crux andrae*) and New Jersey tea (*Ceanothus Americanus*). Very common on wooded slopes are such forms as pink root (*Spigelia marilandica*), sanicle (*Sanicula canadensis* and *S. Marilandica*), the May apple (*Podophyllum pellatum*) and spiderwort (*Tradescantia Virginica*).

On the low lands the common species are the following: Among ferns, the wild maiden hair (*Adiantum pedatum*), Christmas fern (*Aspidium achrosticoides*), royal fern (*Osmunda regalis*), cinnamon fern (*Osmunda cinnamomi*), and moonwort (*Botrychium*) are characteristic. Other than ferns are, boneset (*Eupatorium perfoliatum*) and (*E. album*), deer grass (*Rhexia mariana* and *R. stricta*), centaury (*Sabbatia angularis*), day flower (*Commelyna Virginica* and *C. hittella*), St. John's wort (*Hypericum mutium*), (*Pycnanthemum linifolium*), lizard's tail (*Saururus cernuus*), pimpernel (*Samolus floribundus*), several species of smilax, Solomon's seal (*Polygonatum biflora* and *P. giganteum*), bellwort (*Uvularia perfolia* and *U. sessilifolia*), Jacob's ladder (*Polemonium reptans*) and cardinal lobelia (*Lobelia cardinalis*).

A few characteristic climbers, usually in the low grounds, are various wild grapes, poison oak, Virginia creeper, cross vine (*Bignonia capereolata*), woodbine (*Lonicera sempervirens*), wild yam (*Dioscorea villosa*), and several species of smilax, including the curious carrion plant (*Smilax herbacea*), with its characteristic odor of putrid flesh.

An occasional marsh will show a flora suggestive of northern bogs, as, for example, several species of orchids—the purple fringed orchid (*Calopogon pulchellus*), yellow fringed orchid (*Habenaria ciliata*), and some of the green habenarias. Sphagmum moss is found in these places, forming a peaty mass. Two or three species of *polygala* and a species of shrubby willow, apparently related to the hoary willow (*salix candida*) of northern peat bogs, have been noted in a marsh four miles east of Oxford.

Culture.—Most of this region has been long in cultivation. The high, well-drained condition of the surface, the healthfulness of the climate and the fertility of the soil, at an early period in the State's development invited settlement. In antebellum days, under slavery regime, these lands were owned and worked in large plantations. As elsewhere in the State, cotton was the staple crop, with just enough corn to supply the needs of the plantation.

The methods of cultivation were very exhausting to the soil. Crops were, year after year, taken off the land and nothing returned to it. The clean cultivation of cotton exhausted the humus, and other elements of fertility became gradually exhausted. Since the Civil War, up to within a few years, the exhaustion of these lands has been more rapid than ever before, and careless terracing, or circling of the hill slopes, has caused much of it to wash badly.

The silty character of the prevailing brown loam soil makes it easily cultivated, while it is sufficiently clayey to hold fertilizers well. On the whole, it is one of the best all round soils found in the State. In its run-down condition, and without fertilizer, this soil will produce about fifteen bushels of corn or half a bale of cotton to the acre, when cultivated according to the stereotype method which has come down from the past. The fresh virgin soil, properly cultivated, will easily make forty to fifty bushels of corn or one bale of cotton to the acre. Probably no soil in the State will respond to proper treatment more readily than this loam, and where skilled and intelligent agricultural methods are being applied to it, its productivity is rapidly being restored. As yet, the possibilities of this soil, as of others in the State, are scarcely guessed by the people who live upon them. The Corn Club movement in the State is just now revealing what can be done with it in growing corn.

Duel Cole, of Lafayette County, succeeded in getting from one acre of land 100¼ bushels of corn, at a total cost of $21.00, including $5.00 rent of land, the net profit from this acre being $79.20. This was accomplished by first plowing the land twelve inches deep and pulverizing well before planting; good seed selected and planted twenty inches apart in rows three feet apart; barnyard manure, five tons to the acre, was plowed in, and crop received three workings with a spring tooth harrow, and laid by with a disc cultivator. The same kind of land adjoining this acre, worked in the usual way, made eighteen bushels per acre.

Rowan McElroy, of Lauderdale County, made 92 bushels of corn on an acre of ground, from which he had already gathered 250 bushels of Irish potatoes. It is safe to say that the proceeds of this acre's yield was not less than $250.

Corn exhibited at the State Fair in 1910 from Madison County gave a yield of more than 200 bushels to the acre. Two Corn Club boys in Madison County made respectively, 220 and 223 bushels per acre. A farmer in Madison Coun-

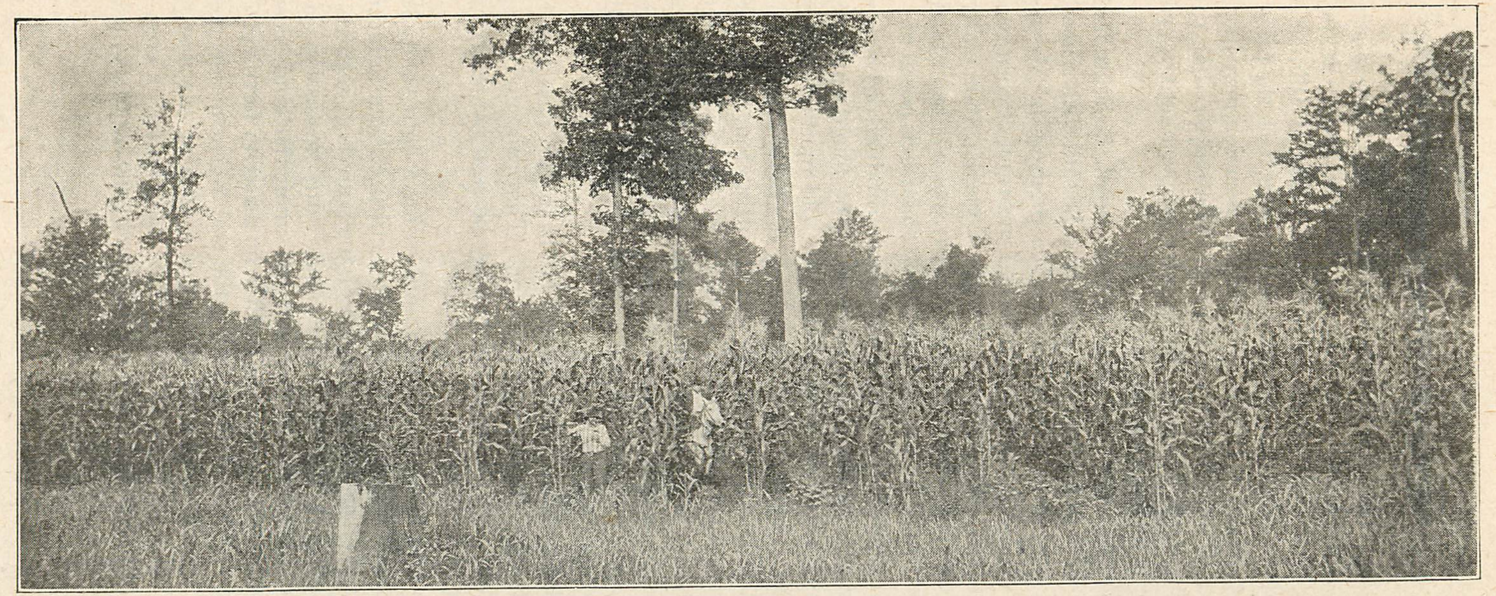


Fig. 4. Corn Field, Grenada County, Mississippi, July 1910.

ty, who came from Illinois, exhibited some of his Mississippi corn at the Ford County Fair, in Illinois, and took the first prize over corn grown on the best lands of Illinios. His land in Mississippi, valued at $50 an acre, took the prize over his $200 land in Illinois, and yet the assertion may be safely ventured that there are lands in Mississippi that can be bought for $15 an acre, which, with proper handling, can be made to produce equally well.

During 1910 sixty or more counties of the State had the Corn Club organizations, and it may be said with truth, that a revolution in corn growing is in progress in Mississippi that will bring the State into the front rank of corn producing states. The records of highest yields, unofficially announced (the official announcement has not been made at this writing) are 224, 217, 192 and 178 bushels per acre.

Not only is the old method of corn producti on being revolutionized, but here and there are to be found enterprising farmers who have improved on the old methods of cotton culture. Cotton has always been the main crop in Mississippi, and, with almost any sort of cultivation, on moderately fertile land will produce a fair crop. It has been preeminently the negro's crop, and the negro's slipshod method of culture is largely responsible for the low yield per acre, as well as for much of the worn out and badly washed fields in this region of the State.

The average yield on hill lands in the past has been about one-third of a bale per acre. That this can be largely increased by intelligent effort may be seen by referring to one or two examples.

A farm in South Carolina possessing a light sandy loam soil, had, by shiftless and careless culture, been reduced in fertility to the low production of 300 pounds of seed cotton per acre. A thrifty farmer came into possession of it, bought barnyard manure and put upon the land, besides feeding cattle upon it to further increase its fertility. By this method, and by plowing the soil 10 inches deep, followed by sub-soiling, he succeeded in getting the first year a yield of 1 3-5 bales to the acre. That planted in corn, instead of producing 5 to 8 bushels, had gone up to 35 bushels per acre. A proper rotation of crops was adopted, and at the end of five years the same land produced 2 bales of cotton per acre, and two year's later, 2¼ bales. Corn production had leaped up to 85 bushels an acre. Here it is manifest that intelligent management of the soil has made the very great difference in productiveness of the land. To the farmers of Mississippi a result like this is well worth pondering over.

But an example parallel to the above may be found nearer home. Mr. G. H. Turner, of Burgess, Lafayette County, Mississippi, has a farm on which is found the poor, yellowish, clayey upland soils so common in the State. On this type of soil, which formerly produced less than a bale of cotton to the acre, he now gets a yield of three bales per acre. This result has been reached by thorough preparation of the ground before planting, deep plowing and putting the ground in perfect tilth. Too much stress cannot be put upon this. Mr. Turner used high grade fertilizers, as much as 1,000 pounds to the acre, finding that by increasing the amount of fertilizer $7 to $9 an acre, the crop was increased an additional bale. The fertilizer was selected to suit the soil. If the soil contained abundant humus and the cotton showed an inclination to grow excessive stalk, a fertilizer with a high per cent of phosphates was used to stimulate fruit production. If the soil, on the other hand, produced undersized, weakly stalks of pale color, a high per cent of nitrogen was used to promote a better stalk growth. If the bolls are small and slow of maturing, phosphates will hasten maturity.

Mr. Turner found it profitable to make two applications of the fertilizer, one at time of planting, and another along in July, when the crop so frequently begins to shed the forms. When the crop begins to put on fruit in July it draws heavily upon the soil for the requisite plant food. If it fails to get the needed supply, some of the future yield is lost by shedding of the squares; hence the importance of the summer fertilization, which may be effected while the crop is being cultivated.

Good distance, both between the rows and in the hill, must be allowed in order to insure full fruitage.

There are those who would call the cases above cited fancy farming, and impracticable on a large scale, but such is not the case. It is progressive and scientific farming, that may, and should, be practiced on every farm in the State. The day of slipshod, unscientific methods of farming in Mississippi is past. Ignorant butchering of the soil by unsupervised negro labor, with resulting slight yields, is no longer permissable. Small wonder that mortgages on the farms have not been lifted with crops of one-quarter of a bale of cotton per acre, and the land getting poorer every year. Let the land be fertilized with brains, as has been forcibly said. Scientific farming and one to three bales of cotton, or 200 bushels of corn per acre, is what Mississippi needs to make it rank among the rich states. It is feasible, and is coming. The move is already begun in isolated spots and, like leaven, will leaven the whole farming interest of the State. Farmers, like men in other occupations, are of three classes: 1st—Those who lead out into new and successful enterprises, guided by a scientific knowledge of their business, reinforced with strong judgement; 2nd—The great rank and file who are ready to follow intelligently such a lead; 3rd—Those natural stragglers who move out of old ruts only when dragged along by the general advance. Unfortunately, the last class has been too large in the past; no coaxing or urging of the leaders has sufficed to make them strike the quick-step of progress. But a new ally, in the Mexican boll weevil, has appeared on the scene, and the castigation which he will give the laggards will force them into the adoption of scientific methods, with diversification, or will force them off the farm.

The soils of this region of Mississippi are adapted to a wide variety of crops; perhaps no part of the country is more so. At the State Fair in Jackson one man exhibited 127 different products from one farm.

Winter oats do well where the rust proof varieties are planted, the yield being from 25 to 50 bushels per acre. Here is the testimony of one farmer in Madison County: "I want to tell you what I did on one 40-acre tract last year. It had been cropped in cotton for 70 years—everything

Fig. 5. Oat Field in Madison County, Miss.—50 Bushels Per Acre.

taken off and nothing put back. I plowed it deep, sowed it in winter oats in December, 1906. In June, 1907, I harvested and threshed from this 40 acres, 1,200 bushels of oats, which I sold for 75 cents per bushel. I then plowed and sowed this same 40 acres to cow-peas, and harvested and threshed 150 bushels of peas, which I sold for $2.50 per bushel, and I sold the peavine hay for $15 per ton."

Taking no account of the peavine hay, the yield of this 40-acre tract for the year was $1,275—a result truly surprising to be obtained upon land that was regarded as too poor to raise cotton.

All over the region under discussion, several varieties of hay may be successfully grown. Lespedeza and bermuda grass grow without care or cultivation on the poorest hills or in the richest bottoms, indifferently. They form the best of pasturage, and with a little attention form profitable crops for cutting, yielding two or three tons per acre. Land once set to either, needs no replanting, the bermuda being perennial and the lespedeza reseeding itself annually.

Timothy is not grown extensively, but will do well on low grounds. Velvet and soy-beans grow luxuriantly and produce several tons of hay to the acre. Hairy vetch makes a good winter pasture, and, on cutting, will yield three or four tons of hay per acre. Perhaps the very best hay that can be grown upon this soil is the cow-pea, which yields four or five tons of the most nutritious forage, besides having a fertilizing effect upon the soil. The following table will show the food value of cow-pea hay as compared with red clover and timothy:

	Protein.	*Carbohydrates.*	*Fats.*
Cow-Pea Hay	16.6	47.7	2.4
Red Clover Hay	12.3	38.1	3.3
Timothy Hay	5.9	45.0	2.5

It will be seen that in the elements of a good food, the cow-pea stands first. It is usually sowed broadcast in corn at the last working, but, as in the case mentioned on a previous page, may follow oats or other crops.

Alfalfa has not been very extensively experimented with on the brown loam soils of this region. The soil is not naturally adapted to the plant, and where it has been successfully grown the land has been carefully prepared by adding one-half to two tons of lime, either air-slacked or ground limestone; humus has been supplied in the form of barnyard manure, 10 to 20 tons per acre; and the soil has been

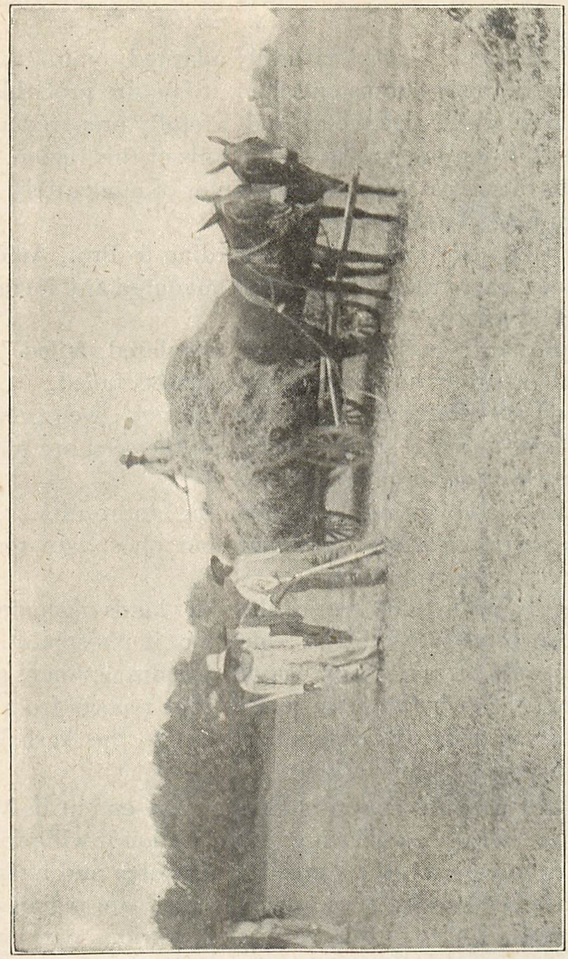


Fig 6. Alfalfa, Third Cutting July 12, 1910—Planted September 24, 1909
Agricultural Experiment Station, Holly Springs, Miss.

inoculated by adding several hundred pounds per acre of inoculated soil from a field where it is grown successfully.

Prof. C. T. Ames, Director of Holly Springs Experiment Station, has grown alfalfa upon his farm by this method.

While his experiment has been successful, so far, the test is perhaps of too short duration to predict ultimate success.

J. D. Peacock, of Water Valley, has grown it successfully in Yallobusha County. In Madison County it has not had extensive tests, but such as have been made proved satisfactory.

While the soil is not naturally adapted to alfalfa, being deficient in both humus and lime, it is quite probable that with these added and the ground carefully prepared and inoculated, it may be grown on the soils of this region. The chances of success seem to be in favor of moderately heavy bottom-land, if well drained.

At Holly Springs Station, according to Prof. Ames "all plantings where the soil was limed, manured and inoculated gave good results."

"All plantings limed and not inoculated, failed,"

"All plantings not limed but inoculated, failed.

"Soil for alfalfa should be well drained, well prepared, limed and manured sixty days before the seed are planted, as a firm seed bed is necessary.

"Early fall plantings have given the best results.

"Acid phosphate or finely ground phosphate rock increases the yield materially."

This is particularly true of the older lands of this region, which are especially liable to be deficient in phosphate.

It should be said, before leaving the discussion of alfalfa growing in the brown loam region, that reports from more than fifty intelligent farmers furnished to the Agricultural College indicate failure with it.

Wheat has never been planted to any extent in Mississippi, and, while as a wheat growing section it will probably never compete with the states farther north and west, this grain has been grown successfully in the loam region under discussion. During 1911, farmers in various parts of the State, impelled by the high price of flour, planted wheat, with reported yields of from 30 to 40 bushels to the acre, while the average yield throughout the United States is 11.8 bushels. This wheat compared favorably in quality with that brought from other states.

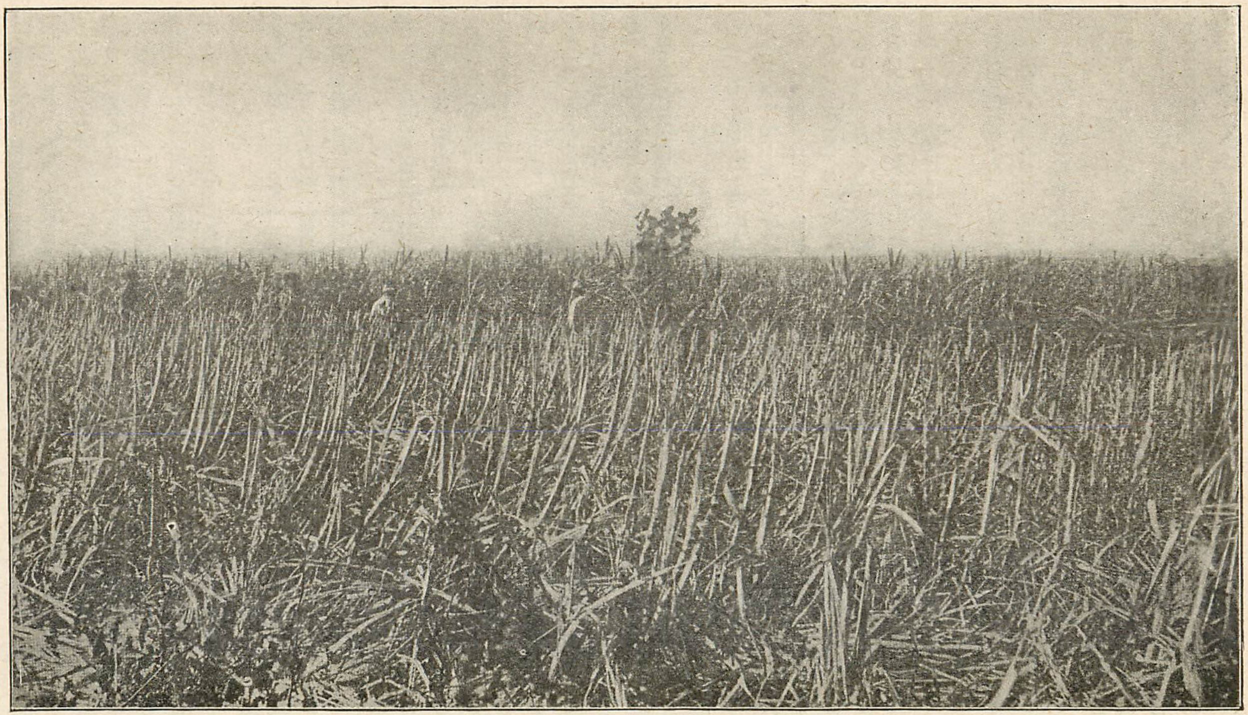


Fig. 7. Stripping Louisiana Sugar Cane on Mr. E. C. Melton's Farm, Meltonville, Madison County, Mississippi.

Wheat as a winter crop, or planted early in the spring, can be harvested early enough so that a crop of corn or sorghum or peanuts may be produced on the same land. Sorghum following oats or wheat will yield 4 or 5 tons of very nutritious hay per acre.

Louisiana Sugar Cane grows well in the southern half of this region, reaching a height of 6 or 7 feet, matures readily and yields syrup of the best quality, 300 to 400 gallons per per acre.

Broom corn has not been planted extensively but has been proved to do well on the soils of this region. During the year 1911 Mr. G. B. Ballard, of Madison County, put 70 acres in broom corn from which he realized a profit of $65 per acre. Experiments in the northern counties of the State had equally favorable results. With local factories to manufacture the yield within accessible distance, the profits would be considerably increased.

Potatoes, both Irish and sweet, grow and produce bountifully in these soils, the lighter sandy loams being better for the sweet potato. In the eastern parts of the State and around Natchez, large fields of the Irish potato are grown on soils essentially the same as those in this region. From 100 to 200 bushels of Irish potatoes per acre can be grown with ease, or even more, if careful attention is given to the crops. These sell at $1 per bushel. It is possible to get an early and late crop from the same land, almost doubling the yield.

While potatoes are very generally planted on farms of this region for home use, few have attempted to grow them for the market. Where it has been done, however, the crop has proved remunerative.

Tobacco has never been grown in Mississippi on a commercial scale, but in years past patches were found on nearly every farm for home use, and the yield and quality were good. It could doubtless be made a profitable market crop by giving it proper attention. The light sandy soils of South Mississippi have been found to produce high grades of Cuban and Sumatran tobacco, and similar soils in this region will probably grow the same.

Jute has been grown experimentally on the brown loam type of soils in Lincoln County, and would most probably grow successfully in this region on the same type of soil. It could be made a good commercial crop if once established and plants installed for preparing the fibre for use.

Ginseng grows wild in this region (Allison) and could probably be made a remunerative crop.

Truck farming is particularly successful on the brown loam type of soil. Almost every variety of vegetable that

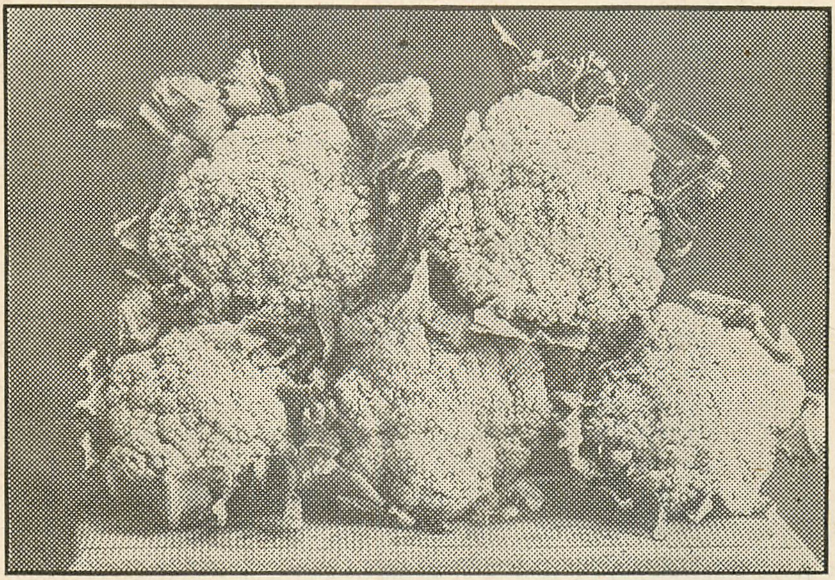


Fig. 8. Cauliflower Grown in Marshall County.

grows outside of the tropics will grow successfully on this soil if the ground is well prepared and proper tillage is given to it. The trucking business is intensive farming, and from the nature of things the truck grower must study his soil and its needs for particular crops, what fertilizers and in what quantities are best for his different crops, and what kind of tillage each requires. No slipshod farmer should undertake trucking, but the intelligent, scientific farmer can succeed at it. Success in this direction of farming means close attention to details, not only in raising the produce, but in marketing it.

The vegetables most extensively grown for the northern markets are tomatoes, cabbage, beans, carrots, turnips, peas, beets and radishes, besides water melons and cantaloups. Our southern position makes it possible to put these on the northern markets early enough to get the highest prices, making the business very remunerative.

The heavy fertilizing and high state of tillage necessary to grow vegetables for market insure large yields per acre. Further, as the crops are planted early and come off early, it is possible to plant two or even more crops on the same land during the year. One man in Grenada County marketed tomatoes that realized him $500 per acre. Another in the same county planted an acre in English peas, after marketing them the land was planted in beans, and then in turnips, all the crops on this acre bringing $150. Water melons brought $125 per acre. One acre of land is reported to have brought E. R. Smith, of Grenada, $800 planted in cabbage, followed by three other crops in one year.

Some trucking is done in Madison County, also at Durant, in Holmes County, and at other points. But the most extensive truck farming on this type of soil is in Copiah County, which really lies south of the region we are now discussing, though the soil is identical. In the vicinity of Crystal Springs is the largest and oldest trucking section in the State. Lands that now could not be bought for less than $75 to $100 per acre, before the development of the trucking business lay out in old fields, overgrown with scrub pine, and could have been bought for fifty cents to a dollar an acre. During the year 1907 the proceeds from about 3,000 acres around Crystal Springs amounted to 818 carloads of vegetables, which brought $495,475.28 in the northern markets. The tomatoes alone filled 432 cars, and brought a sum of nearly three hundred thousand dollars. Cabbage came next, filling 249 cars, beans 60 cars, carrots 45 cars, and others in smaller quantities. The average yield per acre was $165.15. The year was about an average one. Three points in Copiah Countyshipped, during 1910, 1110 carloads of vegetables.

In numerous cases, after the vegetable crops have been harvested, the same land has been planted in corn or cotton, yielding 60 to 75 bushels of corn or one bale of cotton per acre—much better than the average farmer does who grows cotton and corn exclusively.

It is a well known fact that growers of cotton exclusively, as a money crop, find money abundant only during the fall when the cotton is being marketed, whereas the truck grower has money coming in all spring and summer, and as he usually has also a crop for fall harvesting, he has a share in the usually flush conditions of that season.

Fruit of all kinds do well on the loam soils of this section of the State. In fact, this is a typical fruit soil, being heavy enough to produce apples successfully, and light enough, especially on slopes where an admixture of the Lafayette sands enter into the soil, to make peaches of excellent quality. Just across the Tennessee line from Marshall County this type of soil produces apples of fine quality, and, with proper attention, apples may be made a profitable crop in North Mississippi. In Madison County apples have been grown of excellent flavor and perfect in every way. Peaches are grown more or less all over the area for home consumption. W. H. Moss, of Grenada County, realized $600 per acre on Elberta peaches. If fruit has not been a cretain crop in the past, it would seem that the failure has been due, in a large measure, to lack of care of the trees. The fruit tree has been allowed to grow as it pleases, without pruning or other attention, and the fruit is allowed to take care of itself. With careful and intelligent selection of varieties, pruning, spraying and cultivation, apples, peaches, plums and other fruit will become profitable crops in this part of the State. Pears blight badly, and perhaps will not be a success.

Strawberries are produced and shipped north from various points, this soil being well adapted to that fruit. The Holly Springs Experiment Station for two years past has realized $180 per acre on strawberries. Grenada, Durant, Canton, Madison and numerous points southward ship strawberries in large quantities. According to Capt. Merry,

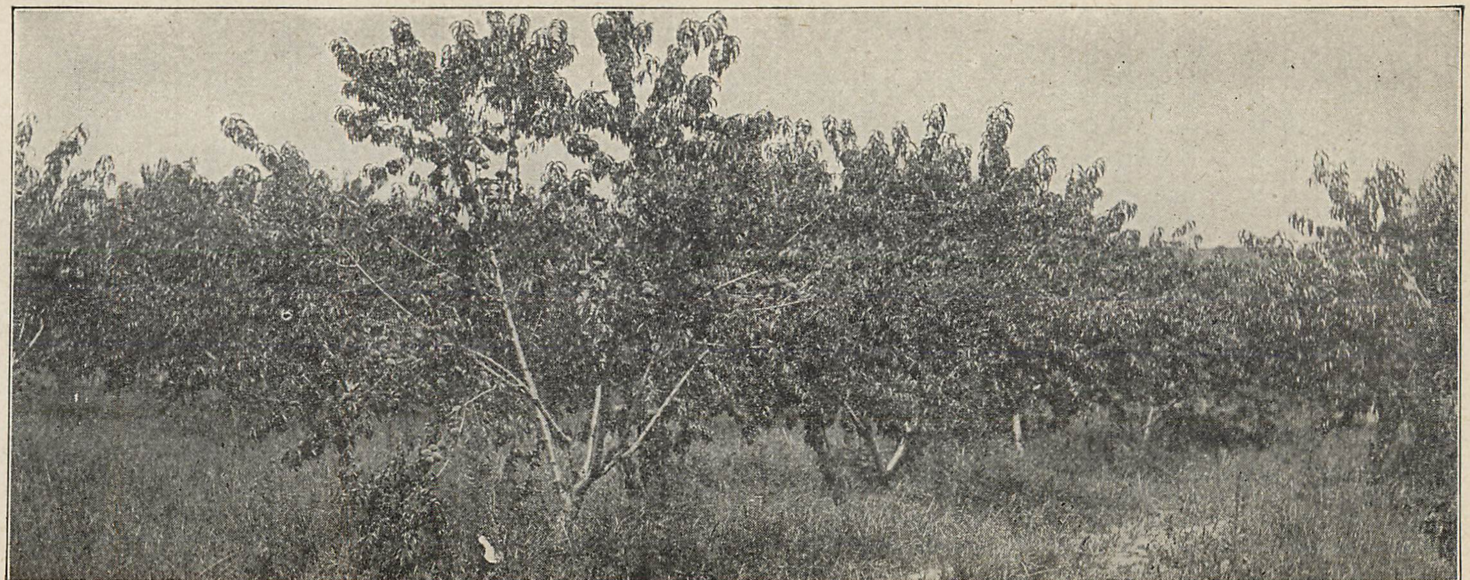


Fig. 9. Peach Orchard of W. A. Odum, Grenada County, Mississippi.

of the Illinois Central Railroad, between Grenada and Magnolia, on that railroad, over a thousand carloads of strawberries were shipped during the season of 1910.

Pecans are grown successfully in the region, and will undoubtedly be a future crop of good proportions. The culture of the pecan has hardly more than made a beginning in this part of the State.

By no means have all the crops that offer good prospects of success here been enumerated, but enough to show the great diversity of farming possible on the soils of this part of Mississippi. With such a large field for choice, and one presenting bright promise along so many lines, there is no valid reason for the farmer of Mississippi to repine or to throw up his hands in despair because the Mexican boll weevil threatens to cut short the yield of one staple crop.

Recommendations.—One feature of the soil of this region that threatens very seriously is its tendency to wash away. So much of the surface is rolling or hilly and underlaid by sandy formations that under heavy rains the soils melt down and wash into the streams, leaving barren and trenched slopes. But this evil can, in a large measure, be prevented by giving attention to the details discussed in the chapter on Soil Erosion.

One thing, however, should be insistently urged—deep plowing. The practice here, as elsewhere in the State, has been to scratch the surface two or three inches deep with a small one-horse plow, which is a first class preparation for the stripping of the soil from the surface with the first heavy rain. If, on the other hand, the soil is plowed and mellowed 8 to 10 inches deep, the water that falls upon it will be all absorbed into the loose soil instead of flowing over it and washing it away.

Besides this benefit, deep plowing will enable the soil to take in enough moisture to resist drouth, and a greater depth of loose earth will give the roots of crops more space in which to grow, and will furnish a larger mass in which the ready exchange of gases may promote the liberation of plant food. Deep plowing, in a certain sense, is a fertilization of the land, since it makes available to crops plant food that otherwise would be beyond their reach.

Most farmers of cotton and corn plant too large an acreage to the man. Their yield would be greater and their land would fare better if the average acreage were cut one-half, and the cultivation were frequent and thorough. Most of the cotton and corn growing in Mississippi partakes too much of the shiftless methods of the negro. Our lands need more work, less waste than heretofore. Scientific methods of agriculture must be adopted. Farming, according to strict scientific principles, is one of the most honorable, as well as satisfactory of occupations. It is a business and a profession—as much so as that of the banker, merchant or lawyer—and, like these professions, must be studied. There is hardly any profession that calls for more gray matter in its practice than that of farming. There has been hitherto too much disposition in our State to place farming on a low plane, and leave it to the ignorant negro. If more of our intelligent citizens would deign to soil their hands with the clean dirt of the fragrant sod it would augur well for the future of the State. Fortunately, conditions are changing, in some quarters rapidly, on account of the boll weevil, and we may hope that farming will eventually be put upon a truly scientific and progressive basis in Mississippi.

Winter crops should be the rule, both to protect the soil from erosion during the winter months and to utilize the plant food that is constantly being liberated in our warm climate, and would be lost. Good winter crops are oats, wheat, barley, hairy vetch, crimson clover and burr clover. In a climate as warm as that of Mississippi there is no reason why the soil should not be cropped during the winter. Scientifically managed, there is no reason why the soil should not yield as many crops as will grow upon it during the twelve months, and the reason why it should be done is more potent when it is remembered that the soil is being depleted of its fertility during the warm southern winters. Why should the farmer stop his business during the winter when that of every other profession goes on? There is excuse for it in a northern climate where the soil freezes to a depth of several inches for several months, but none in our climate where the soil never freezes except for a few days at a time. Northern farmers coming into our climate with their habits of thrift which make every edge cut, enforced upon them by their short growing season in the North, soon grow rich, because they can, and do, grow something all the year round.

Rotation of crops is one of the first principles of rational agriculture. A constant growing of the same crop will eventually exhaust the best soil. This is particularly true where the crop is cultivated clean like the cotton crop. Humus is surely exhausted by continuous clean cultivation. The elements of plant food utilized by the crop will eventually be used up and the crop can be no longer grown profitably. To prevent this, a proper rotation should be practiced, and any system of rotation on the soils of this region should include legumes like cow-peas, vetch, or lespedeza. A rotation should embrace at least three, or better, four different crops, of which, if the soil is run down, two should be legumes, and one of those should be plowed under.

Under any system of rotation, where crops are being constantly taken off the land, the soil will eventually require the replacement of certain elements of plant food that nearly all crops draw upon. So that artificial fertilizers must be applied. In all the older soils of the brown loam type phosphates are deficient and their addition increases the yield of all crops grown. Experiments seem to indicate that potash is usually present in sufficient quantity for field crops, but should be added for vegetable or fruit crops.

Nitrogen is taken from the soil by all crops but may be replaced by cotton-seed meal or nitrate of soda, or by the application of barnyard manure, or by growing and plowing under legumes, which extract it from the atmosphere. By the two last, humus also is added to the soil.

Except in freshly cleared grounds or in alluvial soils, humus is usually deficient in the brown loam region, and the methods just named should be used to supply it. Besides the nitrogen which it adds to the soil, it maintains a mellow, friable condition, and increases its power to hold moisture, so that a soil well supplied with humus suffers less from drouth than one in which it is deficient.

It sometimes happens that a heavy green crop, as of cowpeas, on being plowed under, will induce an acid condition of the soil while fermentative changes are taking place. To prevent this, the soil should be limed, or the mass of vegetation might be cut and allowed to dry before plowing them under.

As in a previous chapter, we wish to again emphasize the advantage of crop diversification. Every farm should produce everything for home consumption that can be grown on the farm. It is sometimes argued that certain articles consumed on the farm can be more cheaply bought than produced. Such articles must be very few indeed when we consided the number of middle men who must handle and get their profits before the article finally reaches the consumer on the farm. The present high prices of everything refute the argument. The Mississippi farmer should never have to buy corn, oats, hay, meat, lard; fruit, either fresh cr canned; vegetables, either fresh or canned; syrup, flour, potatoes. He can grow them all and much more. He has not done so in the past because cotton engrossed his attention. But it is quite pcssible that the boll weevil will force him to that course, and the sooner and more completely he can make all these at home the better he will be prepared for the weevil, or any other emergency.

No farmer should put his whole dependence in one money crop; he should have at least two, and, if more, his chances of complete failure are still less. Conditions which might cause the ruin of one crop, would, perhaps, affect others slightly, if at all. There is greater safety to the farmer and to the business community.

Stock raising should go hand in hand with other farm processes. Of course, every farmer is not expected to go extensively into stock raising, but some stock should be a part of every farm. Horses, mules, cattle, hogs, sheep and poultry can be raised on the farm in limited numbers, without much extra labor and at almost no expense. Instead of buying Missouri mules and Kentucky horses, let the farmer raise them himself at less than $20 a head, which he can do. It is being done by some. Let him have his milk cows and plenty of milk and butter at home and some to sell. Hogs and poultry more than sufficient to supply his own needs can be raised on little more than the waste about the farm. And all these, besides supplying his needs, leave upon the farm valuable products which go to enrich the soil.

Truly, no Mississippi farmer with brains and energy need look with envy upon the lot of any other man. His fortune is cast in a matchless climate and upon a soil, which, if he but *cultivate it instead of mining it*, as has been the custom in the past, will fill his coffers with wealth, his heart with pride, and make him what of right he should be, a prince among men.

Water Supply.—All over this plateau region of North Mississippi springs and shallow wells are abundant and furnish good freestone water. A good many mineral springs and wells occur and are patronized for their medicinal properties. Artesian water of excellent quality is obtained throughout the region. One water horizon supplies the region, the Wilcox, the water-bearing stratum being struck at a depth of from 200 to 500 feet. While the supply is usually sufficient, they are not flowing wells, except where sunk in low river valleys. The water is remarkably pure, except for a small quantity of iron contained in it.

BLUFF HILLS REGION.

Boundaries and Topography.—As has been stated before, this region consists of the eroded edge of the plateau facing the Mississippi River bottom. Streams, large and small, have cut their channels through or into this narrow rim, cutting it into precipitous hills. Where fragments of the original plateau surface remain, areas of level land exist, but most of the region exhibits steep slopes and narrow valleys. This interferes very much with the agricultural development of the region, which otherwise is capable of high productivity.

These hills are not markedly developed in the northern half of the State, where they skirt the broad, low-lying Yazoo Delta. Here the region is only four to six miles wide, and not as badly cut up as farther south, so that as a soil region, their being a part of the central plateau is evident and could very well be so treated.

South of Vicksburg the region widens to 15 to 20 miles and the hills become more broken. It is less evidently a part of the interior plateau. Some of the hills are considerably higher than the interior. This character is maintained through the southern river counties to the boundary of Louisiana. Only the large streams have cut broad valleys, the smaller ones flowing on narrow flood plains between precipitous, and often vertical, walls.

The peculiar topography and soil characteristics are due to the presence of the Loess, or Bluff Formation, which is a fine yellowish, calcareous silt, capping all these hills to a thickness of 25 to 35 feet next the river, and thinning rapidly to an edge at the eastern margin of the region. This often overlies beds of Lafayette sands and gravel, and is overlaid by a few feet of brown loam, which may be the weathered surface of the Loess, though Hilgard regarded it as distinct.

Soils and Native Vegetation.—On the leveler uplands the soil is the brown loam type (Memphis Silt Loam) so widely distributed in the interior of the State. It is perhaps slightly more silty and is deeper than farther east. On the hill slopes the washings from the loam become mixed with the calcareous silt of the loess and the soil becomes distinctly different from either. In some sections the loam has been entirely carried away from the tops of the ridges, and soil is derived directly from the loess.

The characters of the loam are those we have already studied. When the soil is a mixture of the loam and loess it becomes very strong and productive, the silt of the loess making it friable and easily worked and the high per cent of lime added adapting the soil to a larger range of crops than the loam alone. The soil is usually thick and constantly resupplied from the ridges and hills. The soil of the unmixed loess is highly calcareous, but lacking in humus, and is not as highly productive as the mixed soil. Alluvial soils of the region are highly productive, whether originating within the region or beyond it, provided the latter class is not too sandy.

The tree growth of the loess hills is entirely of the hardwood species, and is very robust. Especially abundant on the steep slopes of the numerous ravines are yellow poplar, magnolia, honey locust, mulberry, linden, elm (*Ulmus fulva* and *Americana*), chestnut, white oak, walnut and beech. Beneath these, on the upper slopes, are such shrubbery and small tree growth as chinquapin, witch hazel, flowering dogwood, crab apple, iron wood (*Carpinus Caroliniana*), spice wood (*Lindera benzoin*), pawpaw, red maple and red bud (*Cercis canadensis*).

Very characteristic of the region is the gray moss (*Tillandsia usneoides*) that drapes and festoons the branches of the forest trees. Numerous climbing and creeping vines are in evidence, binding together in matted confusion the shrubs and small trees and even grappling, with knotted and twisted coils, the forest monarchs themselves. Prominent among these are various species of wild grape, Virginia creeper, poison oak, cross vine (*Bignonia capreolata*), trumpet creeper (*Tecoma radicans*) in the edges of openings, supple jack (*Berchemia volubilis*), *cissus ampelopsis* and *bipennata*, and on the hills, in open pastures and waste lands, the beautiful Cherokee rose, whose glossy evergreen leaves form a handsome setting for the magnificent white flowers.

A very characteristic growth is the cane, which is abundant, and, in places, almost impenetrable. In pioneer days the vast cane brakes of these hills were famous hunting grounds for large game.

Among herbaceous species several ferns are very common, as, for example, the Christmas fern (*Aspidium acrostichoides*), maiden hair fern (*Adiantum pedatum*), beech fern (*Phegopteris hexigonoptera*), *aspidium patens*, and hanging from the vertical faces of ravines at Nachez, the graceful *Pteris cretica*. A large, robust species of scouring rush (*Equisetum robustum*) occurs on the bluffs at Natchez and northward.

Very common are the two species of wild hydrangia (*H. arborescens* and *H. quercifolia*), less so *Cornus stolonifera*, elephant's foot (*Elephantopus Caroliniana*), green dragon (*Arisaema dracontium*), strawberry bush (*Enonymus Americanus*) and partridge berry (*Mitchella repens*).

Culture.—While the soils of this region are remarkably fertile, much of the surface is too broken to be used. However, the leveler parts are extensively farmed, and much of the steep hill slopes has been farmed for many years. In fact, these hills from Vicksburg southward into Louisiana are the oldest farming lands in the State, and though the system of culture has not been particularly careful, much of this land is still very productive. The land has not wasted as badly as the steepness of the slopes would lead us to expect. The continued productiveness and absence of widespread erosion is probably due to the lime, which acts as a cement to the soil.

The crops in the past have been almost exclusively cotton and corn, and the yield per acre has been higher than in the loam soils generally. The grades of cotton grown on these soils, especially those resulting from a mixture of the loam and loess, are reported to be better, the lint longer and finer, than on the other hill lands, so that this cotton commands a better price.

Bermuda grass has taken a firm foothold in that portion of the region south of Vicksburg, so that it affords unusually good pasturage. It seems to find in this soil its natural habitat. The Bermuda grass for summer pasture and the switch cane for winter pasture make this one of the best stock raising sections of the State. This is especially important now since the cotton boll weevil has covered that area and made cotton growing very unsatisfactory. Stock raising is an alternative that offers bright prospects to the farmers of that region.

Recommendations.—Recommendations made heretofore, looking to better and more modern methods of culture, apply to this region as elsewhere, and need not be repeated here. Since the more extensive part of this region, embracing all that portion from Vicksburg south, has been invaded by the boll weevil, this part of the State is especially in need of diversified farming. In much of the territory, cotton is no longer a profitable crop to plant, and other crops must be taken up. As has just been said, the region is especially well adapted to stock raising. The natural pasturage is abundant and unexcelled. The Bermuda grass takes to this soil with great avidity, lespedeza grows better than on most soils of the State, and for winter pasture burr clover finds here a congenial habitat. It will grow wild along the railroad embankments. The lime in this soil makes it a good section for the clovers and alfalfa. So far, alfalfa seems not to have attracted much attention, but that it will grow profitably there can be no doubt, if the land is properly prepared, supplied with humus and carefully inoculated.

A further incentive to engage in stock raising here is the possibility of river transportation, as well as railroad, the competition between the two being favorable to the shipper.

Besides stock raising, alfalfa could be grown and shipped out to points along the river by cheap water transportation. It is to be hoped that alfalfa will receive attention in the Southern river counties where the limey soils ought to produce it abundantly.

Trucking could be carried on very profitably, and is being developed in some sections. All kinds of vegetables, melons, and such fruit as peaches, figs, quince and strawberries grow and produce well on this soil. Pecans find in it a congenial soil. Of course, trucking can be developed on a large scale only where railroad transportation is accessible for quick delivery of produce to the markets.

The growing of peanuts, that just now is receiving so much attention over the southern part of the State, will do better here than in most soils because of the friability of the soil and its greater richness in plant food. But in the older lands deep plowing and subsoiling must be resorted to.

Terracing and circling the land must be extensively practiced to hold the soil on hill slopes. Lands that are worn and inclined to wash should be thickly set to Bermuda or lespedeza.

Water Supply.—In that part of the region north of Vicksburg the gravel and sand beds of the Lafayette Formation usually underly the Bluff silt, and wells penetrating to these gravel beds get very good water supply at a depth depending upon the thickness of the silt which varies from a few to 30 or 40 feet. The silt does not furnish water, and water struck in the underlying gravel or sand is liable to be limey, owing to leaching from the calcareous silt. Good artesian water can be gotten, however, at a depth of 300 to 400 feet.

In the southern part of the region a very similar condition prevails, shallow wells being supplied to the Lafayette gravels and sands. Artesian wells get water of good quality at 200 to 500 feet.

JACKSON PRAIRIE REGION.

Boundaries and Topography.—This region of small prai ries extends in a belt varying from 10 to 30 miles wide, in a direction slightly northwest and southeast across the State. Its northern border may be described approximately as extending from Yazoo City slightly south of east through Quitman in Clarke County and on to the Alabama line. On the south, beginning east of the Bluffs, at Vicksburg it passes eastward to Bolton, thence makes a bold curve south of Jackson to Byram on Pearl River, thence northeastward to Rankin and from there southeast to Waynesboro in Wayne County.

It will be seen that its greatest breadth is in the extreme western part and that it narrows eastward to the line of Alabama. It embraces parts of Yazoo, Madison and the northern part of Hinds, a little of the northern part of Rankin, all of Scott except the northeast corner, the northern half of Smith, all of Jasper, except the southwest and northeast corners, the southern third of Clarke and the northern three-fourths of Wayne.

The region is one of greatly rolling topography, though in the more eastern part, towards the southern border, it becomes in places quite hilly. This part corresponds generally with the outcrop of the Vicksburg limestone, though the rough topography is due directly to irregularly eroded thick beds of Lafayette sands overlying the Vicksburg. These are especially conspicuous about Vosburg, in Jasper County.

The characteristic feature of the region is the open prairies distributed through the area. These are not as large as those of the northeastern counties, but sufficiently marked to give name to the region. The lands intervening among the prairies are wooded but quite level, so that with the opening of the country the prairie feature is accentuated. In certain parts the Lafayette sands develop rough topography, as may be seen around Newton, which, however, lies about the northern border.

Soils.—This whole region, except the hilly southern part already mentioned as belonging to the Vicksburg, is underlaid by the marls and calcareous clays of the Jackson Formation, and its characteristic soils are derived from the weathering of that formation. Such are the prairie soils of the area, of which two or three kinds are recognized as prominent by the U. S. Soil Bureau.

The black or "shell prairie" soil is a heavy, clayey soil of dark gray color, looking black when wet, resting upon a lighter gray subsoil which passes at a few feet depth into the highly calcareous shell marls of the Jackson Formation. The soil is distinctly calcareous, forming limited areas of gently rolling prairies. The wet soil, on drying, flocculates and crumbles, when not too wet it works easily. It is technically known as the Houston Clay, which, it will be remembered, was the characteristic soil of the northeast prairies. The characters of the two soils are so nearly the same that the U. S. Soil Bureau regards them as identical.

This soil is irregularly distributed throughout the extent of this region, but is more characteristically developed eastward, as in Scott, northern Smith and Jasper, and southern Clarke and limited parts of Wayne.

A brownish gray clay soil, known locally as the "hog wallow prairie" soil and technically as the Montrose Clay borders the Houston Clay just described, being well developed in parts of Scott, Smith, Jasper and Wayne. It occurs in flat-lying areas that drain poorly, but lying higher than the black soils, is cold, acid, and clothed with a heavy growth of black jack, post oak and pine. It rests upon a yellow clay subsoil of acid reaction. This soil is too heavy and cold to produce well without drainage. Drainage and liming would improve it greatly. This passes by easy gradations into a reddish clayey soil, the Susquehanna Clay, which lies higher and more rolling, and is consequently better drained, the subsoil being of mottled red color. It is slightly calcareous but not as much so as the black Houston Clay. This soil is not as extensive in its distribution as either of the other two prairie soils. Both the Montrose and Susquehanna Clays seem to be developed from the more clayey upper portion of the Jackson Formation, and for that reason, form borders about the areas of Houston Clay.

While the so-called prairie soils are more characteristic of this region, those of widest distribution are the Brown Loam (Memphis Silt Loam) in the western part of the region and the Orangeburg and Norfolk series in the parts in Smith, Jasper and eastward.

The Brown Loam covers to a depth of from 6 to 10 feet the Jackson Clays, or the Lafayette, when present, in all the prairie region of Yazoo, Madison, most of Hinds, but gradually thins eastward until its surface becomes largely detached fragments in the eastern part of the region. While in the eastern part its outlying fragments cap the Lafayette in many places, by far the greater part of the Lafayette is exposed at the surface, forming the red or yellow sandy soils so characteristic of the southern half of the State.

The Jackson Prairie Region forms a water shed for numerous small streams that flow on the one hand north into the Pearl River, or on the other hand southward into the lower Pearl and into the Pascagoula. The bottom soils of the region are not extensive, the small streams heading in this region having rather heavy clay soils where flowing through the heavy soil areas, becoming lighter as the sandy types lying to the north or south are encountered. The Pearl has the same character of bottom soil as will be described under the next soil region.

Native Vegetation.—In the western parts where the soil conditions are essentially those of the brown loam, the native growth is very much the same, consisting of oaks of several species, as Spanish, post, black jack and red oak, and hickory, elm, sweetgum and black gum. In the prairies where trees occur, the growth is chiefly black jack, wild plum, persimmon and crab apple. On the Gypsum prairies—those of gray soils, of southern Scott and northern Rankin the tree growth is stunted, and consists of scattered persimmon, plum and sumac.

The herbaceous plants where the loam prevails is essentially those mentioned in the discussion of the loam area of the Lignitic, where the Lafayette sands form the soil, they are those of the Long-Leaf Pine Hills, which will be discussed next. On the prairies proper the herbaceous forms consist largely of prairie grasses and legumes, as mellilotus, the prairie clover (*Petalostemon candidus*) and wild indigo (*Baptisia lencantha*), together with various milkweeds and the compass plants (*Silphium laciniatum* and *integrifolum*).

Culture.—Some of the most desirable lands in the State occur in this area. The deep rich loam soils of Yazoo, Madison and northern Hinds are not to be surpassed in the State for diversified cropping. The lands lie well, and though in many places run down by the one-crop system of agriculture that has prevailed for so long, can easily be built up to great productiveness. In much of the region decided improvement has already taken place, and diversified farming is being engaged in, with a consequent more intensive method of culture. The soil is responding rapidly to better treatment and the prices of farm lands have more than doubled within a few years.

The methods of growing the staples, cotton and corn, have been greatly improved, with corresponding increase in the yield. The cotton boll weevil has brought some discouragement in the growing of cotton, but improvement in the methods of corn growing are phenominal. Mr. Estin C. Jones, near Jackson, has succeeded in growing corn that has produced from 150 to 200 bushels per acre. From Madison County, corn is reported to have yielded more than 200 bushels per acre. The Corn Club movement is bringing about good results from the various counties, and the average corn yield is being rapidly increased. One of the chief benefits of the movement lies in demonstrating the capabilities of the soils of the State under the intensive system of culture that must eventually prevail throughout the State. The people of Mississippi cannot discover too soon that land made to yield to its utmost capacity by thorough til-

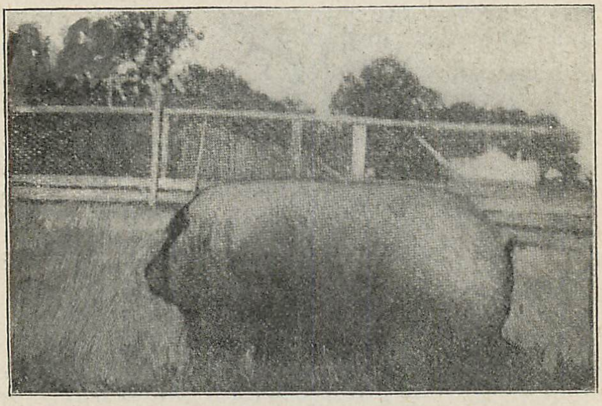


Fig. 10. A MISSISSIPPI PORKER—A Clarke County hog that attracted a great deal of attention. An evidence that Mississippi can produce as good hogs as any State in the Union.

lage, not only enriches the farmer, but the land itself is better by the treatment.

In those parts of the region lying adjacent to the railroads, diversified farming has made more progress than in most parts of the State. About Jackson and through Madison County, truck farming, fruit growing, stock raising, poultry raising and numerous other lines of farm interests are paying large returns to the farmers engaged in them.

All that has been enumerated as crops to be profitably grown on the loam soils of the Lignitic Plateau Region will grow here, and to even better advantage perhaps, and many of them are being grown here. Many people from other parts of the country have come into Madison County and are adding greatly to its prosperity by introducing new crops, and better methods of culture. Oats and wheat are being grown successfully, the oat crop for several years having steadily increased in acreage. Whereas, before it was grown simply to supply feed upon the farm, it is now one of the important money crops of the county. Canton and Madison Station have been for several years important shipping points for vegetables and fruits. Strawberries are grown and shipped extensively. Those sections that have adopted the plan of diversification and improved cultivation are in much better financial condition than they were under the old regime of cotton and corn.

Pecans, peanuts, chufas, lespedeza and perhaps alfalfa will do well. Alfalfa has been tried and found satisfactory in a few places in Madison. The lands about Jackson would perhaps be better for the growth of alfalfa.

The discussion so far has referred to the western portion of the region, over which the thick brown loam soil prevails. It will apply, however, wherever the loam forms the soil. The more sandy red and yellow Lafayette soils pass imperceptibly into the same types in the Pine Hills Region and will be discussed there. The true pairie soil, the black Houston Clay, as its name indicates, is identical in character with the prairie soil in the northeast counties. Hence there can be no question that it offers the largest possibilities in the growing of alfalfa.

Considerable areas around Morton and the intervening black soils to and around Lake ought to grow alfalfa successfully. The same is true of large areas in Smith, Jasper and Wayne. Wherever the black soil exists and fragments of shell can be seen in the soil, alfalfa will grow if the soil is properly prepared and well drained. The prairie clovers and mellilotus thrive on this soil and furnish a very good evidence that alfalfa will do so also. In Clarke County near Pachuta it has been grown experimentally, the alfalfa equaling that of the prairies of Noxubee County.

On the acid soils of the flat "hog wallow" prairies alfalfa could not be successfully grown. It will not grow upon an acid soil. However, by thorough liming and underdrainage and by preparing and inoculating the soil, these areas might be made to grow this crop. Soils of somewhat similar characteristics in the Yazoo Delta are successful alfalfa lands when well drained and otherwise prepared.

Water Supply.—Wherever in this region the Lafayette sands prevail of considerable depth, springs and shallow wells are obtained, the water usually being struck at the contact between the Lafayette and the Jackson clays. In the prairies themselves no water is struck until the Jackson Formation is penetrated and the Claiborne reached, although at Forest, in Scott County, a well 220 feet deep is regarded as receiving its water supply from the Jackson,

Fig. 10-A. Artesian Well in South Mississippi.

though probably from the upper Claiborne. Over the eastern part of the area artesian water can be gotten from the Claiborne at a depth of 200 to 500 feet. In the western parts of the region good water from the Claiborne is obtained at a depth of 600 to 800 feet.

LONG LEAF PINE HILLS.

Boundaries and Topography.—The whole southern half of the State, embracing the whole or parts of thirty counties, constitutes the soil region to which the above name is given. It is the largest soil division in the State, and embraces all the State south of the Jackson Prairies and east of the Bluff Hills.

The topographic features of this large area vary from hilly to nearly level. The irregularities of surface are due to mature erosion upon an original plain which sloped gently from an elevation of 300 to 400 feet in its northern parts

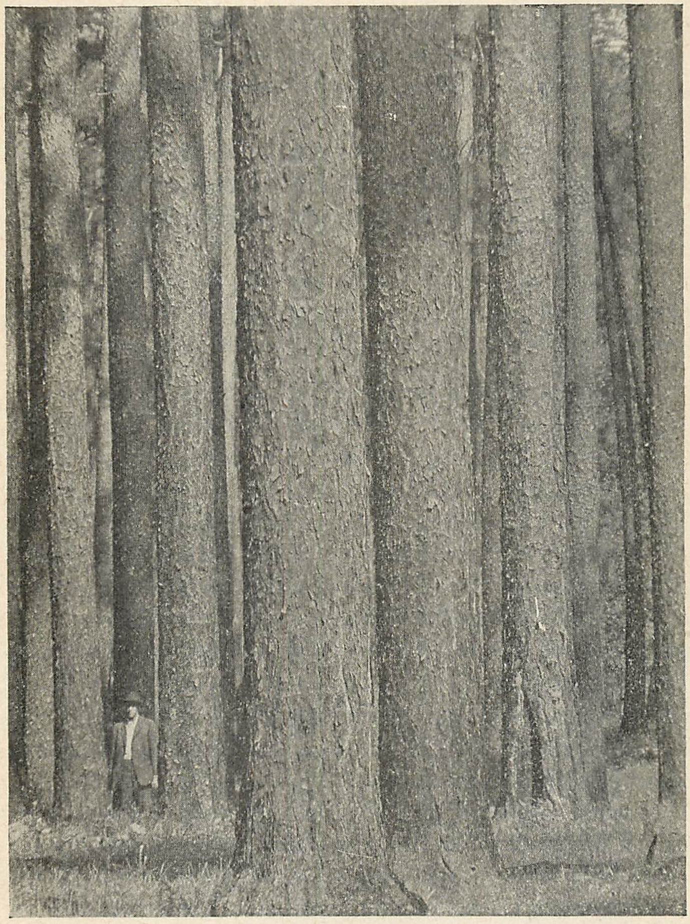


Fig. 11. Long-Leaf Yellow Pine.

to sea-level, where it borders the Gulf. Elevations of numerous points in the area indicate that the western half is between one hundred and two hundred feet higher than the eastern half. Some of the highest lands in the State lie in the western part of this region. Mature erosion upon an easily yielding soil has produced over much of the area a rough surface. The larger streams flow in broad valleys, cut deep into the plateau surface, and the lands in their vicinity are very deeply and intricately cut into hills and ridges The elevated western parts present these features to a marked degree, while the large area lying east of Pearl River has, on the whole, a rolling, rather than hilly topography.

At a distance of five to ten miles from the Gulf the land becomes low and level or gently rolling, presenting in places depressions to ground water level, forming marshes, with a characteristic flora.

The drainage of the whole region is into the Gulf, most of the streams flowing into the Pearl or Pascagoula Rivers, or into the Mississippi in the western part.

Character and Distribution of Soils.—While this region is treated as a soil unit, it is divided into two rather distinct parts, the soils and vegetation of which are different. In a general way, the Pearl River marks the boundary between the two. In the western, more elevated division, the prevailing soil is the brown loam, which has been studied in the regions farther north. The loam which covers the loess in the Bluff Hills along the Mississippi spreads eastward beyond that region, 10 to 15 feet thick at first, but gradually thinning toward the east, until as the Pearl River is approached it becomes cut up into detached fragments. Beyond the Pearl it is still found as scattered patches, but ceases to be the dominant type.

In much of this area the loam shows more or less distinctly a bipartite character, the upper portion being redder in color, more clayey and of finer texture, and on the face of a cut, weathers in verticle smooth surfaces; the lower division is lighter in color, grayish, irregularly streaked and blotched with fine whitish silicious material, has an appreciable quantity of small quartzose pebbles and "buckshot" iron concretions and weathers on a vertical surface in ridges or buttresses, due perhaps to the appreciable tendency to vertical cleavage.

In much of Hinds County, south of the Jackson Prairies, the loam lies directly upon the gray sands and clays of the Grand Gulf, the Lafayette being absent or but slightly developed. In the vicinity of Raymond the Lafayette is well developed, a cut just west of the town exposing about 10 feet of loam and 10 to 12 feet of Lafayette red sand overlying the Grand Gulf clay. Two miles southeast from Raymond are two prominent hills of Lafayette gravel; similar hills lie around Cooper's Well, the water of which undoubtedly comes from the Grand Gulf. The county around Raymond is rolling and the soils of the loam type, much of it run down by long farming, but capable of being rejuvenated, as shown by the results of Mr. Thomas Bridges on his experiment farm.

Between Raymond and Bolton the surface is greatly rolling and the soil of same general character. The bottoms of Baker's Creek are dark sandy loam soils and very productive.

West of Utica in the Scutchalow Hills the country becomes broken, but the soils are very productive, owing to the presence of the loess, which begins to appear. East and southeast of Utica, the country is rolling and the hill soils of the brown loam type. Much of this part of the country, as elsewhere, has soils somewhat run down but capable of improvement. The bottom-lands of Tallahala and White Oak Creeks, are very fertile sandy loam soils. Some of the most prosperous farms in the county lie upon and between these two streams. On the south side of White Oak the land is hilly and the soil is largely red Lafayette sands, with some admixture of loam.

In the vicinity of Crystal Springs the brown loam soils are quite deep, uniformly rich, reddish brown and lie well for cultivation. This is the famous trucking soil, from which such heavy shipments of vegetables are annually made. Here, as elsewhere in this region, the dividing ridges or plateaus between the streams are capped with loam, but on the slopes it is largely removed and a gravelly loam of Lafayette origin forms the soil. This type is not as productive as the silt loam, but by fertilization and thorough tillage, it has been made to produce tomatoes and other vegetables of excellent quality in great abundance. Crops mature earlier than upon the loam. In the vicinity of the streams this type is badly cut up by erosion, the hill sides being often too precipitous to cultivate. Both types, as well as the smaller exposures of the red sandy soils of the Orangeburg series, are almost entircly devoted to the trucking business in the immediate vicinity of Crystal Springs. The same is true at other points along the Illinois Central Railroad, as at Gallman and Hazlehurst, where the same soils and similar conditions prevail.

A few miles west of Crystal Springs the surface becomes hilly and the Lafayette sands and gravels come to the surface, forming the soil over more or less extended areas. East of the town the land lies more favorably, being nearly level, but becoming more rolling as Pearl River is approached. In this area the brown loam shows its bipartite character, the upper part being uniformly about 3 feet deep and quite red and mellow, the lower portion being 3 to 6 feet thick, light tawny in color and inclined to be "buckshotty." This is naturally a very fine soil, and where exhausted can readily be brought to good condition again.

The country lying around Hazlehurst shows the red loam soil as at Crystal Springs, but, on the whole, not so thick. The land is rather hilly, several miles east of the town passing into the rolling hills of the Long Leaf Pine, the Short Leaf Pine being prevalent toward the west. Here, as at Crystal Springs, the loam shows distinctly the two divisions before noted, the upper dark red and loamy, the lower pale and characteristically "buckshotty." Much of the Lafayette is exposed over this general area, and is prevailingly yellow sands with some pebbles, forming a rather thin soil.

Brookhaven lies in a rolling region, the country being attractive. The farms look thrifty and the crops show good yield. Practically all farm lands here are fertilized. The Columbian Loam (brown loam) forms a very distinct and almost continuous layer of 3 to 6 feet thick, and in color varies from rusty yellow to deep red, underlaid by the red clayey sands of the Lafayette. The land generally has been many years in cultivation and much of it is run down, but for the most part it lies well and can be easily rejuvenated.

Along the Illinois Central road south of Brookhaven, the brown loam is sparingly developed. Around Summit, Magnolia, Fernwood and Osyka the prevailing soils are the red sandy Orangeburg soils of the Lafayette, with detached areas of brown loam here and there. The Lafayette of the southern counties, and especially westward, has a larger proportion of clay than farther north. In wet weather the roads become very sticky and heavy on account of the clay. It improves the quality of the soil, however, by giving it body, and these Orangeburg soils are very productive where properly kept up.

The soil and topography of Amite County differs but little from that we have just studied in Pike. The loam is perhaps more generally developed toward the west, rather thin, but in places 5 to 6 feet thick. It is quite "buckshotty," the low lands derived from it being especially so, showing poor drainage. The loam soil, however, is not as generally distributed as the sandy soils of the Lafayette. A good deal of the country east and south of Liberty is nearly level, but toward the north and west it is hilly and somewhat gravelly. Where the gravel comes to the surface in fields the farmer leaves those parts, which are very sterile and dry, and, surrounded by the green fields, look like desert islands in an emerald sea.

The brown loam in this section is very irregular, both in thickness and appearance, in a few yards passing from a thickness of six feet or more to total absence, the top surface being even, the irregularity seeming to exist in the surface of the underlying Lafayette. Further, it passes very suddenly from deep red to a chalky whitish buckshot, which is indicative of poor drainage, and found usually in the flat areas.

In western Lincoln and Franklin counties the surface is rolling to hilly, the greater irregularities lying in the vicinity of the Bluff Region in western Franklin. The loam and Lafayette sands are the surface soils, the loam being more wide-spread but thin, and much of it of the pale buckshot variety. On the low lands along the branches of Homochitto River these whitish buckshot soils are very common. The broken hills around Hamburg show sandy loam soils of good quality; farther south the soils are largely pale sands of Lafayette and very thin. In the central parts of the county about Meadville the soil is sandy and the face of the country rather hilly.

In the River tier of counties, Claiborne, Jefferson, Adams and Wilkinson, this region merges into that of the Bluff Hills. East of the Bluff Hills, however, the topography becomes less broken and over much of this territory assumes the rolling character of a plateau, the streams being generally in wide valleys below the general level of the country. The soils are of the brown loam type generally with large areas of Lafayette in the more uneven portions.

In the eastern part of Wilkinson around Gloster and Centerville the country is rolling and the soils prevailingly the red sandy soils of the Lafayette, with a little loam here and there. This soil rests upon a mottled red and yellowish sandy clay subsoil, the clay in the soil being sufficient to make the roads very sticky when wet, but also giving body to the soil. A block of this clay on drying becomes almost as firm as a brick. Trucking has been practiced to a considerable extent along the Mississippi Valley Railroad, the two principle shipping points being Gloster and Centerville. While much of the soil is thin and badly worn, with proper care it has proved to be a good soil for this line of farming.

Between Centerville and Woodville the country is not so rolling as farther east, the red sands being at the surface or capped by a thin veneer of loam. Crops growing upon these soils indicate more fertility than in the eastern part of the county; grass grows thick over the slopes, making good grazing and giving the country a handsome aspect. Around Woodville the brown loam is the prevailing soil, several feet deep and increasing in depth westward, the topography at the same time becoming more broken. The vegetation shows a marked change as the Bluff Hills are approached, the prevailing trees being water oak, red oak, white oak, chestnut oak, great-flowered magnolia and umbrella magnolia, beech, elm, ash, yellow poplar, hickory, hop-hornbeam, ironwood and some pine, though that is much less abundant than in the eastern portion of the county. The hill soils are beginning to show the effect of long and exhausting cultivation in cotton and corn. Being of the loam type of soils, however, it can be easily renovated by deep plowing and subsoiling, and by practicing rotation of crops in which at least one crop every third or fourth year of some legume should be plowed into the soil. The soil is exhausted of humus, which must be returned in this way, or by heavy dressing of barnyard manure.

The bottom soils of the streams are dark, sandy loam soils of excellent quality.

In the northeastern part of Wilkinson the hill soil is very thin gravelly Lafayette, hilly, and not much farmed. Along the Mississippi Valley Railroad the sterile Lafayette sands and gravels lie at the surface as far north as Harriston. Here the land becomes less hilly and the soil better, and the same general conditions prevail in Jefferson and Claiborne Counties to Port Gibson. Some buckshot land occurs, but not of the whitish type, which is the least promising. The soil is prevailingly the brown loam, deep in the western parts of these counties and thinning eastward. West of Port Gibson and Fayette the loam soils pass into the Bluff Hills, in which the calcareous loess enters into the formation of the slope soils. Loam soils prevail in the eastern part of Jefferson about Union Church, where the fertility is perhaps above the average. Some buckshot is reported to be widespread in the leveler lands. Eastern Claiborne about Hermanville is rolling, but with some broad areas of level-lying land. The soil is loam, and has been in cultivation many years, but is of unusually good quality, and the farms are quite generally above the average in productiveness. Farther south, about Martin and eastward the loam is thinner and shows a transition to the pine land conditions. The topography is gently rolling.

The bottom soils of this region are quite generally dark sandy loams, owing to the streams cutting down into the Lafayette Formation. The chief differences between them depend upon whether or not they have been long cultivated and whether or not they need drainage. Most of them would be benefited by tile drainage, and when they have been long cultivated and the humus has been largely exhausted i ts restoration is indicated.

Most of the so-called buckshot soils mentioned in the previous pages are derived very largely from the brown loam, and are more clayey and heavier than the sandy loams. They occur usually on river flats and indicate the need of drainage; this is especially true of the pale putty-colored soils with small black concretions of bog iron ore. They are usually heavy, cold, sour and crawfishy, and until drained thoroughly, are hopeless. So far as we have observed, these soils, as found in this soil region, are almost confined to the western half of the region, where the loam prevails on the uplands.

In the counties east of Pearl River the brown loam is but sparingly developed in detached areas, the soils being quite uniformly the red or yellow clayey sands of the Lafayette Formation. Over all this part of the region east to the Alabama line and south to the Gulf are the great forsts of long-leaf pine which have given name to the Region. In the past these "Piney Woods" soils have been regarded as of little agricultural value. Farming was almost confined to the bottom-lands, the higher lands being used for pasture, and, to some extent, the forests were boxed for turpentine. Later the great value of the long-leaf pine forests for timber led to their extensive exploitation, which is still going on rapidly. Many thousands of acres of "cut-over" lands were a few years ago thrown upon the market at almost any price, because considered of no value. Later, however, the value of these lands is beginning to be understood, and the prices are steadily going up.

In Rankin, south of the Jackson Prairies, the topography is hilly and the soil mostly of the red Lafayette type, which, throughout the whole of the Long-Leaf Pine Hills, has a considerable proportion of clay, giving body to the soil, the sub-soil being characteristically mottled and heavier.

Simpson, Smith and Jasper, south of the Prairie Region, show uniform conditions of soil and topography. Around Mendenhall the country is very hilly and the red Lafayette almost everywhere forms the hill soils. The soil is generally thin and very much of the hill lands are not farmed; where farms exist they are small and not very productive. The valley soil of the Strong River at Floyd's Bridge is a dark sandy loam and produces well. Towards Magee the land becomes less broken and is more extensively farmed than around Mendenhall, the fields showing good looking crops of cotton and corn. The soil is universally the red sandy loam of the Lafayette, the gravel of the lower portion of the Formation coming to the surface frequently. Just above Magee is the Weathersby gravel pit of the Gulf and Ship Island Railroad.

In the southern part of Simpson, around Pinola and old Westville, the soil is red and yellow sandy loam, and hilly. Farther east the soil and topography seem to give better promise. At Pinola, the Strong River second bottom is two miles wide, the soil a rich dark sandy loam and produces excellent crops of corn, cotton and hay.

In the vicinity of Collins, in Covington County, the land is moderately rolling; in places large areas are nearly level. The prevailing soil is the red sandy loam of the Lafayette, which, with fertilization, can be made to produce well. The bottom-lands, though sandy, are very productive and produce well even after long years of cultivation. Most of the hill sides will produce well for two or three years, after which the soil must be fertilized. Practically all the hill soils of the Long-Leaf Pine Region require fertilizer within a very few years after being put into cultivation.

Three miles west of Collins and one mile north of old Williamsburg is a tract of nearly perfectly level brown loam covering an area of two or three square miles. It has been cut over and has grown up in black jack oak or in grass knee high. It would be beautiful in farms. The loam, however, is not of the rich red that characterizes the best, but is pale and tough, the soil being whitish. This condition is caused by a lack of drainage and could be remedied.

Some trucking has been attempted in the country around Collins, and the crops grown were satisfactory, but the failure of marketing was the difficulty. Trucking ought to succeed on these soils, for, while the soil is sandier and lighter, and would have to be fertilized more highly than in the trucking areas of Copiah, the crops would mature earlier and would get to market first.

Southern Smith is not very different in character from Covington, the divides between streams being of the nature of broad, gently rolling plateaus rather than ridges. The stream bottoms are sandy loams of high productiveness when new.

The hill lands around Laurel, in Jones County, exhibit as the prevailing soil type the deep and sandy loams of the Lafayette. The yellow sandy loam (Norfolk) of the Lafayette is less extensive, but replaces the red in limited areas. Occasionally a bluish, sticky clay soil covers small areas, and is tough and sour, needing drainage. This soil is derived from the gray clays of the Grand Gulf Formation, and occurs to a limited extent in every county of the region.

The red soils of Jones County occur on the higher lands, where they are not too rolling, but lie well for cultivation. They are capable of high productivity, being good truck and fruit lands, besides among the best corn and cotton soils.

Passing west from Covington into Jefferson Davis County the country shows some fine, gently rolling farm lands east of Prentiss. From Prentiss westward the character of soils change, the brown loam appearing abundantly on the higher lands south of Prentiss and prevailing over the western portion of the county. Coincident with the change in the soil is an equally marked change in the tree growth. Oaks of several species, as red oak, black oak, Spanish oak, hickory of two species, sweetgum, black gum, sumac of two species and persimmon, prevail over the pine, but on the hills east of Prentiss the typical pine forests and the red sands appear together.

The land is quite generally farmed and the crops attest good soils, though much of it is showing the need of rejuvenation.

In Lawrence, soil and topographic conditions are very much like the western part of Jefferson Davis County. The Columbian or brown loam prevails quite generally on the uplands. Some of the bottom-lands on Silver Creek exhibit the whitish, sticky buckshot soil which we have noted as accompanying the loam in the region west of Pearl River. This white soil is in places, at least, due to the outcrop of Grand Gulf Clays, as was noted in Lawrence in one place, and once in Hinds County. The loam soil prevails around Silver Creek to a depth of 1½ to 2 feet, but is not continuous. The country is hilly, as it is also towards Monticello, but not of the typical "piney woods" type, ridges both east and west of Monticello showing a heavy growth of oak and hickory. The loam is present as a thin veneering two or three feet thick on all these hills. The farms are small and in need of renovation, much of it having been in cultivation many years.

Marion County is so situated that the Pearl River cuts through the center dividing it into an east half and a west half. Both sections of the county lie strictly in the Long-Leaf Pine Belt, and large bodies of the finest pine timber in the State lie to the west of Pearl River in this county and the eastern part of Pike. East of Pearl River bottom the country is rolling, and presents some good bodies of timber and in the leveler portions, fine farms. The soil differs somewhat from the usual Lafayette of these piney woods counties in being tawny yellow instead of red, and has a considerable admixture of clay. Some parts east of Columbia have characters so closely resembling the brown loam that a careful examination and comparison is required to distinguish them. On the east bank of Magee's Creek is a local deposit of brown loam, and it is probable that some of the slope soils are a mixture of loam and Lafayette. Whatever their origin, these tawny soils possess sufficient body to take fertilizer well, and produce excellent crops.

In the northern parts of the county the soils become largely of the brown loam type, as was noted in Lawrence. West of the Pearl the land is of the red Lafayette, or Orangeburg type. Near the river valley the upland is hilly and broken by numerous sharp deep ravines, and, while the soil is productive, would be subject to rapid erosion. Within a few miles the land becomes gently rolling and in the vicinity of Kokomo lies beautifully for cultivation. Around Kokomo and Knoxo and westward towards Tylertown the land is of the red Lafayette and lies just enough rolling to drain well. At the present time only scattering small farms lie in the observed parts, but it will become a very prosperous farming section as soon as the timber is cut off. The lands are among the best in South Mississippi. Tylertown is located in good agricultural country and southeast from the town, along the Great Northern Railroad are some of the most beautiful lands in the pine belt.

The Pearl River Valley cuts north and south through the whole Pine Belt, and presents a prominent soil region, worthy of separate consideration. It is a broad second bottom, the first bottom being usually rather narrow, varying in width from 2 to 4 miles. Most of it is free from overflow, and, for the most part, heavily timbered with various hardwoods, except where in cultivation.

The soils where the river passes through the Jackson Prairie Belt is rather heavier than lower down because of the washings from the heavy clays of that region. After entering the region of prevailing sandy formations the soils of the bottom become lighter and sandier. Opposite Crystal Springs this soil is a very fine sandy loam, and where it stands in vertical walls, very loess-like, both in texture and color. The cultivated soil is darker with humus, and is very productive. Its sandy nature makes it very mellow and easily cultivated. At Georgetown, the valley is two or three miles wide and the bottom surrounding the town is in a good state of cultivation. The soil is a yellowish sandy clay loam, the subsoil being a yellow sandy loam. Some of this land has been in cultivation for more than a generation, but it is still highly productive. At Monticello the soil is light gray, resting upon a yellowish sandy loam subsoil, similar to that at Georgetown, but apparently having less clay. At Columbia the soils are sandy loams, dark with humus, with the same character of subsoil as at Monticello.

The River in much of its course cuts into the blue clays of the Grand Gulf, and considerable clay occurs in the alluvial soils, but for the most part is locally distributed, the general character of the soil being, as before stated, sandy loams derived from the washings of the Lafayette. While an alluvial soil and, therefore, usually rich in plant food, this soil has the advantage of being a light soil and easily worked. Where it lies low and too level to drain readily, tile drainage would produce marvelous results, removing the acidity and converting a clammy, cold soil into a warm, mellow loam of high productivity.

Lamar and Forest Counties are very much alike in soils and topography. The surface is distinctly rolling with some extensive nearly level stretches. Here, as over most of this Long-Leaf Pine region, until very recently the uplands were of value because of the pine timber, but now more and more of this hill soil is being put into cultivation. Purvis, in Lamar County, is situated in the midst of rolling pine lands. The pine has been largely cut away, but some remains, and is boxed for turpentine. Grass grows tall and thick among the trees, making good pasturage. Everywhere the intense red clayey sands of the Lafayette lie at the surface and furnish the soil. On the surface for a few inches down the soil is black, due less perhaps to humus than to the charred vegetation of past burnings of the forest before clearing. Below this it is red.

West of Purvis the farms in the Coal Town neighborhood lie very level or slightly rolling, and the crops that are grown indicate a soil of high productiveness. In the southern part of the country around Lumberton are some remarkably fine agricultural lands. These lands lie perhaps more generally level than farther north. Three or four miles east of town Dr. Thompson owns a fine property on what is locally called the "Big Level," a large level tract of black sandy loam soil which produces abundantly, I am told, without fertilization. In the humus tests given in the appendix it will be seen that this soil has the highest humus content of any soil collected in the pine belt. These lands are coming rapidly into demand. Investors have been giving considerable attention to this region, which is destined to become a fine farming and perhaps trucking section.

The ridge lands around Hattiesburg are identical in character with those of Lamar County, perhaps more rolling, but the soils are black sandy loams, with a deep red sandy sub-soil. One mile south of the town a second bottom soil of Leaf River, taken from the land of J. B. Burkett, is a purely sandy soil with little or no clay. This land grows cabbage, sweet and Irish potatoes, lettuce, sugar-cane, corn and cotton. Soy-beans, when planted in rows and cultivated, grow 3 to 5 feet tall, and between the rows Alabama clover grows without seeding. With careful cultivation and 500 pounds of fertilizer per acre, cotton is said to produce a bale per acre. The first bottom-land contains more clay and will produce all kinds of vegetables and the staple crops, but cotton must be fertilized, otherwise it runs to weed and the bolls formed fail to mature. Phosphates would greatly increase the fruitage.

Perry County presents no new features, the ridge lands being of the red Lafayette type and generally rolling. Comparatively little of the uplands in this county have been put into cultivation. Lumbering is still the chief interest, and the lands are being rapidly stripped of their timber. Some efforts are being made to settle up the cut over lands. Specimens of soil were taken from the land of T. W. Hinton, two miles south of Richton. New lands planted in corn produced 40 bushels to the acre. An older portion of the farm had been in cultivation twenty years. The soil is a dark mellow sandy loam, of second bottom. Cotton grown on this land was reported to have produced in 1908 an average of 1¼ bales of lint per acre.

The soils of Green and the new county of George are well represented around Lucedale. The best type of upland soil is illustrated here. The country for several miles north and south of Lucedale is a level plateau, in places too flat to permit of good surface drainage. The porous nature of the soil permits the rainfall to become readily absorbed, thus enriching the soil by the ammonia absorbed with the water.

The soil is a dark sandy loam, with a red sandy subsoil. The sub-soil is so compact, however, that it retains the moisture. In the virgin state, this soil is not highly productive, but is capable of being brought to a high state of fertility by proper care. The surface is so nearly level that fertilizers applied to the soil are not carried away by surface waters, and the subsoil contains enough clay to prevent leaching. Many of the farmers have brought their land to a high state of cultivation, with resulting heavy yields. These lands are especially adapted to sweet potatoes, the yield being as much as 400 bushels per acre, much of the crop being shipped out at fancy prices. This year, 1911, shipments of strawberries began as early as February 12th from Lucedale.

Pearl River County in the northern parts resembles very closely the adjacent portions of Lamar. Conditions around Poplarville are fairly representative. The surface of the land is moderately rolling and the soils very much like those examined near Purvis, in Lamar County—very dark, almost black when moist for several inches, beneath which the subsoil is deep red. In fact, the statement may be made as a general truth that the typical piney woods soil is a dark sandy loam of the Orangeburg series, derived from the red Lafayette. This series is a good one for general cropping, but is better adapted to corn than to cotton, the cotton stalk being large enough but often bearing but little fruit, showing the need of phosphate. The corn is uniformly good where it has received proper attention. Sugar cane, of the finest quality, is grown and the syrup made from it has a very superior flavor and beautiful color.

From Poplarville southward the country is generally rolling, with some wide level stretches, and an occasional low area with marshes and ponds. In these the soil is very largely sand, but the ground water stands at, or near, the surface. Under-drainage will be a problem in bringing into successful cultivation these low wet areas.

The McNeil Experiment Station is located just north of the southern border of the county and is representative soil for this part of the country. The land is rolling, though much of it is nearly level, and some showing the need of drainage. The soil is a grayish sandy loam, with a subsoil of yellow sandy clay. This is technically called the Norfolk fine sandy loam, and is derived from the Lafayette. It very generally replaces the red Orangeburg soils in the southern parts of this county, and is the prevailing soil in the coast tier of counties.

The Pearl River bottom lies along the western border of this county as a broad flat two or three miles wide and fifty to one hundred feet below the uplands. Its soil has changed to a cold, sticky clayey loam, badly in need of drainage. It is subject to overflow, and, in time of drouth, bakes so that under present conditions, this part of an otherwise magnificent valley holds little immediate promise of agricultural development.

The three coast counties,—Hancock, Harrison and Jackson, present very similar conditions. The rolling topography of the more northern counties continues into the northern and central parts of these, but five to ten miles back from the coast the aspect changes and the surface becomes low and level. The natural drainage is not good; ground water is within a few feet of the surface, in the numerous low depressions coming to the surface in marshes and ponds. These become more prevalent as the coast is approached, and somewhat more extensive in the eastern parts of the area.

The soil of the uplands is the grayish sandy loam, with a yellow subsoil, belonging to the Norfolk series. Owing to irregularity of surface and the open texture of the soil and subsoil drainage, both surface and under-drainage is good. The porosity of the subsoil allows rain water to sink rather too readily and the soil in summer is liable to suffer from drouth.

The soils right near the coast are very sandy, while those a little way back on the lowlands are finer and more silty. In the depressed areas where the ground water stands permanently, or for much of the year at the surface, forming marshes, the soil becomes acid and supports a very characteristic flora.

Most of the territory included in these counties, until very recently, was covered with fine forests, and, even yet, the lumbering, turpentining and charcoal industries in the interior, and fishing along the coast overshadow the agricultural development of the region. Outside of the coast towns and a few railroad points of recent growth, very little of this territory has been improved. Within a few years truck farming on a limited scale has been engaged in with success. The Scranton series of soils, quite dark sandy loams with yellow subsoils, seem especially well adapted to truck gardening. It is probable, however, that any of these soils, properly drained and fertilized, will prove valuable for that purpose.

Native Vegetation.—Throughout most of this region the characteristic and dominant tree is the long-leaf pine (*Pinus australis*) which formed vast forests on the uplands. These forests were almost pure growths of this species, very few of the other pines and a scattering shrubbery growth of black jack and post oak occurring with them. Toward the coast the pine barrens oak (*Quercus catesbaei*) and Cuban pine (*Pinus heterophylla*) appear in considerable quantity. Little or no undergrowth occurs in the pine forests, except grasses and a few xerophyte herbaceous species.

On the river bottoms occur water and willow oaks, gums, sweet bay (*Magnolia glauca*), tulip tree (*Liriodendron tulupifera*), short-leaf pine (*Pinus mitis*), slash pine (*P. heterophylla*), beech and swamp maple (*Acer rubrum*). Several very characteristic shrubs grow on the valley lands, as star anise (*Illicium floridanum*), bay galls (*Laurus carolinensis*), candle berry (*Myrica cerifera*), calico bush (*Kalmia latifolia*), grand sir graybeard (*Chionanthus Virginica*) and sourwood (*Oxydendron orboreum*).

In that division of this region lying west of Pearl River, where the brown loam so largely forms the soil, a very large admixture of hardwoods accompany the pines, gradually replacing them as the Bluff Hills are approached. A small tree, very common throughout this part of the region and not very common elsewhere in the State, is the large leaf magnolia (*Magnolia auriculata*).

On approaching the low lands of the coast the laurel oak and live oak appear, the candleberry increases in abundance and the gallberry (*Prinos glaber*) appears, and borders the swamps and marshes in dense copses. In the low, wet depressions and marshes the flora embraces the following peculiar forms: Two species of pitcher-plant (*Sarracenia purpurea* and *S. flava*), sundew (*Drosera rotundifolia*), star grass, white and yellow species (*Aletris farinosa* and *A. aurea*), the peculiar flower-like grass, *dichromena*, whose crown of white-tipped blades glint like silver stars flecking the green savannahs, two species of cord rush (*Eriocaulon*), several beautiful orchids, butterworth (*Pinguicula punila*) and bladderwort (*Utricularia*), an assemblage that suggests very strongy the flora of the pine dune marshes at the southern end of Lake Michigan.

Culture.—The uplands of this region have for the most part been in pine forests until quite recently. In the western parts, however, where the loam soil prevails, the hill lands, as well as the stream bottoms, have been extensively farmed for many years. Since the removal of the forest over extended areas, new lands are being opened to cultivation. The railroads at first built through this territory in various directions to handle the lumber business, now furnish means of transportation both to incoming settlers and to out-going products, with the result that a new impetus is given to agriculture. Heretofore much of this territory was far removed from markets because of lack of transportation, and farming was almost limited to stream bottoms and lands adjacent to streams. The population was sparce and marketed little produce, the farm products being limited to cotton, corn, sugar cane and potatoes, and such things as were consumed at home. The lands were regarded as poor and undesirable, and, too often in the more fertile regions of the State, the piney woods farmer was regarded as living next door to starvation. That was before the day of fertilization. All farming depended upon the natural fertility of the soil and the virgin loam, prairie and Delta soils outstripped the thin sandy soils of this region. With the advent of railroads and the more scientific understanding of the soil and its needs and of the crops to be grown upon it, a new era has dawned in the pine regions of Mississippi, and it is being discovered that some of the most promising soils for varied products lie in that section, and, with the discovery, a lively demand for these lands has begun.

Copiah County has long been famous as a truck-farming district. It has been possible to engage in this business at Crystal Springs, Gallman and Hazelhurst, because of the facilities offered by the Illinois Central Railroad for shipping to the northern markets. Other points along that road through the southern counties into Louisiana have taken up trucking and fruit growing successfully, and diversified farming is forging to the front. Strawberries, especially, are very profitably grown. The growing of perishable vegetables and fruits, of course, cannot be carried on successfully without easy access to markets and facilities for transportation, but where these are offered, the business is developing, and the soil proves uniformly adapted to such crops.

Truck farming has been developed to a considerable extent around Gloster and Centerville, on the Mississippi Valley Railroad, and the soil seems well adapted to it. Interviewing a successful truck farmer, he inclined to think that the success of truck farming depends primarily and chiefly on good cultivation and fertilization, and subordinately upon soil. This is undoubtedly true, but the loam and sandy loams mature such crops earlier than heavier soils, and the success of this line of farming depends quite largely in getting the early markets. The soils around these points are what are generally called thin soils, partly loam, but largely of the Orangeburg series, but have enough clay to hold moisture well. The same farmer said the soils in the vicinity of Gloster and Centerville were well adapted to corn and cotton, and the crops indicated it. He found cabbage, tomatoes and strawberries—the chief marketable crops—do well. Cabbage do best in soil enriched with plenty of barnyard manure and acid phosphate. Tomatoes should not be grown on low, damp ground, nor should they be fertilized with much barnyard manure; in either case black rot is liable to develop. For strawberries, acid phosphate is used to advantage, giving them a bright red color which makes them more marketable. It perhaps also improves the flavor. He has used Kainit in his trucking, but is not sure of any results from its use. Humus he supplies to the soil in barnyard manure, leaves and leavings from sugar cane mills. Peas have also been used some. All are found to be beneficial.

These thin loam and sandy loam soils are usually deficient in humus and phosphates, but experiment seems to indicate that potash is present is sufficient quantity in all the

Fig. 13. Potato Field of Northern Settler at State Line, Clarke County.

soils of the State. This might account for the lack of decided results from the use of Kainit.

In the vicinity of Hattiesburg the lands are proving of good quality for vegetable and fruit growing, as well as for the more staple crops. Figs, pecans, peaches, strawberries, potatoes, sugar cane, peanuts and numerous other crops grow to perfection with proper attention.

At Lumberton, trucking is making decided progress. Pecans of the best paper shell varieties are grown here to perfection. The growing of nuts is in its infancy and in its development South Mississippi will be prominent.

Laurel is the center of an, as yet, limited but very successful truck-growing region. All the fruits and vegetables that have been mentioned as growing successfully in this region, and many others, are grown around Laurel. Mr. J M. Lindsay, two miles north of the town, has thirty acres in cultivation in truck crops, and has realized as much as $450 on one acre of ground in a season. From one acre Mr. Lindsay received as follows:

1st crop—Turnips, harvested by Feb. 10	$100 00
2d crop—Lettuce	150.00
3d crop—Bunch Beans, planted in every other middle between the lettuce	150.00
4th crop—Corn, after lettuce came off	75.00
5th crop—Peas planted in corn and harvested for hay	

To produce this remarkable succession of yields the land had an application of 10 tons of barnyard manure and 1,000 pounds of dissolved bone per acre, the latter applied after the turnips were harvested.

The fertile soils of the Pearl River valley are just now being brought to notice, but will in the future become one of the most magnificent farming and trucking sections of South Mississippi. However, due attention should be given to drainage in certain parts, especially near the coast.

At several points along the coast the trucking business is commanding attention. These coast soils are more purely sandy than any in the State and would seem to be the most hopelessly sterile. For a number of years now these sand ridges have been the seat of a very successful truck-growing enterprise at Long Beach, in Harrison County. J. W. Quarles was the first man to engage in truck gardening there. His success in growing winter vegetables on this soil was such as to attract the attention of some men from Youngstown, Ohio, who moved to the Mississippi Coast and went into the vegetable business. Since then the business has grown steadily, others taking it up, until, in 1909, about seventy carloads of vegetables were shipped from that vicinity. These are grown on the sandy ridges on the south side of the bayou that lies back of the town of Long Beach. There are large areas of level land on the north side that will be equally good, if not better, when under-drained.

The chief products of these farms are radishes, lettuce, sweet and Irish potatoes, beans, carrots, turnips, peanuts, watermelons, cantaloupes and cucumbers. Two crops of Irish potatoes can be grown in a year.

What has been said of truck growing at Long Beach will apply all along the coast so far as soil capabilities are concerned. In Jackson County, perhaps, the greatest progress has been made. Here, besides the growth of vegetables, several other crops are commanding attention. Among these the paper shell pecan is prominent. Mr. Frank Lewis has large nurseries there and the trees produce especially fine nuts in great abundance. A tree ten years old will pro-

Fig. 14. Corletta Ponderosa Lemon, Mississippi.

duce twenty-five to thirty pounds of nuts and the yield steadily increases for an indefinite time. These nuts are the large paper shell variety, which bring from 50 cents to $1.00 per pound. In growing a pecan orchard, vegetables and other crops are usually grown between the trees until they reach bearing size.

The Satsuma orange yields abundantly in this coastal region, as does also the grape fruit, fig and cassava, all of which offer possibilities of profitable development in the coast counties. It is perfectly practicable to grow successfully along the Mississippi coast most of the sub-tropical fruits, if proper attention is given to protecting them against occasional cold waves by planting sheltering groves of quick-growing trees around the orchards. If these should not be entirely effective the orchardist might, with profit, resort to the use of the smudge pots, as is done in the fruit growing regions of the West. They would be necessary, perhaps, only two or three nights during the season, the resulting expense and inconvenience being slight as compared with the value of the crop.

While under the old regime the chief agricultural products of the pine belt of Mississippi have been cotton and corn, these sandy soils are not so well adapted to cotton growing as the heavier brown loam soil; corn, however, yields well on these soils. This is the testimony of the McNeil Experiment Station. However, the McNeil Station is located on the yellow Norfolk soils and the same experiments conducted upon the red Orangeburg soils farther north might have proved more favorable to cotton.

The advent and the march across the State of the boll weevil, however, has suddenly diminished interest in cotton growing with a corresponding increase in interest in corn growing. During the last two or three years the corn clubs have brought a revelation to our own people of the possibilities of the soils of the State in the growing of corn. The Governor of the State recently received from Dr. S. A. Knapp, Special Agent of the U. S. Department of Agriculture in charge of the Corn Clubs of the South, a statement that of the one hundred boys who were the leaders in raising corn in the Southern States, thirty-four were from Mississippi, the yield per acre ranging from 109 to 225 bushels. Nearly a dozen of these were from South Mississippi, the highest, 225 bushels, from Lincoln County, the third highest, 215 bushels, from Lawrence. The others were scattered over the pine belt, Harrison County coming forward with two, the yields being 130 and 158 bushels per acre. This is certainly a remarkable showing on soils that have been accounted by many, not so long ago, as worthless for agriculture. And it is perfectly fair to assume that equally startling results will be attained in this region along other lines not yet developed.

In the presence of the boll weevil invasion, the farmers of this section are looking about to find some crop or crops that will take the place of cotton as a money crop. One that is especially well adapted to these light soils and one of the most remunerative is the sugar cane. The cut-over lands can be made to yield fifteen to twenty tons of cane per acre, which will produce 300 to 400 gallons of syrup. This syrup has a delicious flavor and a beautiful, golden amber color, so that it commands a price of 40 to 60 cents a gallon. It is far superior to the syrup made from cane grown on the heavy, alluvial soils of Louisiana, and is reported to be in demand in the sugar regions of that State.

The light, sandy soils of southeast Mississippi give good promise of growing successfully the Cuban tobacco. Capt. Hardy, of Hattiesburg, has solved the problem by having grown it, and cigars made from it were pronounced by experts as equal to the genuine article from Havana. It is worthy of further trial.

Just now the crop that is receiving most attention in South Mississippi as a substitute for cotton is the peanut. During 1910 a very considerable acreage was planted in peanuts, the Spanish peanut being the variety used. The chief effort in this direction was in the southwestern counties where the weevil had made the greatest ravages. Several cotton seed oil mills installed machinery for crushing peanuts, and bought the output of the farms at $1.00 per bushel. This price will probably not be maintained, but the crop is not expensive to grow, and will be profitable at 75 cents. At a conference of mill managers in Jackson it was estimated that the acreage in peanuts in this State during 1911 would probably reach 150,000.

It is too early yet to say what will be the outcome of this extensive experiment, which amounts to an agricultural revolution. The United States imports peanut products in large quantities, and there should be a ready market for the home grown product. The agreeable flavor and the nutritious properties of both the oil and the cake give them a wider range of usefulness for both human and animal food than the oil and meal of cotton seed. We venture the prediction that American ingenuity will devise more ways of using the peanut than we can at present conjecture, and

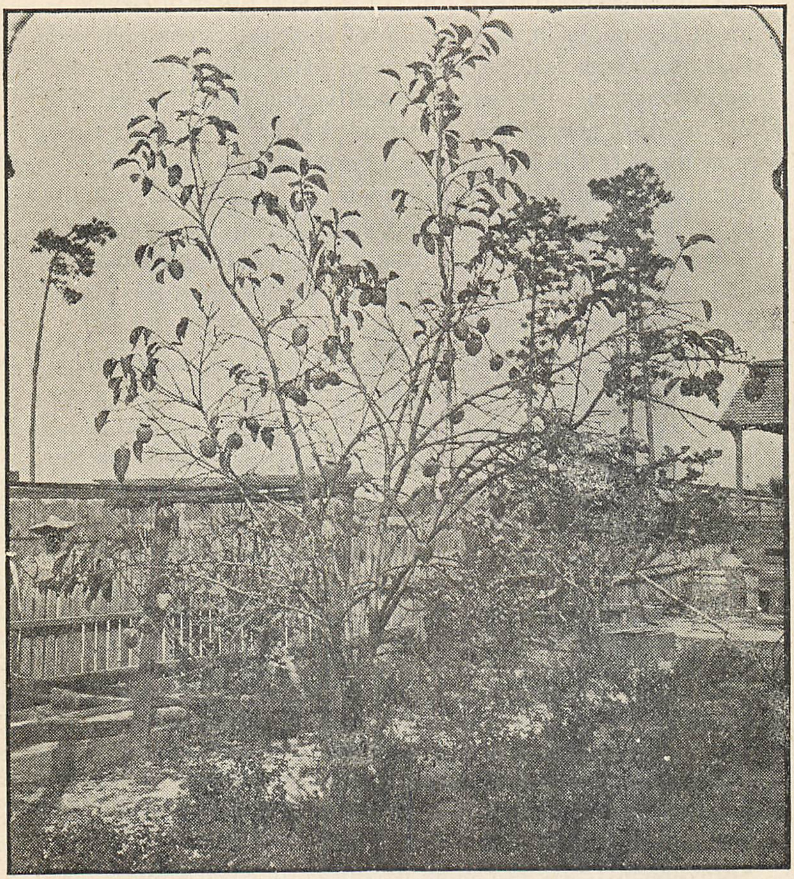


Fig. 15. Japan Plum, South Mississippi.

even though the boll weevil should cease to be a menace the peanut is here to stay.

Besides the nut itself, the stalk and leaf of the plant, when properly cured, make a valuable hay, little inferior to that of clover, the yield being two or three tons per acre.

Alfalfa has so far not succeeded in South Mississippi, though hairy vetch and burr clover grow satisfactorily at the McNeil Experiment Station.

Recommendations.—The pine belt lands have never been held in large plantations, and in the new order of development beginning in that section of the State, it is believed that the farms will be small, worked by the owners, and maintained in better state of cultivation than has existed in the State generally. It is true that at the present time very much of the cut-over lands remains in the hands of syndicates who purchased it in large tracts for the timber upon it. Now that the timber is removed it is to be hoped that it will be sold off in small tracts to the real homesteader. This is being done rapidly in many sections, and the prices asked are generally moderate.

Under a system of small farms intelligently worked, this region may anticipate a bright futrue. Antiquated, careless methods of culture of the staples will not pay on these soils. The methods of using negro labor as employed in the Delta would fail here, as it will ultimately fail there. It would be poor economy to attempt to farm these lands without fertilization. The soils are especially well adapted to the intensive methods of truck farming. The Southern location and proximity to the tempering breezes of the Gulf, the warmth and lightness of the soil and the perfect drainage of most of the pine belt of Mississippi, fit these soils preeminently for truck and fruit growing for the northern markets. Intensive, scientific farming—gardening, if you please—will make this one of the richest sections of Mississippi or of any other state. We have thus far received but half glimpses of the possibilities along this line of this region. Subtropical fruits not now attempted or even thought of will eventually be grown here. Who in Mississippi has ever thought of making a dollar by growing flowers in this land of flowers? A northern establishment has a rose farm of more than a thousand acres in the Delta of Mississippi. Why did they select Mississippi? Because they found our soils would grow the most perfect roses. The Cape Jessamine is strictly a southern plant. It is much sought in the

North on account of its delicate wax-like flowers and leaves and its rich fragrance. Fancy prices are paid for it. Why should not Mississippi grow it for the northern market? Others, even of our wild flowers, intelligently bred up could be made remunerative, besides contributing to the development of the esthetic in ourselves. We have not looked out to discover what possibilities lie around us; our eyes have been fixed upon but one thing—cotton.

Of course it is not to be expected that every farmer will go into the truck business. A large number will, others will go into peanuts, others into sugar-cane or tobacco, and still others will grow pecans, oranges, figs and the many things for which the soil and climate are adapted. But it should be the practice of every farmer to have sufficient diversity of crops to supply his own wants and have at least two money crops. In the climate of South Mississippi it is possible to have a succession of crops on the same land throughout the year, and since the lands must be fertilized for any crop grown, it would be economy to succeed one crop with another all the year and so get the fullest benefit of the fertilizer applied.

Here, as on all other soils, thorough tillage is equal to one fertilization, whatever the crop to be grown. Rotation of crops is indispensable for best results.

Stock raising should go along with other lines of farming. Besides the direct saving of money by having milk, butter, eggs, meat, lard, as a part of the farm yield, at very little cost, it is very easy to raise enough to have a few head of cattle or sheep or hogs or poultry for the market. The trouble and cost would be trifling. And, then, the land needs the barnyard manure. These lands must have humus and nitrates and phosphates, which the barnyard manure furnishes at no cost.

Owing to the sandiness of these soils, especially the lighter Norfolk soils, they are apt to suffer during a drouth unless well supplied with humus, which conserves moisture. If barnyard manure cannot be had in sufficient quantity, some leguminous crop, as cow-peas, should be plowed into the soil from time to time. The soil must be kept supplied with humus.

Fig. 16. Natural Meadow and Stock Barns, Pearl River Valley.

Of recent years large quantities of commercial fertilizers have been used by the farmers and truck growers of the pine belt of Mississippi. The soil is found to be deficient in certain essential elements of plant food, and these must be supplied in the chemical fertilizers put upon the market. The subject of fertilization is one too large to take up here, and those who are interested in fertilizers, as applied to particular crops, are referred to the bulletins of the McNeil Experiment Station, where full and reliable information may be had. Farmers of South Mississippi, or those who

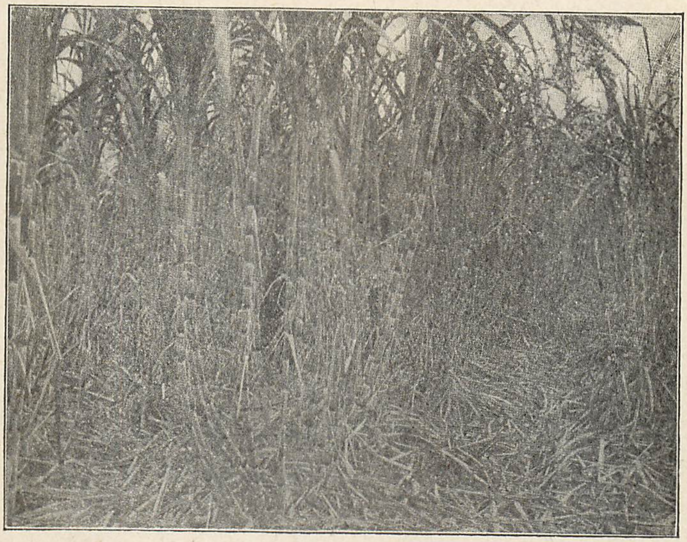


Fig. 17. Louisiana Sugar-Cane.

contemplate investing in farms in that section of the State, should visit that station and study the results of experimentation there. Mr. Ferris, the director, will be found to be not only a skilled farmer, but a courteous gentleman, ready to give any information to the interested inquirer. His experiments cover a wide range of crops, and his results are most valuable to farmers of South Mississippi and to the State at large.

His experiments seem to indicate that this soil is deficient in humus and the nitrogen with which it is usually associated and in phosphates. All crops increase their yield on application of nitrates or cottonseed meal and phosphates, though potash seems not to add to the yield.

Many have supposed that the sandiness of these soils allows the fertilizers to be readily leached out and lost. According to Mr. Ferris, of the McNeil Experiment Station, thirty head of cattle were fed upon cottonseed meal and hulls for one hundred days on five acres of ground. After three years of cropping, the effects of the fertilization by the cattle was practically as evident as the first year, the yield

Fig. 18. Gathering Pecans in Mississippi

being three times what it had been before the cattle were pastured.

Water Supply.—All over the area springs and shallow wells may be had that supply good water. In the lowlands near the coast such water is liable to be brackish and unwholesome. All over the area artesian water of excellent quality can be had at depths varying from less than 300 to 600 or 700 feet. In the low flats along the coast and in the larger river valleys, flowing wells are obtained.

YAZOO-MISSISSIPPI DELTA.

Area and Topography.—This topographic region, called as above, often also the Mississippi or Yazoo Delta, but perhaps more properly called the Mississippi-Yazoo Flood Plain, is a large elliptical area in the western part of the northern half of the State. Its northern point is just below Memphis, the southern at Vicksburg, a distance approximately of 200 miles, and its greatest width about 60 miles. The whole area is a nearly level surface, bounded on the west by the Mississippi River and on the east by the rim of Bluff Hills, which stand abruptly above it one or two hundred feet. The surface of this region slopes gently towards the gulf, the altitude at Memphis being 217 feet, that at Vicksburg 94 feet above sea level. The area is about 8,600 square miles in extent.

While the general topography is that of a level plain, there are slight differences in elevation which have a definite relation to the drainage. The whole area is alluvium, deposited by the Mississippi and its tributaries flowing through the area. Until a few years ago these streams in flood season overflowed their channels and spread over the broad flats. Sediments brought from the higher lands by the streams were deposited, gradually building up the alluvial plain; but the coarsest and heaviest deposits were made along the borders of the streams, while the finer materials were carried out and deposited farther away from the water courses. As a result, the land built up more rapidly near the streams and slowly in the interstream areas, so that the front lands are a few feet higher than the areas farther back and gradually slope away from the rivers. The scils formed of the materials deposited are coarser and sandier near the streams, and finer loams and clays farther back on the lower lands.

The area is drained by a net work of tortuous, sluggishly flowing streams, the principal of which are the Yazoo, Big and Little Sunflower, Tallahatchie, Coldwater and Deer Creek. Besides these, numerous bayous, sloughs and lakes, many of which are old stream channels silted up, wind about and intersect in such a way as to convert large areas into islands. An example is seen in Tchula Lake, an old channel of Yazoo River, which, together with the present river, encloses Honey Island, an area half as large as an ordinary county. With all the mileage of natural drainage channels, the Delta is poorly drained, and the great problem confronting that richest section of the State now is one of drainage. A large proportion of this area, including the richest soil on the continent, is rendered useless by the lack of drainage. The Delta, however, has one compensation in its numerous rivers—more than a thousand miles of navigable waters, besides its excellent system of railroads—transportation facilities unequaled elsewhere in the State.

Character and Distribution of Soils.—Along the eastern border of the Delta is a narrow fringe of soil scarcely a mile wide anywhere, lying slightly above the general level of the Delta next to the base of the Bluffs, and sloping gently down to that level. It is gray and silty in character and is derived chiefly, if not entirely, from washings from the Loess Hills. With this single exception the soils of the Delta are alluvial deposits of the Mississippi and its tributaries. The silty soil just mentioned, technically known as Lintonia Silt loam, is, on account of its slope, well drained, and because of its slightly greater elevation than the Delta lands escapes overflow. It is a light, easily worked and productive soil, well adapted to the staples, cotton and corn, as well as to oats, grasses, vegetables and fruits, and is very generally under cultivation. There is little difference between soil and subsoil, the soil being very deep, producing as much as 1½ bales of cotton per acre.

The discussion of the topography of this region gives some intimation of the character of the soils. Popularly, they are spoken of as of two kinds—the light loam soils near the streams, and the heavy clay or "buckshot" soils of the lower lands between the water courses. The first drains well, the latter very poorly. All the older settlements in the Delta were upon the higher land along the streams, both because of convenience of transportation and immunity from overflow, as well as because this soil was more satisfactory to cultivate and more certain of crop.

Technically, four types of soils are recognized as of importance in the Delta.

The front lands along the streams are the highest, in times of overflow seldom being covered, giving them an ad-

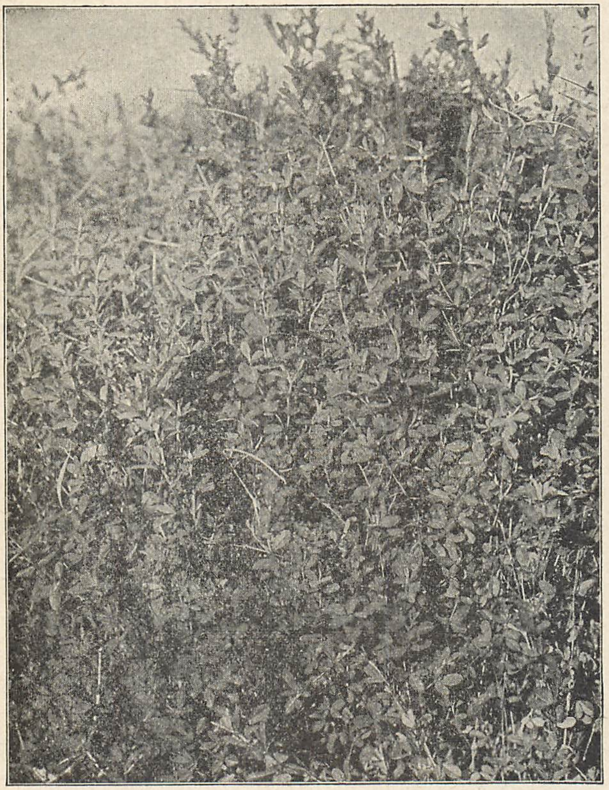


Fig. 19. Lespedeza—Estimated Yield, Three Tons Per Acre.

vantage over the lower lands. The soil, technically known as Yazoo fine sandy loam, is a rather fine sandy loam of variable color, though the prevailing color is dark brown. The soil proper is six to eight inches deep and rests upon a brown loamy subsoil, usually heavier than the soil. Both the soil and the subsoil are coarser and sandier next to the

Mississippi than along smaller streams farther back. Along Deer Creek the soil is fine in texture and the subsoil heavy, sometimes quite clayey.

This soil occurs as a low ridge or series of parallel ridges along the streams which slope very gently down to the flat back lands. The elevation is seldom greater than a few feet above the back lands. Owing to slightly greater elevation and natural slopes this type of soil has usually good surface drainage, and the loose, open texture allows underdrainage.

The Yazoo, sandy loam is naturally rich in humus derived both from vegetation growing upon it and from vegetable matter deposited with the soil from the flood waters. That it is rich in plant food is shown by the fact that much of this type has been in cultivation more than half a century without any sort of renovation or rest, and yet produces, on the whole, good crops. Yet much of it is now beginning to show exhaustion, and rotation and fertilization must be practiced to restore its strength.

The sandy loam, just described, passes gradually into the next type, the Yazoo loam, which has less sand, and is, as the name indicates, a loam soil. The soil is yellowish brown to dark brown, six to eight inches deep, upon a dark gray silty clay subsoil. When dry it is loose and powdery, and works easily when moist. Its surface is very gently sloping away from the streams and is generally sufficiently well drained to produce good crops. It lies in bands a mile or two wide bordering the Yazoo fine sandy loam on the lower side, hence in elevation it is lower than the sandy soils.

This, together with the first type, was early occupied and has been in steady cultivation of cotton and corn. The soil is a stronger, and, on the whole, a better soil than the first, richer in humus and all the other elements of plant food. It is easily worked, and under existing methods produces a bale of cotton or 40 to 50 bushels of corn to the acre. With a good system of rotation and more intensive and careful cultivation, this soil would easily double its yield of both staples.

These two soil types being the earliest settled are mostly under cultivation, though considerable areas of the Yazoo loam type which lie low and nearly flat are still clothed with hardwood timber.

The next two types to be taken up are far more extended in their distribution than the two already discussed. They lie lower, and constitute the flat basin-like back lands which occupy the broad inter-stream areas. As has already been said, the fine clay and silt settlings in these flat basins during and after overflows built them up very slowly. The resulting soils are heavy tenaceous clays, lying so low as to receive the drainage of the surrounding higher lands and much of their surface remain permanently boggy and swampy, so as to be useless for agriculture under present conditions.

The Yazoo Clay is a bluish gray clay soil, five or six inches deep, resting upon a subsoil of plastic mottled yellow or gray clay. This is the typical "buckshot" soil of the Delta, so called because of the manner in which on drying, the surface crumbles down into angular particles about the size of a buckshot, and having the bluish gray color of lead. To the Delta farmer there are two types of "buckshot" land—blue buckshot and black buckshot, the difference being in the amount of contained organic matter, the black being richer and more amenable to cultivation. Blue buckshot, unless plowed when the moisture is just right, clods and bakes and is difficult to reduce to a condition suitable for crops.

Both these soils, but the blue buckshot in more marked degree, become so water-logged during the winter that they are not in workable condition until late in the spring—too late, not infrequently, for the cotton to mature a full crop before the frost catches it. The soil is cold and needs drainage. It is quite possible to see on the sandy loams a crop of cotton already reaching nearly to a man's shoulders, while within two or three miles on the buckshot lands, the cotton will have scarcely attained a foot in height.

The difference lies not in the native productiveness of the two soils, but in the matter of drainage. The buckshot soil is really much the stronger soil of the two and will stand longer cropping without exhaustion, but without drainage, farming upon it is by no means certain. In dry years it does remarkably well, producing one and a half to two bales of cotton to the acre, but in wet years the crop may be almost a failure.

The great extent of this soil in the Delta and its undoubted richness in all the elements of plant food, making it one of the most fertile on the continent, with possibilities unlimited, will undoubtedly stimulate the State to take up, seriously, the great problems of drainage in this region.

The area covered by this soil type is not as extensively opened to cultivation as the two already discussed. Much cannot be brought to cultivation successfully until drained. Extensive hardwood forests still occupy the land and furnish one of the most valuable forest assets of the State.

The last type of soil to be mentioned is the Sharkey Clay, which resembles the last closely—in fact, the two, to ordinary observation, would be considered one type. It is a stiff brown clay soil, three to six inches deep, underlaid to a depth of three to five feet by a waxy, impervious mottled or drab colored clay subsoil. It lies lower than the last, occupying the lowest areas between the streams, and is, for the most part, permanently swampy. Most of the type is still in forests of magnificent hardwood trees, and much of it covered by lakes and sloughs.

This soil, like the one above, shows the buckshot character on drying, and, like it, is locally called "buckshot," or, sometimes, on account of its stickiness, is called "gumbo." The extent of this soil throughout the Delta is great, this and the last being much more extensive than the two first. It is a soil that properly drained would be of very great fertility and would add incalculably to the resources of that rich region. Fully two-thirds of the Delta is buckshot land, a relatively small proportion of which is, at the present time, under cultivation, yielding uncertain returns. With a thorough system of drainage most of these lands would be brought into cultivation and would become highly productive. Their native fertility is very great, and, beyond question, under cultivation they will prove the most durable soils in the Delta.

Native Vegetation.—The Delta is preeminently a region of hardwood growth, the whole area having been originally covered with heavy forests of white oak, over-cup oak, red oak, water oak and willow oak, black, red and tupelo gum; cotton wood, willow and cypress along the sloughs and old river channels, box elder, ash, sycamore, mulberry, honey locust, linden (*Tilia pubescens*), hackberry (*Celtis Mississippinsis*) and swamp hickory (*Carya aquatica*).

Much of these forests have little undergrowth except blue cane, which grows in impenetrable "breaks" about the sloughs and bayous. Dwarf palmetto grows abundantly on the low areas bordering the true swamps. Creepers, as poison oak, trumpet creeper, Virginia creeper and wild grapes frequently coil and cling to the trees of the forests, especially along the borders of openings.

A few very common herbaceous forms of the lowlands are knotweed (*Polygonum Virginianum*), lizzard's tail (*Saururus cernuus*), swamp day-flower (*Commelyna hirtella*), button-weed (*Spermacoce glabra*) and swamp milkweed (*Asclepias paupercula*).

Culture.—Nowhere in Mississippi have ante-bellum conditions of land-holding been so nearly preserved as in the Delta. The land is held in large plantations, several hundred to several thousand acres in extent, which are devoted almost entirely to cotton growing, and are worked entirely with negro labor. The landowner, especially of the larger estates, frequently does not live upon the plantation (in this respect differing from the ante-bellum landowner), but in some neighboring town or city, the immediate affairs of the plantation being left in the hands of a manager. The work of the negro tenants is under the supervision of the managers. Each place has its commissary store from which the negroes are supplied, a deed of trust being given upon their crops for the year's supplies advanced.

The usual spectacle presented on these plantations is that of two or three white families surrounded by two or three hundred negroes, though the automobile has, in a large measure, relieved the social isolation of the Delta planter. The negro is naturally gregarious in instinct, and is never so happy as when massed together in large numbers, as on the Delta plantations. The management is necessarily firm, but, strange to say, there seems to be really less difficulty in controlling the labor satisfactorily in large numbers than in smaller numbers, as on the hill farms.

Since the first settlement of the Delta the sole crop has been cotton, the corn grown being always less than that consumed on the plantations. Occasional sporadic efforts have been made in other directions, but only by way of limited experimentation. For a number of years long staple cotton has been largely grown, the soil being especially adapted to it. This has added greatly to the wealth of the Delta, since the price is much higher than that of the short staple varieties.

The Experiment Station at Stoneville has proved the Delta soils to be adapted to a large variety of crops. That these soils are remarkably adapted to cotton growing need not be stated. It is beyond comparison the greatest cotton producing region of the globe, and quite probably will always be so, since the soil, climatic and labor conditions are such as do not exist elsewhere. The soils, however, are capable of producing heavier crops under improved cultural conditions. Smaller acreage to the man, more thorough and more scientific preparation of the land and cultivation of the crops, a system of rotation to bring up the exhausted soil, and raising sufficient foodstuffs and feed to supply the place, would greatly improve conditions in the Delta.

The system of culture so far produced is very exhausting, all being taken off and nothing put back upon the soil. The constant growing of the same crop is beginning to tell upon the lighter soils and the time is not far distant when the process must be changed. We are not yet in position to know the extent to which the boll weevil will affect the cotton planting in the Delta, but it would certainly be the part of prudence for the planters to begin to make provision for the contingency by growing at home everything that can be grown for consumption upon the place. Every year a large proportion of the proceeds of the plantation goes to buy from the northern markets supplies for the tenants, feed for the animals and even the mules and every piece of machinery used on the place, nearly all of which can be produced on the place with little expense. Why buy up-country corn and oats when the soil of the Delta plantation will

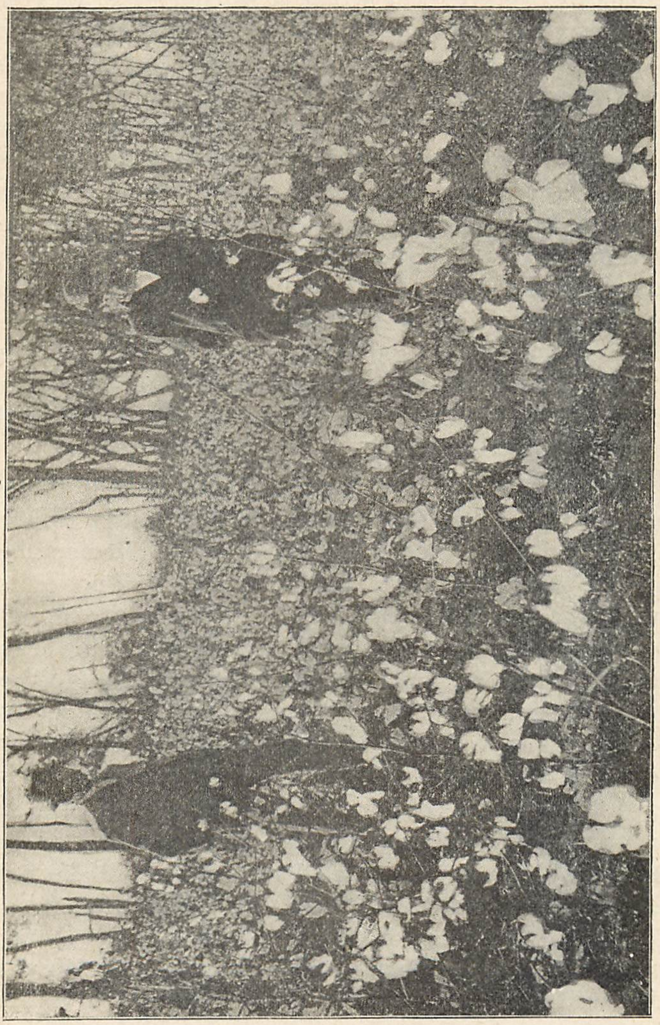


Fig. 20. Cotton Field of G. H. Turner, Burgess, Miss. Bottom Soil Fertilized with Potash and Phosphoric Acid. Yield 4,200 Seed Cotton Per Acre.

yield both in great abundance with little expense? Why buy meat from the packing houses, when, as Prof. Fox, of the Delta Station, has demonstrated, hogs can be raised at small expense in the Delta? Why buy Missouri mules at $200 a head when just as good can be raised at $20 apiece?

Even if the boll weevil does not commit in the Delta such ravages as he has committed in the hill counties—and what reason has anyone to believe that he will not—is it not good farm policy to raise these things at little cost rather than to have to buy them at much greater cost? In plain words, facing the inevitable invasion of the boll weevil and the uncertainty as to the magnitude of the consequences of that visitation, is it not wise to retrench some along this line and launch a crusade for home-raised mules, horses, hogs and cattle and home-grown corn, oats, hay, wheat and vegetables and fruit? Let the first step towards security be in making a living at home, then if the weevil hurt the cotton crop, the planter can do with less money than before because his plantation is supplied at home. Then, if the weevil prove a harmless windmill instead of a ferocious giant (as some Delta planters seem to believe), the planter is all the better off by the change.

Alfalfa has been proved to grow wonderful crops on the Delta lands, the soils best adapted to it being the heavier loam and buckshot types when well drained. Remarkable crops are being grown, the plant doing almost, if not quite, as well as in the eastern prairie belt. The sandy loam soils grow it, but seem not quite so well adapted to it as the heavier soils. The black buckshot is better than the blue because of the greater supply of humus and the usually better drainage. The soil must be thoroughly drained, for the roots of alfalfa will not grow in a soil permanently waterlogged. Aside from the hurtful effects of bad drainage, the worst evils to be dreaded are the crab grass and winter weeds. Crab grass once started in a field of alfalfa will gradually choke and crowd it out. Prof. Fox recommends before planting a piece of land in alfalfa that the ground should be plowed thoroughly and harrowed and cultivated and stirred at intervals for two or three months to kill all weeds and grass and get the soil in good condition. With attention to details of selection of soil, preparation and culture, alfalfa is uniformly successful in the Delta. Five cuttings a year of one to one and a half tons each, is the usual yield, and the market price is $15 to $20 in the neighboring towns.

The growth of alfalfa in the Delta should be encouraged. It furnishes a certain money crop, and its growth will stimulate the raising of more stock and better grades of stock.

Lespedeza, hairy vetch, red clover, cow-peas and other legumes produce heavy crops of hay, and should be grown extensively. Oats, wheat and sorghum may be successfully grown as forage, or the two first planted in the fall may be allowed to ripen. They can be harvested in time to grow a second crop on the same land.

Fig. 21. First Cutting Alfalfa, Grown in the Yazoo Mississippi Valley. Was Cut Five Times During the Year. Yield, 7,660 Pounds.

Corn, of course, is one of the staples in the Delta as elsewhere in the State. It should be grown more extensively. The Delta soils are perhaps as well adapted to corn as to cotton, and with good cultural methods on the better grades of soil the yield is very heavy; but even on the older lands the yield at present surpasses that of most of the hill land.

Perhaps no section of the State is better adapted to stock raising than the Delta. The soils are naturally adapted to the growing of forage and grasses, and in the low wooded areas cane makes a good winter pasture. One grass that is spreading over much of the lower Delta now is the coco grass (*Cyperus rotundus*), which is becoming quite a nuisance in places, being of very rapid growth and extremely difficult to eradicate. It has no value for forage, though hogs eat the underground tubers.

The lighter soils of the Delta are well adapted to the growing of vegetables of almost every variety. The growing of vegetables for the markets has not been attempted, but on the lighter soils could be done successfully. In certain kinds, as the Irish potato, it is probable that this section of the State could surpass all others, but in the growing of a variety of market vegetables it could hardly compete with the thinner but warmer soils of South Mississippi.

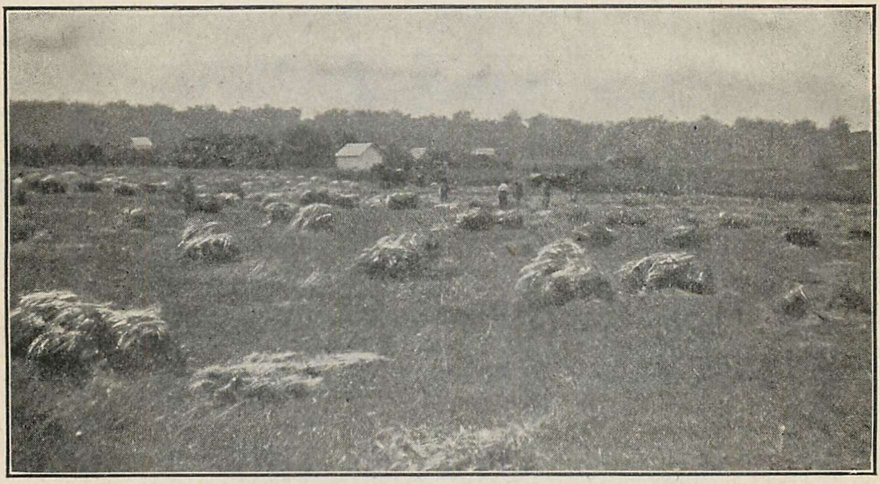


Fig. 22. View of a Barley Field Showing Barley Grown on Clover Hill Plantation, Miss.

The Delta could produce vegetable crops at less expense, but could not compete with the southern counties in reaching the early markets—and in that lies the largest returns in market gardening. The more southern position, the well-drained condition of the soil and the lightness and warmth of the soil put South Mississippi in the lead of any other section of the State for early market gardening.

Potatoes, cabbage, turnips and carrots do especially well in the Delta soils, making much larger yields without fertilizing than the thinner soils. Onions, which in Southern Texas have made fortunes for the growers, will probably do as well here.

Fruits have done well where tried. Strawberries, raspberries, peaches and perhaps apples, can be grown successfully. The small fruits should be tried more extensively. Elberta peaches have been tried on a limited scale and found remunerative as a market crop. Melons produce abundantly and of the finest quality.

Pecans are being grown successfully—indeed in the Delta forests the pecan finds its natural habitat. It has always grown there in the wild state. It is not improbable that the nut crop of the Delta will in the future be an important source of revenue.

Rice is undoubtedly destined to be one of the important crops of the Delta. The soils are well adapted to its growth and lie so nearly level as to make the flooding of the land at the proper season very easy. The numerous streams and lakes, as well as the ready accessibility of flowing artesian wells in most of the Delta region, furnish unparalleled facilities for irrigation.

An experiment made under Government supervision on a twenty-five acre tract belonging to Hon. Chas. Scott, in Washington County, resulted in a yield of ninety-two bushels to the acre. The land was flooded by pumping from an adjoining lake. The water of these lakes is so frequently silty that its application to land is, to some extent, a fertilization, and this fact might in a measure account for the unusually large yield in the experiment referred to. Others, however, have experimented successfully with rice in the Delta, and a progressively increasing acreage may be expected.

While all the varied possibilities of these alluvial soils should receive development, and diversified farming should be practiced more than in the past, it is almost certain that the over-shadowing crop of the Delta will always be cotton —not to the same extent as heretofore, but to the extent of being the great staple of that region. No other region of the globe has the same facilities for cotton growing, and its soils are preëminently adapted to the cotton plant. Under these conditions and with cotton bringing its present high prices, nothing less than a destructive visitation will turn the planter from the growing of cotton; but the future will bring about a revolution in the method of growing it.

Water Supply.—In the past, shallow wells furnished the water of the Delta, but it was unwholesome and dangerous. Such wells drew their water from sand beds of the alluvial deposits and contained much organic matter. Now, flowing artesian wells are found throughout the Delta, furnishing abundance of wholesome freestone water. Water is reached in the eastern part of the Delta at a depth of 500 to 800 feet, in the western counties at 1,000 to 1,200 feet.

APPENDIX.—A.

SOIL EROSION.

It may not be inappropriate in this place to present a few facts about soil erosion, which, unfortunately, has disfigured much of the surface of our State. Trenched and scarred surfaces are so prominently developed in some sections of the State as to attract the unfavorable attention of every stranger passing through, and many years ago were graphically described by Dr. W. J. McGee, of the U. S. Geological Survey as the "bad lands" of Mississippi—a term we are in the habit of applying to regions of the Dakotas or Wyoming. Nevertheless, the term is descriptive of our conditions.

It is a fact well known that the surface soils of all lands, whether the slopes be gentle or steep, are slowly but surely under the action of ordinary agencies of the weather, moving down toward, and eventually into, the sea. This is unavoidable and absolutely beyond our control, though by various devices we may retard or check it for a while.

The process is normally very slow, permitting of the regeneration of the soil in any given locality as rapidly as it is removed. Under certain conditions, however, the removal of soil may be more rapid than its renewal, producing a condition of sterility which we ordinarily describe by saying the soil is washed away. This is literally true, the soil of agricultural value is gone, and there remains a bare surface, devoid of humus and other fertilizing elements necessary to farm crops.

This loss of the soil is only the first step in a seriously dangerous process. Many of these lands, no longer productive, have been thrown out in the past and left to the merciless action of the elements, as no longer useful. While cultivated and frequently stirred the land will rarely be allowed to seriously wash. If the surface has slopes—and a large proportion of our lands have decided slopes—in cultivation it is either terraced or circled to prevent washing, and any wash that begins is filled with brush, or otherwise arrested. Not so, however, when it is once thrown out.

The heavy rains that fall frequently in our climate soon furrow the slopes; if the slopes are steep the furrows quickly become gullies, and within a few years, if unchecked, may become tremendous washes fifteen to twenty-five feet deep, and large enough to engulf a moderate sized house. If the soil be sandy, or if loam underlaid by a sandy stratum a few feet beneath the surface, the destruction is all the more rapid. Beginning as they generally do on the lower slopes, these washes eat back farther and farther into the abandoned lands until the whole surface may become cut to pieces.

A field of once swelling, graceful slopes may, under this process, present an intricate maze of gullies and washes, until the original surface remains only as narrow crests between yawning chasms, or as clustered peaks and buttes which are but the finger marks of even greater destruction. And all this results because man has withdrawn his intelligent use of the soil.

It may be asked, What are the conditions favoring this state of things? How do they operate? They are briefly stated below:

1. *Slopes.* Since all soils are moving toward the sea, which is their final resting place, it is evident that the steeper the slope, other things being equal, the more rapid the removal will be. Hence, hilly lands which have steep slopes will wash most rapidly. The erosive power of running water varies with the square of the velocity of flow, and since slope is the chief factor affecting velocity, it will be readily understood why it is that washing begins on the steeper slopes of abondoned fields.

2. *Deforestation.*—Removal of forests lays bare the soil to the direct action of the elements. The thick canopy of a forest, as well as the carpet of leaves and twigs beneath it, protect the forested surface from the erosive violence of heavy rains. Remove the forest and stir the soil and erosion is favored. This does not necessarily lead to evil results, however. The forests must be cleared and the lands

must be cultivated for man's sustenance and as long as he gives intelligent care to the soil excessive washing need not result. It is only when he relinquishes it after clearing and cultivating it that it goes to destruction.

Manifestly then, care should be used in chosing land to clear, leaving in woodland very hilly, sandy lands, and especially if located near the headwaters of important streams, for forests are feeders of springs and springs are the only permanent feeders of our streams.

3. *Loose Shallow Soils.*—As intimated in the above paragraph, loose sandy soils and clayey loams underlaid by sands, permitting undercutting and slumping, favor washing of the land. This is patent to any intelligent observer. On the other hand dense homogeneous structures well compacted yield less readily to erosion.

4. *Heavy Rainfall.*—Heavy rainfall, particularly where it falls at times with torrential violence, rushing down the slopes with destructive force, furnishes the agency of rapid erosion.

These are some of the most important factors influencing the rapid washing of the land. Let us apply them to conditions in Mississippi. Where is soil washing most active and where least so in the State?

Where most Active.—In the light of the brief study of the geological formations of the State, given elsewhere, we would be led to infer from the character and arrangement that, on the whole, erosion would be most active on Pontotoc Ridge and in the broad central Lignitic Plateau of North Mississippi corresponding to the outcrop of the Wilcox Formation. It is most active here because these regions are of considerable elevation and of decided slopes—hilly—the soil is sandy or a mellow loam underlaid by sand which becomes exposed on the slopes and permits undercutting; the rainfall is heavy, as elsewhere in the State; the timber has been very largely removed, and a considerable proportion of the surface lies out in old fields. The mature erosion of these regions antedates present conditions, the original slopes having been heavily timbered when the country was settled, and where the timber still remains, washing of the land has not taken place. Erosion is hardly ever seen in the wooded parts, and then only by invasion from bordering fields, or after thinning of the forest has destroyed the natural balance in conditions under which the original slopes were developed. Confirmation of these statements can be found anywhere in those regions.

The southern section of the State has such a large proportion of sand in the soil and surface formations that erosion progresses rapidly if unchecked, and over the surface of much of the older cleared areas, washing of the lands is more or less prominently developed. The newer sections have been so recently cleared of the pine forests that erosion has progressed but little.

The Loess or Bluff Hills present some of the most striking erosion features to be seen in the State. Great "gulfs" or chasms with vertical walls dissect the uplands in places, though the general surface shows less evidence of rapid erosion than the plateau region of North Mississippi. This may be accounted for in two ways: (1) The Loess is highly calcareous, and for this reason possesses greater coherence than we would expect in a similar material without a lime cement. (2) The whole Bluff region is thickly carpeted with Bermuda grass, whose roots and underground stems protect the surface against rapid erosion.

The prairie regions of the State present little evidence of washing where the black prairie soil occurs, but where the lighter and sandier soils prevail erosion has been notable.

In the Delta we find least evidence of surface erosion because of the absence of appreciable slopes, which are necessary to develop erosive violence in the run off of surface water. An entirely different principle is involved in the undercutting of streams, which is not considered here.

Resulting Damages.—What are the damages resulting from surface erosion? They are numerous, a few of which will be noticed here.

1. Loss of fertility of soil, as before stated. The working of the land becomes unprofitable and its abandonment follows. This should not happen. There is here an evident

lack of adaptibility on the part of our farmers. They seem to have failed to realize that land unfit for certain uses may be very profitable for other uses.

2. Following abandonment comes the cutting up of the surface into gullies and washes that eventually mar very greatly its agricultural value. Especially may this happen in a region of sandy soils and decided slopes.

3. In many cases the washing from the hills may destroy the fertility of the smaller bottoms by spreading over them sand in layers, the thickness of which tends to increase from year to year.

4. Loss of underground water results. This result is not so remote as might at first appear. Many springs that existed dissappear; bold, strong springs become weak; wells become less certain; the level of ground water sinks—all because the feeder of the springs, the forest, has been removed and only bare, steep slopes remain, which absorb little water, but shed it rapidly into the streams, These are flooded with devastating effects, and then in a short time go dry because the springs that fed them are dry. Such has been the history of other regions similarly placed, and may be the history of Mississippi unless steps are taken to avert it.

5. After every heavy rain myriads of gullies pour their torrents of mud and sand into the smaller streams; these pour their loads into the larger streams, and so thousands of tons of the wreckage of our fields eventually find their way into our great waterways—the navigable streams of the State, and they cease to be navigable—choked out of existence by the wasted wealth of our lands.

When it is considered that before many decades, if events develop in the direction toward which they now point, her great waterways ought to be a rich asset of the State, avenues by which her products may reach the seaboard and thence be transported to every quarter of the globe, how can her citizens with patience see these God-given thoroughfares blotted out of existence when, with proper and timely attention, both these and the wealth of her lands may be conserved to present and future generations.

Remedies.—Is there any remedy for this evil? Up till the present time a large proportion of our people have seemed to regard this as unavoidable and consequent upon the wearing out of our hill soils, but the trouble can be remedied by proper effort. It could more easily have been avoided in the first place.

It is not the purpose here to arraign those who have occupied the wasting lands in the past. The trouble grew out of natural conditions for which they were not altogether responsible. Up till the Civil War conditions in Mississippi partook somewhat of those of a frontier state. Our methods of agriculture were crude and wasteful, but sufficient to extort from a virgin soil abundant sustenance for those occupying the land; the population was far too sparse to use all, or even the larger part, of the land. With land so abundant it was but natural that if a field grew poor and unremunérative it was thrown out and more land cleared and put in cultivation, resulting in a double waste—a waste of land and a waste of forests. Frontier people are proverbially wasteful and in those days Mississippi was a frontier state.

What are we to say of conditions following the war? For many years worse, far worse, than before. Our homes and lands had suffered the waste of four years of destructive war; our population had been decimated, the negroes were freed, and anxious to assert their freedom, moved away from the plantations; a large proportion became profligate and idle loafers seeking the patronage and support of the Federal bureaus.

Reconstruction days, worse if anything than the War itself, saw very little, if any, betterment of industrial conditions.

When finally things settled down and it became possible to begin the rebuilding process Mississippi had a smaller white population than before the war, no money with which to operate, and an unsatisfactory tenantry, idle and non-progressive. Necessarily much of the poorer lands had to be abandoned.

By far the greater part of the washed lands of the State have had this history. But conditions have now changed. Our population is doubled, the wealth of the State is vastly increased, and while our tenantry is not yet satisfactory, there are no longer the same forcible reasons, as once existed, why our waste lands should be neglected. Can they be remedied? Nature has furnished us several remedies which with a little exercise of man's intelligence and energy may become operative.

1. *Old Field Pine.*—The name of this pine suggests the tendency so well known which the tree has to take possession of worn out fields. It usually grows very thickly over the whole surface, the seeds being very abundant and light, making them easily transported by the wind. When this pine once gets thickly set upon an old field the surface is protected from washing, both by the canopy of the young forest and by the thick mat of needles on the forest floor, which also stop washes already begun. This may be observed in any of the old fields of the State occupied by this pine.

This is a valuable tree for future use for timber because of its quick growth and rapid re-production. When it does not occur in old fields it should be planted unless the area is to be used for pasture, when a different course may be pursued. For reforesting purposes it is one of the best, and much of our hilly lands should be reforested and kept in forest. In the long run the lands will prove most remunerative used in this way.

Considerable areas of the worst of the worn out hill lands have from time to time in the past reverted to the State for non-payment of taxes. Since the law gives the Governor authority to withdraw from sale any lands belonging to the State, it might be a good present policy for the more hilly and sandy of these lands, particularly where favorably located to conserve the water of our streams, to be withdrawn from sale for an indefinite time, reset with a good growth of old field pines or other useful trees, and made the nucleus of a state forest reserve.

Should the increase of population in Mississippi at some future time demand these reforested lands for agriculture, and it should be deemed a wise policy to do so, they can again be cleared and farmed with profit in small tracts, on the intensive plan, though now no longer profitable as farm lands under present methods of culture.

2. *Black Locust.*—This is an invaluable tree to plant in thin soil and washed areas. It thrives is such places, sending out long fibrous roots, which, as the groves are usually thick, interlace so as to prevent or arrest washing of the land. It has been planted quite extensively in places for this purpose. But the tree is of moderately fast growth and soon attains a size suitable for fence posts; its wood is very durable and makes the best of posts or telephone poles. An acre of old washed land can support such a number as to make it a really valuable crop on lands that otherwise would be useless.

3. *Lespedeza or Japanese Clover.*—This plant is not native to the State but is thoroughly naturalized and exhibits a marked tendency to take possession of old red hills and waste lands generally. It forms a thick mat, and if encouraged the least bit will carpet level land, hills and washes alike. It reaches down the gully slopes from above, takes possession of the bottom and creeps up to meet the carpet on the upper slopes until the whole surface is captured. The wash is stopped and gradually fills.

This plant is a very valuable forage, both when cut for hay and when pastured. Besides, being a legume, its nitrogen-gathering tubercles enrich the soil. If not already growing there it should be sown in all old fields turned out to pasture. The seed can easily be obtained and once set it reseeds itself.

The expression "fields turned out to pasture" should be corrected. Under no condition should lands be "turned out." If fields prove no longer profitable used in farm crops it may be converted into pasture or used to grow a forest crop, giving it due attention and care. While a pasture or a forest may require less attention and labor than a farm crop, to be remunerative they must receive proper care. Under no circumstances must washing be allowed to begin, to prevent which the land must be kept well covered with its proper growth. Forage plants should not be allowed to get thin in the pasture, nor trees in the young forest.

4. *Bermuda Grass.*—As a forage and as a hay this grass is almost equal to the lespedeza, and its power of capturing and stopping washes is even greater. It must be a very rapidly washing gully that Bermuda will not stop with its long, knotty, lace-like rootstocks. These grow very rapidly, reach out in every direction and root at every joint, and if for a few days the soil stops shifting the grass begins to lock it in its myrid fingers. Its power to stop washing is remarkable and best seen in the Bluff Hills between Vicksburg and Natchez.

The farmer of Mississippi has heretofore dreaded Bermuda grass, but it is one of his best friends; it feeds his stock and poultry, holds the soil of his hills and enriches it with its decaying rootlets. The temporary inconvenience to the farmer in his field crops is more than repaid by its great usefulness. It should be more extensively propagated in the State, especially in those counties where washing is active. The seed may be sown, or, better still, small pieces of the sod may be dropped along in furrows and the area will soon be covered.

5. *WildHoneysuckle.*—In some of the northern counties of the State the wild honeysuckle (*Lonicera japonica*) proves itself to be a useful plant in this connection. It has a pronounced disposition to spread by the root, new shoots from year to year invading new territory. In many places the mat of vines resulting from this tendency to spread has completely choked great chasms that have now begun to fill up.

The plant seems to prefer such places and given a little encouragement can be used to check erosion where deep washes are already developed.

6. *Old Field Plum.*—The habit of this plant to grow in dense thickets, preferring old fields, where it often fills the shallower washes with its roots and twigs, proves it to be fitted by nature for the reclamation of waste places. If thickets border a wash many of the seeds are sure to find their way into it and become covered somewhere along its

course, where they spring up and a new thicket is started just where it is most needed.

These are not all, but a sufficient number of these natural remedies to the evil of land washing, so that there is no difficulty in seeing where the wasting lands can be, not only reclaimed, but made remunerative while undergoing reclamation.

Artificial Means.—In order to expedite the work of these natural agencies the farmer must often supplement their action with systematic effort of his own. Often a load of pine or cedar brush will be sufficient if taken in time. At the beginning the evil is easily remedied. After large washes have formed an effective method is to throw a series of dams a few feet high at intervals across the wash. To prevent washing away these should be reinforced with logs or plank placed on the lower side and braced behind. In a very short time the accumulations in front will fill the wash to a level with the tops of the dams. All the sand and silt that passes the first will be caught by one of those lower down.

When filled to the top of the first dam let the washings go over and fill the second space and then the third, and so on. Then raise the dams and allow the filling to go on. When the wash is filled to within a few feet of the top, plow and scrape down the edges until the sides are gentle slopes. In other words, when this stage is reached, where the wash was before has now been converted into a gentle depression with sloping sides that can be plowed across if necessary.

At this stage Bermuda grass or lespedeza may be set, or if in a field, cow-peas may be sown over the new surface, the peas being furnished with sufficient phosphoric acid to give them a good, healthy growth. The peas will prevent washing andat the same timeadds humus and nitrogen to the soil, so that after two or three years of such treatment the former threatening wash will have become a productive part of the field, yielding once more its harvest. When the surface is cut up with numerous washes, reforestation is the best procedure.

If there be doubt in the minds of any as to the possibility of the undertaking as outlined, they are invited to visit the

Experiment Station at Holly Springs and see what intelligent work can do along this line. Professor Ames began work four years ago on certainly one of the most unpromising areas in Mississippi, which under his intelligent and skilled management has been converted into a model farm, the unsightly washes that scarred its surface all removed, or in process of removal.

Mississippi has too much land for her population. The soil cannot be used to best advantage under such conditions. We must fill up the vacant places with intelligent white farmers—encourage immigration from the older states in every legitimate way. We have land to spare—they have people enough to spare to fill these lands. With proper inducements may we not expect to fill up our excess of lands with this thrifty, hardy class, as the newer states of the West have done. May the tide flowing across our northern border into Canada not be turned Southward?

This is the most rational and feasible way, and perhaps only in this way can the problem of soil waste be seriously attacked in a large way. As long as there is a disproportion between land and population, as has existed heretofore, there will be waste. The land is not our heritage alone but belongs equally to those who come after us. We fall far short of the promise of our civilization if we fail to develop that spirit of altruism that regards the man who lives after us as much our neighbor as the man who lives beside us. We cannot disregard the rights of either.

APPENDIX B.

ANALYSES OF SOILS.

Typical Brown Loam (Memphis Silt Loam).

Mechanical Analysis (U. S. Soil Bureau). (From Holmes Co.)

Mechanical analyses of Memphis silt loam.

Description.	*Fine gravel.* %	*Coarse sand.* %	*Medium sand.* %	*Fine sand.* %	*Very fine sand.* %	*Silt.* %	*Clay.* %
Soil	0.0	0.4	0.7	3.0	2.4	83.6	9.1
Subsoil	.0	.1	.2	.7	5.0	70.9	22.3

Chemical (Hilgard.) (From Marshall Co.)

	Soil.	*Subsoil.*
Insol. matter	83.347	83.993
Potash	0.549	0.700
Soda	0.082	0.049
Lime	0.245	0.139
Magnesia	0.479	0.579
Brown Oxide Mn	0.760	0.332
Peroxide Iron	4.798	3.862
Alumina	6.282	7.279
Phosphoric Acid	0.068	0.236
Sulphuric Acid	0.062	0.054
H_2O and Organ. Matter	4.195	2.716
	100.033	100.399

Richland Silt Loam (U. S. Soil B). (From Holmes Co.)

Mechanical analyses of Richland silt loam.

Description.	*Fine gravel.* %	*Coarse sand.* %	*Medium sand.* %	*Fine sand.* %	*Very fine sand.* %	*Silt.* %	*Clay.* %
Soil	0.0	0.3	0.2	1.2	4.0	86.3	7.8
Subsoil	.0	.1	.3	1.0	5.4	70.2	23.1

Black Prairie Soil (Houston Clay), Monroe County.

Mechanical Analysis (U. S. Soil Bureau).

Mechanical analyses of Houston clay.

Description.	*Fine gravel.* %	*Coarse sand.* %	*Medium sand.* %	*Fine sand.* %	*Very fine sand.* %	*Silt.* %	*Clay.* %
Soil	0.1	0.7	0.9	5.6	14.1	56.9	21.6
Subsoil	.0	1.2	.9	7.7	11.9	50.4	28.1

Subsoil (Hilgard). (No analysis of soil.)

Insol. Matter	71.539
Potash	0.542
Soda	0.230
Lime	1.075
Magnesia	0.771
Brown Oxide Mn	0.046
Peroxide Iron	5.419
Alumina	13.153
Phosphoric Acid	0.051
Sulphuric Acid	0.036
Organic Matter and H_2O	6.992
	99.945

Mulatto Soil (Orangeburg Clay) from Pontotoc Ridge, Pontotoc County.

Mechanical Analysis (U. S. Soil Bureau).

Mechanical analyses of Orangeburg clay.

Description.	*Fine gravel.* %	*Coarse sand.* %	*Medium sand.* %	*Fine sand.* %	*Very fine sand.* %	*Silt.* %	*Clay.* %
Soil	0.4	6.3	6.6	9.4	5.5	57.6	14.1
Subsoil	.3	5.2	5.8	7.7	3.4	48.9	28.2

Chemical analysis (Hilgard).

Insol. Matter	90.572
Potash	1.096
Soda	0.423
Lime	0.178
Peroxide of Iron	2.060
Alumina	3.555
(Rest not determined)	2.116
	100.000

Heavy Flatwoods Soil (Lufkin Clay), Pontotoc County.

Mechanical analysis (U. S. Soil Bureau).

Mechanical analyses of Lufkin clay.

Description.	*Fine gravel.* %	*Coarse sand.* %	*Medium sand.* %	*Fine sand.* %	*Very fine sand.* %	*Silt.* %	*Clay.* %
Soil	0.9	1.6	0.9	1.7	4.7	59.2	31.4
Subsoil	.2	.9	.7	1.3	3.6	50.8	42.0

Chemical analysis (Hilgard).

Insol. Matter	77.854
Potash	0.753
Soda	0.106
Lime	0.178
Magnesia	0.831
Brown Oxide Mn	0.167
Peroxide of Iron	5.899
Alumina	10.302
Phosphoric Acid	0.052
Sulphuric Acid	0.032
Organic Matter and H_2O	3.689
	99.841

Light Flatwoods Soil (Lufkin Silt Loam), Chickasaw County.

Mechanical analysis (U. S. Soil Bureau).

Mechanical analyses of Lufkin silt loam.

Description.	*Fine gravel.* %	*Coarse sand.* %	*Medium sand.* %	*Fine sand.* %	*Very fine sand.* %	*Silt.* %	*Clay.* %
Soil	0.2	0.6	0.5	2.6	15.0	68.9	11.5
Subsoil	.3	.7	.4	6.7	16.3	59.2	17.3

Chemical analysis (Hilgard).

Insol. Matter	93.575
Potash	0.254
Soda	0.066
Lime	0.082
Magnesia	0.175
Brown Oxide Mn	0.111
Peroxide Iron	1.445
Alumina	2.605
Phosphoric Acid	0.008
Sulphuric Acid	Trace
Organic Matter and H_2O	1.333
	99.653

Typical Loess Silt (Claiborne County).

Chemical analysis (Hilgard).
(No Mechanical analysis.)

Insol. Matter	75.344
Potash	0.511
Soda	0.115
Lime	5.921
Magnesia	3.278
Brown Oxide Mn	0.252
Peroxide Iron	3.272
Alumina	2.823
Phosphoric Acid	0.145
Sulphuric Acid	0.060
Carbonic Acid	6.729
Organic Matter and H_2O	1.231
	99.681

Typical Soil from Bluff Hills (Memphis Silt Loam) Claiborne County.

Chemical analysis (Hilgard).
(No mechanical analysis.)

Insol. Matter	87.573
Potash	0.458
Soda	0.124
Lime	0.224
Magnesia	0.545
Brown Oxide Mn	0.205
Peroxide Iron	3.231
Alumina	4.842
Phosphoric Acid	0.105
Sulphuric Acid	0.028
Organic Matter and H_2O	3.073
	100.429

Subsoil of Brown Loam, Hinds County. Typical of Loam Soils of Hinds and Madison Where It Rests Upon Jackson Marls.

Chemical analysis (Hilgard).

Insol. Matter	80.788
Potash	0.634
Soda	0.185
Lime	5.921
Magnesia	0.266
Brown Oxide Mn	0.159
Peroxide Iron	4.727
Alumina	8.940
Phosphoric Acid	0.151
Sulphuric Acid	0.076
Organic Matter and H_2O	3.239
	100.393

Soil of Gypseus Prairie, Rankin County.

Chemical analysis (Hilgard).

Insol. Matter	82.558
Potash	0.339
Soda	0.023
Lime	0.432
Magnesia	0.513
Brown Oxide Mn	0.092
Peroxide Iron	3.084
Alumina	7.424
Phosphoric Acid	0.076
Sulphuric Acid	0.058
Organic Matter and H_2O	5.322
	99.911

Black Prairie Soil (Houston Clay), Jasper County.

Mechanical analysis (U. S. Soil B).

Mechanical analyses of Houston clay.

Description.	*Fine gravel.* %	*Coarse sand.* %	*Medium sand.* %	*Fine sand.* %	*Very fine sand.* %	*Silt.* %	*Clay.* %
Soil	0.1	2.5	3.3	9.0	3.2	47.6	34.6
Subsoil	.2	.8	1.3	13.9	7.1	48.7	27.6

Chemical analysis (Hilgard).

Insol. Matter	63.435
Potash	0.796
Soda	0.127
Lime	1.815
Magnesia	1.112
Brown Oxide Mn	0.479
Peroxide Iron	6.996
Alumina	16.127
Phosphoric Acid	0.232
Sulphuric Acid	0.085
Organic Matter and H_2O and Loss	9.028
	100.000

Subsoil of Gypseus Prairie (Rankin County).

Insol. Matter	67.027
Potash	0.518
Soda	0.414
Lime	5.695
Magnesia	1.233
Brown Oxide Mn	0.509
Peroxide Iron	4.344
Alumina	10.751
Phosphoric Acid	?
Sulphuric Acid	5.751
Carbonic Acid	1.018
Organic Matter and H_2O	2.740
	100.000

Hog-Wallow Prairie Soil (Montrose Clay), Smith Co.

Mechanical analysis (U. S. Soil B).
(Jasper County.)

Mechanical analyses of Montrose clay (Jasper Co.)

Description.	Fine gravel. %	Coarse sand. %	Medium sand. %	Fine sand. %	Very fine sand. %	Silt. %	Clay. %
Soil	1.0	2.7	2.8	5.8	2.4	50.6	34.3
Subsoil	.2	1.8	2.1	6.3	3.4	46.0	35.3

Chemical analysis (Hilgard).

Insol. Matter	76.758
Potash	0.525
Soda	0.190
Lime	0.424
Magnesia	0.674
Brown Oxide Mn	0.559
Peroxide Iron	4.121x
Alumina	10.059
Phosporic Acid	0.063
Sulphuric Acid	0.059
Organic Matter and H_2O	5.733
	99.100

x—Accidental loss in determining Iron.

Orangeburg Fine Sandy Loam of Long-Leaf Pine Hills.

Mechanical analysis (U. S. Soil B).
(Jasper County.)

Mechanical analyses of Orangeburg fine sandy loam (Jasper Co.).

Description.	Fine gravel. %	Coarse sand. %	Medium sand. %	Fine sand. %	Very fine sand. %	Silt. %	Clay. %
Soil	0.5	5.2	8.0	37.5	11.9	32.1	4.5
Subsoil	.3	3.3	5.5	29.3	7.3	24.8	29.1

Chemical Analysis (Hilgard) Pike Co.

Soil.	
Insol. Matter (chiefly sand)	889.801
Potash	0.218
Lime	0.034
Magnesia	0.806
Brown Oxide Mn	0.072
Peroxide Iron	2.402
Alumina	3.783
Phosphoric Acid	0.036
Sulphuric Acid	0.038
Organic Matter and H_2O	3.446
	100.202
Subsoil.	
Insol. Matter	77.931
Potash	0.266
Soda	0.072
Lime	0.152
Magnesia	0.352
Brown Oxide Mn	0.091
Peroxide Iron	5.456
Alumina	11.870
Phosphoric Acid	0.043
Sulphuric Acid	0.035
Organic Matter and H_2O	3.261
	99.934

Norfolk Fine Sandy Loam, Harrison County.

(Mechanical analysis (U. S. Soil Bureau).

Mechanical analyses of Norfolk fine sandy loam.

Description.	*Fine gravel.* %	*Coarse sand.* %	*Medium sand.* %	*Fine sand.* %	*Very fine sand.* %	*Silt.* %	*Clay.* %
Soil	0.0	2.3	9.3	40.5	18.5	24.1	5.4
Subsoil	.1	1.6	7.7	35.3	14.3	21.3	19.9

Chemical analysis (Hilgard).

Insol. Matter	95.502
Potash	0.061
Soda	0.050
Lime	0.023
Magnesia	0.069
Brown Oxide Mn	0.045
Peroxide Iron	0.459
Alumina	0.848
Phosphoric Acid	0.021
Sulphuric Acid	Trace
Organic Matter and H_2O	2.277
	99.443

Marsh Soil of Pearl River Bottom (Harrison County).

Insol. Matter	74.150
Potash	1.003
Soda	0.379
Lime	0.182
Magnesia	1.004
Brown Oxide Mn	0.065
Peroxide of Iron	3.350
Alumina	10.643
Sulphuric Acid	0.856
Phosphoric Acid	0.188
Organic Matter and H_2O	8.390
	100.212
	(*Hilgard.*)

Marsh Soil of Coast (Jackson County).

Insol. Sand and Silica	70.183
Potash	0.559
Soda	0.957
Lime	0.109
Magnesia	0.743
Brown Oxide Mn	0.067
Peroxide of Iron	1.171
Alumina	5.894
Phosphoric Acid	0.111
Sulphuric Acid	0.176
Organic Matter and H_2O	19.826
	99.796
	(*Hilgard.*)

Yazoo Bottom Soils (Hilgard).

Constituents.	Coahoma County.		Tallahatchie County.	Sunflower County.		Issaquena County.	
	Dogwood Ridge soil.	*Light-colored "buckshot" clay.*	*Tallahatchie bottom soil.*	*Indian Bayou front-land soil.*	*Indian Bayou front-land subsoil.*	*Sunflower River front-land soil.*	*Deer Creek "buckshot" soil.*
	No. 395.	No. 396.	No. 354.	No. 376.	No. 377.	No. 394.	No. 390.
Insoluble matter	83.886 } 90.908	75.513 } 86.408	87.146 } 91.944	87.898 } 91.934	87.898 } 91.714	71.164 } 84.670	51.063 } 71.767
Soluble silica	7.022	10.895	4.798	4.036	3.816	13.506	20.704
Potash	0.392	0.606	0.301	0.226	0.305	0.401	1.104
Soda	0.086	0.146	0.084	0.116	0.079	0.191	0.325
Lime	0.259	0.386	0.301	0.153	0.147	0.406	1.349
Magnesia	0.596	0.972	0.385	0.256	0.392	0.696	1.665
Brown oxide of manganese	0.086	0.133	0.158	0.048	0.050	0.011	0.119
Peroxide of iron	2.691	2.804	2.120	1.848	2.312	3.845	5.818
Alumina	3.593	4.457	2.151	2.565	2.998	6.889	10.539
Phosphoric acid	0.142	0.278	0.112	0.162	0.283	0.165	0.304
Sulphuric acid	0.010	0.007	0.005	0.062	----	0.016	0.024
Water and organic matter	2.007	4.401	2.644	3.013	1.499	2.748	7.369
	100.700	100.598	100.205	100.383	99.779	100.038	100.383
Hygroscopic moisture	3.945	6.043	4.786	4.067	5.684	7.385	14.305
Absorbed at	10 C.°	12 C.°	22 C.°	14 C.°	15.5 C.°	15 C.°	15 C.°

The analyses given in the following pages were made in the winter of 1909-'10 for the Geological Survey by the Chemical Department of the State University. As will be seen, the analyses are not complete, and the soils analyzed are but a small proportion of the number in the Survey collection. The funds available were not sufficient to permit of the analysis of the whole collection and, owing to the boll weevil invasion in the Southern counties, with consequent necessity for immediate diversification, it was believed that those counties had the first and strongest claim, and the analyses made are almost entirely of soils from the Southern half of the State.

It was not thought necessary to make a complete analysis of the soils. It has been abundantly proved that the only elements of plant food liable to be deficient in Mississippi soils are phosphorus, nitrogen and humus. Hence the determination of these was the chief object of the analyses, though we regret now that lime was not also determined, and that the insoluble matters were not separated so as to determine the relative proportions of sand and clay—a matter of importance in soil study. A mechanical analysis of each soil was intended, but never undertaken because of lack of funds. These features will be added in later analyses.

The test for humus here used is the official test used by the U. S. Soil Bureau. Since these tests were made, some doubt has been thrown on the accuracy of the method as then practiced, and it must be understood that the results are only approximately correct.

No. 164. Virgin Black Prairie Soil. Near Jackson.

Analysis	*Per Cent.*
Moisture	2.15
Vol. Matter	13.33
Insol. Matter	90.09
Phosphoric Acid	0.044
Nitrogen	0.184
Humus	2.8

No. 171. Same as 164; cultivated 3 years. Jackson.

Analysis	*Per Cent.*
Moisture	2.56
Vol. Matter	12.15
Insol. Matter	81.01
Phosphoric Acid	0.012
Nitrogen	----
Humus	2.8

No. 165. Pearl River Bottom Soil. Jackson.

Analysis	*Per Cent.*
Moisture	0.56
Vol. Matter	5.08
Insol. Matter	92.98
Phosphoric Acid	0.058
Nitrogen	0.080
Humus	1.3

No. 139. Hill Loam Soil, 2 miles south of Bolton. (Cult.)

Analysis.	*Per Cent.*
Moisture	0.60
Vol. Matter	2.63
Insol. Matter	93.52
Phosphoric Acid	0.045
Nitrogen	0.061
Humus	1.5

No. 142. Big Black 2d Bottom, 3 miles S. W. from Edwards.

Analysis.	*Per Cent.*
Moisture	0.96
Vol. Matter	3.68
Insol. Matter	90.44
Phosphoric Acid	0.55
Nitrogen	0.096
Humus	2.6

No. 152. Loam Soil near Raymond. (Reagan Place.)

Analysis.	*Per Cent.*
Moisture	0.58
Vol. Matter	2.20
Insol. Matter	93.53
Phosphoric Acid	0.063
Nitrogen	0.045
Humus	1.4

No. 107. Mississippi River Bottom, Warrenton. (Cult.)

Analysis.	*Per Cent.*
Moisture	0.99
Vol. Matter	3.69
Insol. Matter	90.09
Phosphoric Acid	0.108
Nitrogen	0.079
Humus	0.8

No. 122. Virgin Soil (Hill) 1½ miles east of Yokena, Warren Co.

Analysis.	*Per Cent.*
Moisture	1.31
Vol. Matter	5.76
Insol. Matter	83.26
Phosphoric Acid	0.243
Nitrogen	0.058
Humus	1.3

No. 141. Bottom Soil of Bayou Pierre, Carlisle, Claiborne Co. (Cult.)

Analysis.	*Per Cent.*
Moisture	0.86
Vol. Matter	3.67
Insol. Matter	92.09
Phosphoric Acid	0.078
Nitrogen	0.113
Humus	2.5

No. 140. Woodland Soil (Hill). 1 mile west of Hermanville.

Analysis.	*Per Cent.*
Moisture	1.45
Vol. Matter	4.73
Insol. Matter	96.58
Nitrogen	0.098
Phosphoric Acid	0.107
Humus	1.4

No. 128. Loam Hill Soil (Buckshot). Price's field, 3 miles east of Martin, Claiborne Co.

Analysis.	*Per Cent.*
Moisture	0.81
Vol. Matter	2.90
Insol. Matter	90.90
Phosphoric Acid	0.059
Nitrogen	0.046
Humus	1.2

No. 150. Baker's Creek Bottom. (Cult.

Analysis.	*Per Cent.*
Moisture	0.96
Vol. Matter	3.46
Insol. Matter	92.48
Phosphoric Acid	0.063
Nitrogen	0.094
Humus	1.3

No. 153. White Buckshot Soil, Raymond. (Cultivated field on Ratliff Place.)

Analysis.	*Per Cent.*
Moisture	0.72
Vol. Matter	2.62
Insol. Matter	90.95
Phosphoric Acid	0.072
Nitrogen	0.053
Humus	1.2

No. 108. Mississippi River Bottom, Grand Gulf.

Analysis.	*Per Cent.*
Moisture	1.49
Vol. Matter	3.72
Insol. Matter	88.72
Phosphoric Acid	0.176
Nitrogen	0.075
Humus	2.5

No. 123. Same as 122, cultivated field

Analysis.	*Per Cent.*
Moisture	0.90
Vol. Matter	5.24
Insol. Matter	92.60
Phosphoric Acid	0.010
Nitrogen	0.099
Humus	1.3

No. 143. Same as 141. Soil of Woodland.

Analysis.	*Per Cent.*
Moisture	0.43
Vol. Matter	3.57
Insol. Matter	88.50
Phosphoric Acid	0.095
Nitrogen	
Humus	2.6

No. 147. Same as 140, cultivated field.

Analysis.	*Per Cent.*
Moisture	1.18
Vol. Matter	3.60
Insol. Matter	88.71
Nitrogen	
Phosphoric Acid	0.115
Humus	1.3

No. 129. Typical old field Loam, Martin, Claiborne Co.

Analysis.	*Per Cent.*
Moisture	0.67
Vol. Matter	2.75
Insol. Matter	92.36
Phosphoric Acid	0.027
Nitrogen	0.067
Humus	1.3

No. 133. Subsoil of above Buckshot soil, Price's field, 3 miles east of Martin, Claiborne Co.

Analysis.	*Per Cent.*
Moisture	1.26
Vol. Matter	4.90
Insol. Matter	88.54
Phosphoric Acid	0.033
Nitrogen	0.136
Humus	2.2

No. 124. Soil of Bayou Pierre Bottom at R. R. Bridge, Port Gibson. (2d year cult.)

Analysis.	*Per Cent.*
Moisture	0.62
Vol. Matter	2.02
Insol. Matter	94.82
Phosphoric Acid	0.065
Nitrogen	0.042
Humus	1.2

No. 126. Hill Soil from Bullen's Place, 6 miles east of Fayette, Jefferson Co.

Analysis.	*Per Cent.*
Moisture	1.14
Vol. Matter	4.56
Insol. Matter	92.55
Phosphoric Acid	0.059
Nitrogen	0.108
Humus	3.2

No. 130. Soil from bottom of small bayou, Natchez, resulting from mixture of Loam and Loess Silt.

Analysis.	*Per Cent.*
Moisture	1.78
Vol. Matter	5.05
Insol. Matter	87.85
Phosphoric Acid	0.100
Nitrogen	0.059
Humus	1.3

No. 136. Same as 131, 1 mile northeast of Natchez. A typical hill soil in this region.

Analysis.	*Per Cent.*
Moisture	1.24
Vol. Matter	3.55
Insol. Matter	86.92
Phosphoric Acid	0.053
Nitrogen	0.055
Humus	1.3

No. 110. Bottom Soil of Homochitto River, Rosetta, Wilkinson Co.

Analysis.	*Per Cent.*
Moisture	0.76
Vol. Matter	2.70
Insol. Matter	92.83
Phosphoric Acid	0.051
Nitrogen	0.047
Humus	1.2

No. 116. Creek Bottom Soil, Benjamin Hollow, Grand Gulf and Port Gibson Road.

Analysis.	*Per Cent.*
Moisture	1.29
Vol. Matter	7.78
Insol. Matter	88.71
Phosphoric Acid	0.138
Nitrogen	0.110
Humus	2.2

No. 137. Soil of Cole's Creek Bottom at R. R. Crossing north of Harriston.

Analysis.	*Per Cent.*
Moisture	0.96
Vol. Matter	3.74
Insol. Matter	91.15
Phosphoric Acid	0.035
Nitrogen	0.094
Humus	1.3

No. 163. Loam Soil from Hunt Place, 10 miles west of Fayette, Jefferson Co.

Analysis.	*Per Cent.*
Moisture	0.56
Vol. Matter	4.84
Insol. Matter	93.22
Phosphoric Acid	0.005
Nitrogen	0.083
Humus	3.0

No. 131. Loam soil from old field, Natchez, Loess Silt beneath.

Analysis.	*Per Cent.*
Moisture	1.11
Vol. Matter	3.58
Insol. Matter	90.02
Phosphoric Acid	0.072
Nitrogen	0.087
Humus	2.5

No. 117. Bottom Soil of Dawson Creek, Thos. Dixon Place, 1 mile east of Centerville.

Analysis.	*Per Cent.*
Moisture	0.83
Vol. Matter	3.73
Insol. Matter	91.51
Phosphoric Acid	0.060
Nitrogen	0.070
Humus	1.5

No. 125. Hill Soil, W. S. Gallman's Place, Centerville, Wilkinson Co.

Analysis.	*Per Cent.*
Moisture	0.84
Vol. Matter	5.43
Insol. Matter	91.31
Phosphoric Acid	0.033
Nitrogen	0.122
Humus	2.2

No. 112. Hill (Loam) Soil, Woodville, Wilkinson Co. (Cult.)

Analysis.	*Per Cent.*
Moisture	0.83
Vol. Matter	3.59
Insol. Matter	91.19
Phosphoric Acid	0.059
Nitrogen	0.054
Humus	1.3

No. 114. Same as No. 112. (Uncult.)

Analysis.	*Per Cent.*
Moisture	1.26
Vol. Matter	4.05
Insol. Matter	89.02
Phosphoric Acid	0.081
Nitrogen	0.081
Humus	1.3

No. 101. Creek Bottom Soil, 1½ miles south of Liberty, Amite Co. (Field of J. McKnight.)

Analysis.	*Per Cent.*
Moisture	1.45
Vol. Matter	8.29
Insol. Matter	
Phosphoric Acid	0.065
Nitrogen	0.184
Humus	3.3

No. 119. Bottom Soil of Little Amite River, 3 miles west of Liberty, on Centerville Road. (Cult.)

Analysis.	*Per Cent.*
Moisture	0.88
Vol. Matter	3.40
Insol. Matter	93.03
Phosphoric Acid	0.091
Nitrogen	0.084
Humus	2.6

No. 166. Hill Soil, field of J. W. Day, Crystal Springs, Copiah Co.

Analysis.	*Per Cent.*
Moisture	0.89
Vol. Matter	5.00
Insol. Matter	93.02
Phosphoric Acid	0.066
Nitrogen	0.073
Humus	1.4

No. 168. Pearl River 2d Bottom, John Gates' Place, east of Crystal Springs. (Old field in Lespedeza.)

Analysis.	*Per Cent.*
Moisture	0.39
Vol. Matter	2.93
Insol. Matter	95.12
Phosphoric Acid	0.021
Nitrogen	
Humus	1.3

No. 113. Creek Bottom Soil, 1½ miles west of Woodville. (Field of Judge Ventress.)

Analysis.	*Per Cent.*
Moisture	1.13
Vol. Matter	3.94
Insol. Matter	89.30
Phosphoric Acid	0.105
Nitrogen	0.092
Humus	1.3

No. 102. Creek Bottom Soil, Roxie, Franklin Co. (Cult.)

Analysis.	*Per Cent.*
Moisture	0.68
Vol. Matter	2.34
Insol. Matter	
Phosphoric Acid	0.018
Nitrogen	0.070
Humus	1.3

No. 106. Hill Soil, Roxie, Franklin Co. (Cult.)

Analysis.	*Per Cent.*
Moisture	0.52
Vol. Matter	2.07
Insol. Matter	94.51
Phosphoric Acid	0.046
Nitrogen	0.045
Humus	1.2

No. 132. Hill Soil (Cult.), 2 miles southeast of Liberty, Amite Co.

Analysis.	*Per Cent.*
Moisture	0.54
Vol. Matter	2.54
Insol. Matter	99.02
Phosphoric Acid	0.025
Nitrogen	0.066
Humus	2.2

No. 167. Creek Bottom Soil (Cult.), on land of J. W. Day, Crystal Springs.

Analysis.	*Per Cent.*
Moisture	0.76
Vol. Matter	3.08
Insol. Matter	94.86
Phosphoric Acid	0.077
Nitrogen	0.073
Humus	2.2

No. 169. Pearl River 2d Bottom Soil, 11 miles east of Crystal Springs. (Wiley Grantham's Place.)

Analysis.	*Per Cent.*
Moisture	0.63
Vol. Matter	3.72
Insol. Matter	89.10
Phosphoric Acid	0.041
Nitrogen	
Humus	1.3

No. 118. Bottom Soil, Johnson Creek, 4 miles west of Hazlehurst, Copiah Co.

Analysis.	*Per Cent.*
Moisture	0.79
Vol. Matter	3.35
Insol. Matter	93.80
Phosphoric Acid	0.055
Nitrogen	0.107
Humus	1.5

No. 134. Hill Soil (Cult.), 2 miles east of Hazlehurst. (Field of I. N. Ellis.)

Analysis.	*Per Cent.*
Moisture	0.90
Vol. Matter	3.61
Insol. Matter	90.29
Phosphoric Acid	0.024
Nitrogen	0.074
Humus	2.2

No. 105. Same as No. 103. (Woodland Soil.)

Analysis.	*Per Cent.*
Moisture	1.39
Vol. Matter	3.77
Insol. Matter	91.21
Phosphoric Acid	0.055
Nitrogen	0.079
Humus	1.5

No. 103. Bottom Soil (Cult.), Key's Creek, 7 miles southeast of Brookhaven, on Monticello Road.

Analysis.	*Per Cent.*
Moisture	0.77
Vol. Matter	2.38
Insol. Matter	94.80
Phosphoric Acid	0.029
Nitrogen	0.060
Humus	1.3

No. 120. Hill Soil (Uncult.), 5 miles southeast of Brookhaven, on Monticello Road. (Dalton Moore's land.)

Analysis.	*Per Cent.*
Moisture	0.71
Vol. Matter	3.96
Insol. Matter	87.39
Phosphoric Acid	0.034
Nitrogen	0.069
Humus	1.4

No. 121. Same as 120, cultivated field of long standing. (Fertilized.)

Analysis.	*Per Cent.*
Moisture	0.71
Vol. Matter	4.18
Insol. Matter	91.93
Phosphoric Acid	0.045
Nitrogen	0.080
Humus	2.6

No. 109. New Hill Soil, Tomkins' Place, 1 mile northwest of Magnolia, Pike County.

Analysis.	*Per Cent.*
Moisture	0.83
Vol. Matter	5.64
Insol. Matter	91.62
Phosphoric Acid	0.032
Nitrogen	0.088
Humus	3.2

No. 111. Bottom Soil, Minnehaha Creek 2 miles northwest of Magnolia. (Cult.)

Analysis.	*Per Cent.*
Moisture	0.57
Vol. Matter	3.83
Insol. Matter	92.73
Phosphoric Acid	0.040
Nitrogen	0.082
Humus	2.2

No. 100. Hill Soil (Cult.), 3 miles east of Osyka, Pike County.

Analysis.	*Per Cent.*
Moisture	0.84
Vol. Matter	3.51
Insol. Matter	93.26
Phosphoric Acid	0.020
Nitrogen	0.069
Humus	3.2

No. 127. Soil from Pine Forest in same locality as No. 100.

Analysis.	*Per Cent.*
Moisture	0.85
Vol. Matter	3.55
Insol. Matter	92.40
Phosphoric Acid	0.018
Nitrogen	0.043
Humus	3.0

No. 138. Bottom Soil (Virgin), Tangipahoe River, Osyka, Pike Co.

Analysis.	*Per Cent.*
Moisture	1.05
Vol. Matter	5.29
Insol. Matter	89.21
Phosphoric Acid	0.036
Nitrogen	
Humus	1.5

No. 151. Same as No. 138; cultivated field.

Analysis.	*Per Cent.*
Moisture	0.58
Vol. Matter	3.19
Insol. Matter	92.48
Phosphoric Acid	0.032
Nitrogen	0.062
Humus	2.2

No. 36. Bottom Soil (Cult.), T. J. Doolittle's land, 3 miles north of Newton, Newton Co.

Analysis.	*Per Cent.*
Moisture	1.16
Vol. Matter	4.52
Insol. Matter	
Phosphoric Acid	0.050
Nitrogen	
Humus	2.5

No. 34. Hill land. (Cult.) T. M. Scanlan, Newton, Newton Co.

Analysis.	*Per Cent.*
Moisture	0.30
Vol. Matter	2.05
Insol. Matter	
Phosphoric Acid	0.034
Nitrogen	
Humus	1.4

No. 135. Upland Soil (Cult.), 5 miles north of Hattiesburg, Forrest Co.

Analysis.	*Per Cent.*
Moisture	0.88
Vol. Matter	3.37
Insol. Matter	91.00
Phosphoric Acid	0.026
Nitrogen	0.094
Humus	1.5

No. 11. Second Bottom Soil, 40 years in cultivation; J. B. Burkett, Hattiesburg.

Analysis.	*Per Cent.*
Moisture	0.25
Vol. Matter	1.84
Insol. Matter	87.87
Phosphoric Acid	0.021
Nitrogen	
Humus	1.3

No. 157. Pearl River, 1st Bottom, ½ mile east Wagon Bridge, Columbia. (Cult.)

Analysis.	*Per Cent.*
Moisture	0.35
Vol. Matter	1.65
Insol. Matter	96.59
Phosphoric Acid	0.016
Nitrogen	0.043
Humus	1.5

No. 145. Creek Bottom Soil, 1 mile east of Lumberton, Lamar Co. (Virgin.)

Analysis.	*Per Cent.*
Moisture	0.58
Vol. Matter	2.93
Insol. Matter	95.08
Phosphoric Acid	0.057
Nitrogen	0.056
Humus	2.5

No. 37. Same as No. 36, old field in cultivation 15 years.

Analysis.	*Per Cent.*
Moisture	0.53
Vol. Matter	3.06
Insol. Matter	
Phosphoric Acid	0.037
Nitrogen	
Humus	2.5

No. 31. Old Field Soil, M. & O. R. R., 1½ miles north of Meridian.

Analysis.	*Per Cent.*
Moisture	0.76
Vol. Matter	4.27
Insol. Matter	71.93
Phosphoric Acid	0.043
Nitrogen	
Humus	3.4

No. 10. Virgin 2d Bottom Soil, J. B. Burkett, Hattiesburg.

Analysis.	*Per Cent.*
Moisture	0.51
Vol. Matter	3.65
Insol. Matter	94.98
Phosphoric Acid	0.057
Nitrogen	
Humus	1.3

No. 149. Pearl River 2d Bottom at Columbia, Marion Co. (Uncult.)

Analysis.	*Per Cent.*
Moisture	0.94
Vol. Matter	5.13
Insol. Matter	91.88
Phosphoric Acid	0.018
Nitrogen	0.107
Humus	3.2

No. 158. Hill Soil, 4 miles east of Columbia, on Purvis Road. (New field.)

Analysis.	*Per Cent.*
Moisture	0.50
Vol. Matter	4.78
Insol. Matter	93.08
Phosphoric Acid	0.021
Nitrogen	0.063
Humus	3.0

No. 154. Soil from "Big Level," 3½ miles east of Lumberton. (Dr. Thompson's field.)

Analysis.	*Per Cent.*
Moisture	0.73
Vol. Matter	4.87
Insol. Matter	92.32
Phosphoric Acid	0.031
Nitrogen	0.096
Humus	3.7

No. 155. Hill Soil (Uncult.), at Coal Town, 3 miles west of Purvis, Lamar Co.

Analysis.	*Per Cent.*
Moisture	0.44
Vol. Matter	2.77
Insol. Matter	95.13
Phosphoric Acid	0.016
Nitrogen	0.043
Humus	3.0

No. 148. Hill Soil, ½ mile east of Poplarville, Pearl River Co. (Field of Andrew Smith.)

Analysis.	*Per Cent.*
Moisture	0.36
Vol. Matter	2.87
Insol. Matter	95.87
Phosphoric Acid	0.017
Nitrogen	0.043
Humus	2.2

No. 21. Hill Soil 2¾ miles north of Laurel, Jones Co. (Field of J. N. Lindsey.)

Analysis.	*Per Cent.*
Moisture	0.69
Vol. Matter	4.38
Insol. Matter	97.56
Phosphoric Acid	0.093
Nitrogen	----
Humus	2.6

No. 25. Hill Soil, 3 miles north of Waynesboro, Wayne Co. (Field of Jim Hays.)

Analysis.	*Per Cent.*
Moisture	0.54
Vol. Matter	3.75
Insol. Matter	95.23
Phosphoric Acid	0.015
Nitrogen	----
Humus	2.6

No. 8. Upland Soil (Cult.), 1 mile north of Lucedale, George Co. (Land of Geo. Mallet.)

Analysis.	*Per Cent.*
Moisture	0.68
Vol. Matter	6.00
Insol. Matter	93.05
Phosphoric Acid	0.022
Nitrogen	----
Humus	2.8

No. 156. Hill Soil (Cult.), land of J. T. Purvis, 3 miles west of Purvis.

Analysis.	*Per Cent.*
Moisture	0.53
Vol. Matter	3.63
Insol. Matter	----
Phosphoric Acid	0.026
Nitrogen	0.063
Humus	3.0

No. 18. Bottom Soil on land of Frank Gardner, Laurel, Jones Co.

Analysis.	*Per Cent.*
Moisture	0.57
Vol. Matter	3.65
Insol. Matter	93.80
Phosphoric Acid	0.015
Nitrogen	----
Humus	1.4

No. 23. Soil of 2d Bottom of River, A. B. Brown's field, Taylorsville, Smith Co.

Analysis.	*Per Cent.*
Moisture	0.80
Vol. Matter	5.09
Insol. Matter	93.57
Phosphoric Acid	0.038
Nitrogen	----
Humus	3.4

No. 28. Soil from 2d Bottom of Chickasawhay River, Waynesboro. (Miss Hay's land.)

Analysis.	*Per Cent.*
Moisture	0.28
Vol. Matter	1.87
Insol. Matter	96.14
Phosphoric Acid	0.011
Nitrogen	----
Humus	1.3

No. 7. Hill Soil (Cult.), J. L. Holoman's land, Wiggins, Harrison Co.

Analysis.	*Per Cent.*
Moisture	0.29
Vol. Matter	2.72
Insol. Matter	92.16
Phosphoric Acid	----
Nitrogen	----
Humus	1.4

ERRATA

On page 21, line 21, for "Forest" read "Frost."
" " 21, line 23, for "right" read "night."
" " 27, line 28, for "is" read "of."
" " 28, line 39, for "become" read "becomes."
" " 33, line 27, for "control" read "controls."
" " 86, line 3, for "This" read "The."
" " 144, line 12, for "supplied to" read "supplied by."
" " 197, line 5, for "chosing" read "choosing."

No. 36. Bottom Soil (Cult.), T. J. Doolittle's land, 3 miles north of Newton, Newton Co.

Analysis.	*Per Cent.*
Moisture	1.16
Vol. Matter	4.52
Insol. Matter	
Phosphoric Acid	0.050
Nitrogen	
Humus	2.5

No. 37. Same as No. 36. old field in cultivation 15 years.

Analysis.	*Per Cent.*
Moisture	0.53
Vol. Matter	3.06
Insol. Matter	
Phosphoric Acid	0.037
Nitrogen	
Humus	2.5

No. 34. Hill land. (Cult.) T. M. Scanlan, Newton, Newton Co.

Analysis.	*Per Cent.*
Moisture	0.30
Vol. Matter	2.05
Insol. Matter	
Phosphoric Acid	0.034
Nitrogen	
Humus	1.4

No. 31. Old Field Soil, M. & O. R. R., 1½ miles north of Meridian.

Analysis.	*Per Cent.*
Moisture	0.76
Vol. Matter	4.27
Insol. Matter	71.93
Phosphoric Acid	0.043
Nitrogen	
Humus	3.4

No. 135. Upland Soil (Cult.), 5 miles north of Hattiesburg, Forrest Co.

Analysis.	*Per Cent.*
Moisture	0.88
Vol. Matter	3.37
Insol. Matter	91.00
Phosphoric Acid	0.026
Nitrogen	0.094
Humus	1.5

No. 10. Virgin 2d Bottom Soil, J. B. Burkett, Hattiesburg.

Analysis.	*Per Cent.*
Moisture	0.51
Vol. Matter	3.65
Insol. Matter	94.98
Phosphoric Acid	0.057
Nitrogen	
Humus	1.3

No. 11. Second Bottom Soil, 40 years in cultivation; J. B. Burkett, Hattiesburg.

Analysis.	*Per Cent.*
Moisture	0.25
Vol. Matter	1.84
Insol. Matter	87.87
Phosphoric Acid	0.021
Nitrogen	
Humus	1.3

No. 149. Pearl River 2d Bottom at Columbia, Marion Co. (Uncult.)

Analysis.	*Per Cent.*
Moisture	0.94
Vol. Matter	5.13
Insol. Matter	91.88
Phosphoric Acid	0.018
Nitrogen	0.107
Humus	3.2

No. 157. Pearl River, 1st Bottom, ½ mile east Wagon Bridge, Columbia. (Cult.)

Analysis.	*Per Cent.*
Moisture	0.35
Vol. Matter	1.65
Insol. Matter	96.59
Phosphoric Acid	0.016
Nitrogen	0.043
Humus	1.5

No. 158. Hill Soil, 4 miles east of Columbia, on Purvis Road. (New field.)

Analysis.	*Per Cent.*
Moisture	0.50
Vol. Matter	4.78
Insol. Matter	93.08
Phosphoric Acid	0.021
Nitrogen	0.063
Humus	3.0

No. 145. Creek Bottom Soil, 1 mile east of Lumberton, Lamar Co. (Virgin.)

Analysis.	*Per Cent.*
Moisture	0.58
Vol. Matter	2.93
Insol. Matter	95.08
Phosphoric Acid	0.057
Nitrogen	0.056
Humus	2.5

No. 154. Soil from "Big Level," 3½ miles east of Lumberton. (Dr. Thompson's field.)

Analysis.	*Per Cent.*
Moisture	0.73
Vol. Matter	4.87
Insol. Matter	92.32
Phosphoric Acid	0.031
Nitrogen	0.096
Humus	3.7

No. 155. Hill Soil (Uncult.), at Coal Town, 3 miles west of Purvis, Lamar Co.

Analysis.	*Per Cent.*
Moisture	0.44
Vol. Matter	2.77
Insol. Matter	95.13
Phosphoric Acid	0.016
Nitrogen	0.043
Humus	3.0

No. 156. Hill Soil (Cult.), land of J. T. Purvis, 3 miles west of Purvis.

Analysis.	*Per Cent.*
Moisture	0.53
Vol. Matter	3.63
Insol. Matter	
Phosphoric Acid	0.026
Nitrogen	0.063
Humus	3.0

No. 148. Hill Soil, ½ mile east of Poplarville, Pearl River Co. (Field of Andrew Smith.)

Analysis.	*Per Cent.*
Moisture	0.36
Vol. Matter	2.87
Insol. Matter	95.87
Phosphoric Acid	0.017
Nitrogen	0.043
Humus	2.2

No. 18. Bottom Soil on land of Frank Gardner, Laurel, Jones Co.

Analysis.	*Per Cent.*
Moisture	0.57
Vol. Matter	3.65
Insol. Matter	93.80
Phosphoric Acid	0.015
Nitrogen	
Humus	1.4

No. 21. Hill Soil 2¾ miles north of Laurel, Jones Co. (Field of J. N. Lindsey.)

Analysis.	*Per Cent.*
Moisture	0.69
Vol. Matter	4.38
Insol. Matter	97.56
Phosphoric Acid	0.093
Nitrogen	
Humus	2.6

No. 23. Soil of 2d Bottom of River, A. B. Brown's field, Taylorsville, Smith Co.

Analysis.	*Per Cent.*
Moisture	0.80
Vol. Matter	5.09
Insol. Matter	93.57
Phosphoric Acid	0.038
Nitrogen	
Humus	3.4

No. 25. Hill Soil, 3 miles north of Waynesboro, Wayne Co. (Field of Jim Hays.)

Analysis.	*Per Cent.*
Moisture	0.54
Vol. Matter	3.75
Insol. Matter	95.23
Phosphoric Acid	0.015
Nitrogen	
Humus	2.6

No. 28. Soil from 2d Bottom of Chickasawhay River, Waynesboro. (Miss Hay's land.)

Analysis.	*Per Cent.*
Moisture	0.28
Vol. Matter	1.87
Insol. Matter	96.14
Phosphoric Acid	0.011
Nitrogen	
Humus	1.3

No. 8. Upland Soil (Cult.), 1 mile north of Lucedale, George Co. (Land of Geo. Mallet.)

Analysis.	*Per Cent.*
Moisture	0.68
Vol. Matter	6.00
Insol. Matter	93.05
Phosphoric Acid	0.022
Nitrogen	
Humus	2.8

No. 7. Hill Soil (Cult.), J. L. Holoman's land, Wiggins, Harrison Co.

Analysis.	*Per Cent.*
Moisture	0.29
Vol. Matter	2.72
Insol. Matter	92.16
Phosphoric Acid	------
Nitrogen	
Humus	1.4