

Mississippi
State Geological Survey

E. N. LOWE, Director

BULLETIN No. 11

FOREST CONDITIONS
of MISSISSIPPI

BEING
A REPRINT WITH ADDITIONS OF
BULLETINS Nos. 5 and 7
NOVEMBER, 1953

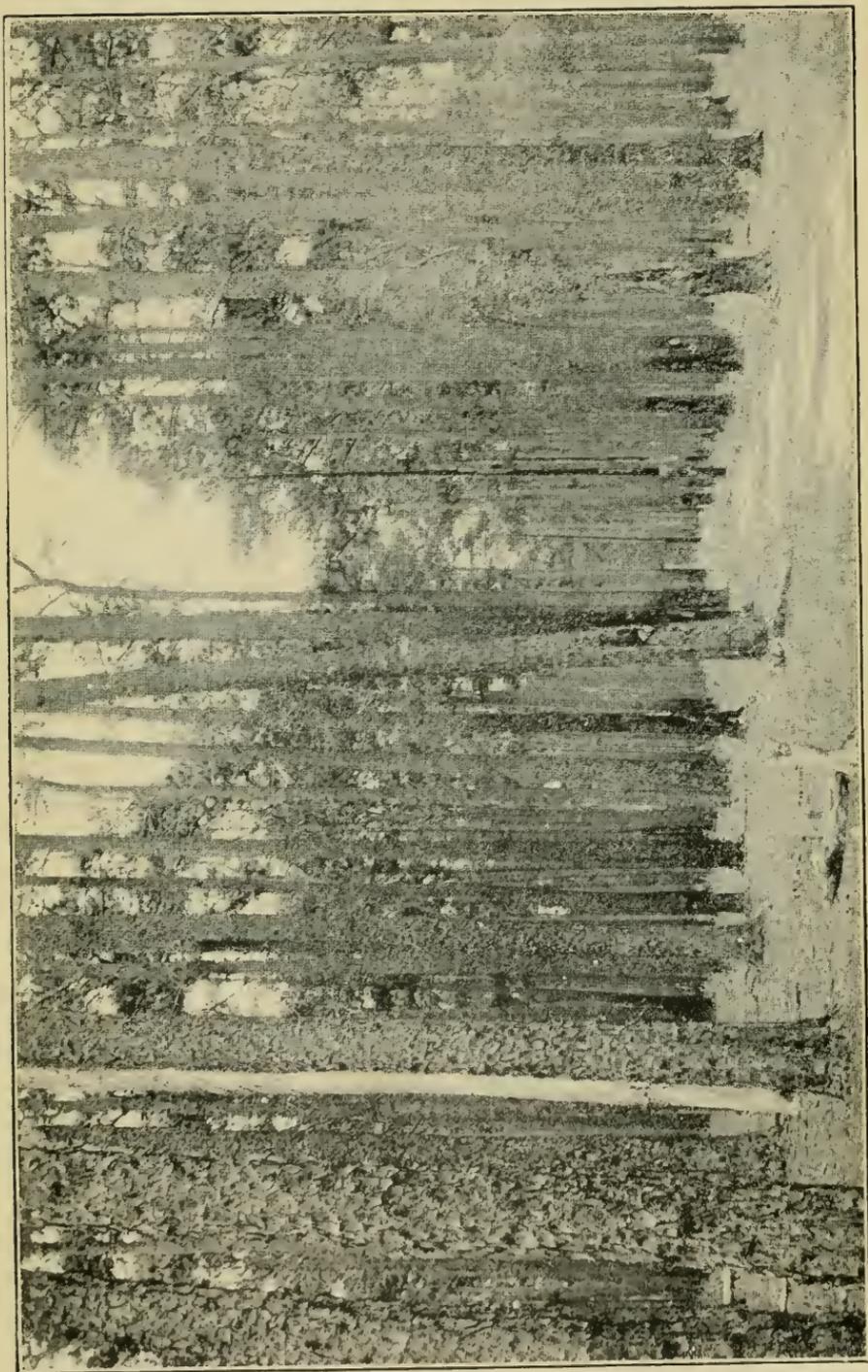


FIG. 1.—Longleaf Pine Forest, Virgin, Scorched by Fire as Usual.—From Mohr's Timber Pines of the Southern United States.

MISSISSIPPI
STATE GEOLOGICAL SURVEY

E. N. LOWE, DIRECTOR.



BULLETIN No. 11

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FOREST CONDITIONS
OF MISSISSIPPI

BEING

A REPRINT WITH ADDITIONS OF
BULLETINS Nos. 5 and 7.

NOVEMBER, 1913.

LETTER OF TRANSMITTAL.

STATE GEOLOGICAL SURVEY,
JACKSON, MISSISSIPPI, October 20, 1913.

*To His Excellency, Governor Earl Brewer, Chairman,
and Members of the Geological Commission:*

GENTLEMEN: Owing to the fact that one of the Bulletins on Forest Conditions of Mississippi was issued about five years ago, and the edition has been exhausted for several years, I have become impressed, from the frequent demands for these bulletins, that it would be desirable to re-issue both these bulletins in one, so that the one volume will cover the whole state. I have, therefore, combined the bulletins into one, preserving the text of each intact, but adding in a Supplement some data on forest products not available earlier. I have also added a brief chapter on the Flora and Floral Regions of the State, believing it will add value to the Bulletin.

I, therefore, present this for your approval, to be published as Bulletin No. 11, of the Mississippi Geological Survey.

Very respectfully,

E. N. LOWE, *Director.*

STATE GEOLOGICAL COMMISSION.

HIS EXCELLENCY, EARL BREWER..... *Governor*
HON. DUNBAR ROWLAND..... *Director of Archives and History*
HON. A. A. KINCANNON..... *Chancellor of State University*
HON. G. R. HIGHTOWER..... *President of A. & M. College*
HON. JOE N. POWERS..... *State Superintendent of Education*

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MISSISSIPPI
STATE GEOLOGICAL SURVEY

E. N. LOWE, DIRECTOR.

BULLETIN No. 7

PRELIMINARY EXAMINATION
OF THE
FOREST CONDITIONS
OF MISSISSIPPI



BY

C. E. DUNSTON
FOREST EXAMINER, FOREST SERVICE

LETTER OF TRANSMITTAL.

STATE GEOLOGICAL SURVEY,
JACKSON, MISSISSIPPI, June 16, 1910.

To His Excellency, Governor E. F. Noel, Dr. Dunbar Rowland, Chancellor A. A. Kincannon, President J. C. Hardy and Superintendent J. N. Powers, Members of the Geological Commission:

GENTLEMEN: I submit herewith a report on Preliminary Examination of the Forest Conditions of Mississippi, by Mr. C. E. Dunston, of the United States Forest Service, and respectfully recommend its publication as Bulletin No. 7 of the Mississippi Geological Survey.

Very respectfully,

E. N. LOWE, *Director.*

STATE GEOLOGICAL COMMISSION.

HIS EXCELLENCY, E. F. NOEL.....*Governor*
DUNBAR ROWLAND.....*Director of Archives and History*
A. A. KINCANNON.....*Chancellor of State University*
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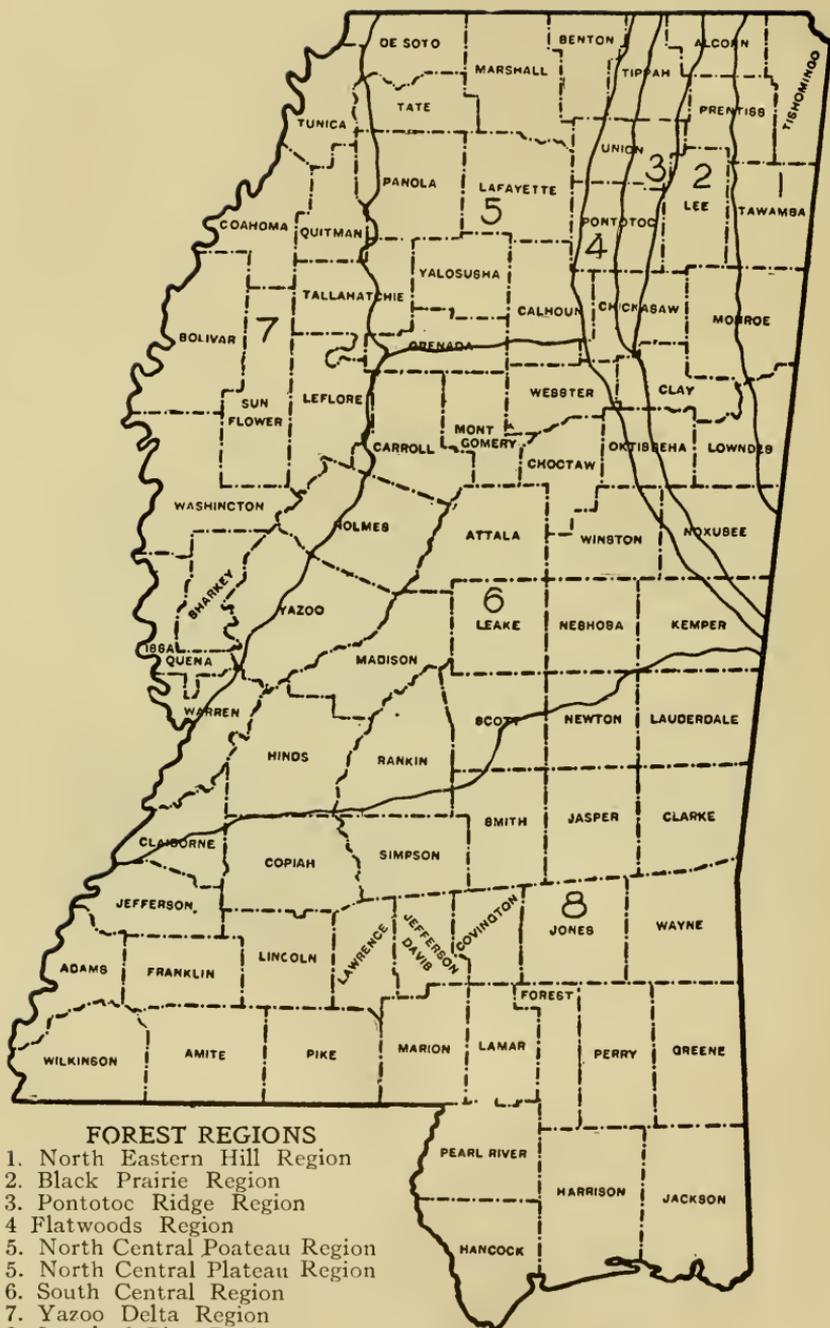


FIG. 2.—Field Examination by C. E. Dunston, Oct.-Nov., 1909.

PRELIMINARY EXAMINATION OF THE FOREST CONDITIONS OF MISSISSIPPI.

By C. E. DUNSTON,
Forest Examiner, Forest Service.

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INTRODUCTION.

The rapidly diminishing timber supply of the Gulf States, from which the bulk of the lumber-cut of the United States is now derived, has begun to cause a general awakening to the seriousness of the situation and an apprehension as to the future supply of timber needed for home consumption in the region. At the present rate of cutting the lumber industry in these States thirty years hence will be conducted on a very small scale, unless every effort is made to keep lands which are unsuited for agriculture fully stocked with rapid-growing, valuable trees.

The future wealth of Mississippi lies in agriculture. No one can travel in the State and fail to be impressed with its vast agricultural resources. The causes for its undeveloped condition are many and complex, but an awakening is taking place and a vigorous spirit in favor of agricultural development is apparent in all parts of the State. Forest conservation is closely akin to conservation in agriculture. The agricultural prosperity of a State or country is bound up in the wise use of the soils. Just as certain soils and certain situations are suited to various branches of agriculture, so certain other soils and situations are suited to the less intensive use of land—forestry.

Forestry does not necessarily mean the careful, painstaking methods applied in agriculture to the raising of crops. This comes later when the high value of wood crops makes it profitable. Forestry as needed at present in Mississippi is very simple. It means chiefly that the land not in cultivation and not likely to be in cultivation

1928

for years to come shall not lie barren and unproductive, but shall be covered with fast-growing trees. In this way the land will improve in quality and will be a source of revenue to its owners, to the counties, and to the State. In 1907 the State Geological Survey requested the co-operation of the Forest Service in a study of the forest resources of Mississippi. The examination was conducted in the southwestern counties, in the longleaf pine region, during November and December, 1907. Forest Service Circular 149, "Condition of Cut-over Longleaf Pine Lands in Mississippi," was issued as a result of this examination.

After the conference of Governors at the White House, in May, 1908, the Forester of the United States Department of Agriculture wrote to the Governors offering to co-operate in a preliminary examination of the forest resources in their respective States. In response to this offer, Governor Noel requested that a member of the Forest Service be detailed to an examination of this kind in Mississippi, and set aside the sum of \$200 to cover in part the expense of the work. The salary of the examiner and his traveling expenses in excess of \$200 were paid by the Forest Service.

The examination on which this report is based was made during October and November, 1909, and as much detailed study was given to each region as the time would allow. The data regarding forest industries and the market conditions were obtained from county officials, lumber men and private owners of timberland. Much information was given by the State Geologist, Dr. E. N. Lowe, and Professor G. L. Clothier, of the A. and M. College. Dr. Eugene Hillgard's report on the geology and agriculture of Mississippi was consulted for descriptions of the forest as it existed before 1860.

GENERAL DESCRIPTION.

Geology and Topography.—With the exception of a small area in the northeast corner, the entire State lies within the coastal plain. The surface slopes gently southward and westward from the Tennessee River hills and the plateau region of the northern part of the State.

Northeast Mississippi is a region of high, abrupt hills. The hard limestone and sandstone rocks of the carboniferous geological period form great outcrops through the region. The ridge dividing the waters of the Tennessee River from those of the Tombigbee has an average altitude above sea level of 600 feet. The broad valley of the Tombigbee River lying west of the Tennessee River hills is commonly known as the Black Prairie. The wedge-shaped Pontotoc Ridge extends from northeastern Alcorn County to central Chickasaw County, and separates the fertile prairie region on the east from the poor, post oak flatwoods on the west. It is characterized by the red soils of the Lafayette formation. West of the Pontotoc Ridge the flatwoods extend southeastward in a narrow strip of gently undulating land to the Sucarnoochee River in Kemper County.

The north central part of the State is a large plateau sloping gently southwestward. Many streams have carved deep, narrow valleys through the unconsolidated materials which form this plateau. Its western border is sharply defined by the high line of loess bluffs which extend in a great inward curve from Vicksburg to Memphis, enclosing the great flood plain of the Mississippi River known as the Yazoo Delta. The whole southern part of the State constitutes the longleaf pine region. Its topography is for the most part very similar to that of the north central plateau. The large streams also flow in deep, narrow valleys, and the small streams are short and have steep gradients. The roughest country lies west of the Pearl River, where interstream areas have a maximum elevation of 600 feet.

Climate.—Mississippi lies wholly within the warm temperate zone. The summers are long and warm and the winters mild, except for occasional short cold snaps. The average growing season for field crops is seven months, while forest trees often grow during eight months. Live-stock can graze in the bottom-land woods during the entire year.

The annual precipitation, which is almost entirely in

the form of rain, averages fifty inches, and is fairly well distributed throughout the year. The heaviest rains occur in January, February and March, when torrents cause a great deal of erosion in the cultivated uplands and flooding and filling of ditches in the lowlands.

THE FOREST BY REGIONS.

Eight forest regions are distinguishable in Mississippi, corresponding more or less closely to the chief geological subdivisions of the State. They are as follows:

1. Northeastern hill region.
2. Black Prairie region.
3. Pontotoc Ridge region.
4. Flatwoods region.
5. North central plateau region.
6. South central region.
7. Yazoo Delta region.
8. Longleaf pine region.

Although in the discussion of the geological formation of the great central plateau this whole area was considered as one subdivision, on account of the covering of brown loam which is found practically everywhere throughout its extent, in the consideration of forest conditions it seemed advisable to distinguish between the northern plateau region and the country lying south of the Yalobusha River and north of the longleaf pine region because of the wide difference in the economical development of these two sections. The former was one of the first regions to be extensively cultivated, while the latter still contains vast areas of excellent timber lands.

1. *Northeastern Hill Region.*—This region includes the eastern portion of Alcorn and Prentiss Counties, the whole of Tishomingo, nearly all of Itawamba, which lies east of the prairie section, parts of eastern Monroe and Lowndes and the northeastern corner of Noxubee. It is best described under a number of subdivisions.

Tennessee River Hills.—The eastern part of Tish-

omingo and Itawamba Counties lie in the oldest geological formation of the State. Here alone has a high-grade building stone been found. This stone and the gravel of these hills are excellent for road building, and will doubtless be exploited for that purpose.

On the Mississippi side of the Tennessee River, which borders the northeast corner of the State, the hills begin only a short distance away, and there is very little bottomland. The original forest of oaks, black walnut, yellow poplar, ash, hickories, sycamore and gums on the immediate banks of the Tennessee has for many years been culled of the merchantable species. The Tennessee hills, which divide the waters of the Tennessee River from those of the Tombigbee, were originally forested with shortleaf pine mixed with post, blackjack and Spanish oaks. In the more fertile situations, as on the low slopes and near the heads of streams, white and red oaks, yellow poplar and dogwood enter into the mixture.

Some portions of the region within eight or twelve miles of railroads have been cut over for from fifteen to twenty-five years. A line of railroad, extending in a southeasterly direction through Tishomingo County, has recently been built by the Illinois Central. It traverses large tracts of virgin shortleaf pine timber land, the greater part of which is held by a few large companies. One company owns 130,000,000 feet of shortleaf pine stumpage in Tishomingo County. This is less than nine years' run with a mill cutting about 15,000,000 feet a year. The largest tract in the region contains approximately 28,000 acres, and is located in eastern Itawamba County along the Alabama State line. The timber on this tract is mainly shortleaf pine mixed with white and red oaks and yellow poplar. It will average fully 6,000 board feet an acre. The land was purchased a few years ago for about \$5 an acre, and the timber alone is now worth several times that amount.

In northern and eastern Lowndes County there are a few very large tracts of shortleaf pine timber land. On one tract of 5,000 acres, where the company which owns the timber has already cut a great deal, it is estimated

that there still remains 10,000,000 board feet. Another large belt of pine land in Lowndes County, a few miles south of Buttahatchie Creek, contains between 3,000 and 4,000 acres. The cut-over hill lands along the eastern tier of townships in Lowndes and Monroe Counties contain large areas of excellent second-growth shortleaf pine.

None of the large shortleaf pine lumber companies are at present operating in the Tennessee River hills, because of the low price of this lumber. The price is kept low because of competition with longleaf lumber from Southern Mississippi and Louisiana, where logging and manufacturing expenses are very much lower than in the shortleaf pine hills of Northeastern Mississippi. A lumberman of Northern Mississippi asserts that shortleaf pine cannot be manufactured profitably while the average price remains, as it is now, less than \$18 per 1,000 board feet.

Bottom-lands of the Tuscumbia River and Yellow Creek.— Fifty years ago the bottom-lands of the Tuscumbia River and Yellow Creek were timbered with excellent white oaks, willow and water oaks, yellow poplar, hickories, ash, cypress, red gum, maple and beech. Being near the Southern Railroad, these lands were exploited from fifteen to twenty-five years ago by stave cutters, who culled the choicest white oaks for tight cooperage stock, and by sawmill men, who cut the finest yellow poplar, ash and cypress. There are only a few scattered tracts on which the timber has never been culled, and these, as a rule, are ten miles or more from a railroad. Nearly all the bottom-land of the Tuscumbia River within Mississippi is subject to annual overflow, and though the land is extremely fertile probably not more than 3 per cent of it is in cultivation. It is possible that at some future time much of this bottom-land will be reclaimed by means of large drainage projects; but undoubtedly the greater part of it will remain wild for a great many years.

Uplands of the Tuscumbia River and Yellow Creek.— The interstream areas of Yellow Creek and Tuscumbia River are for the most part pine hills, from which, in almost

every locality, the virgin shortleaf pine has been cut. This cut-over land, as well as a great deal of farm land which was abandoned after the Civil War, is now, for the most part, thickly covered with second-growth shortleaf. The tree grows very rapidly on old fields; a tract east of Corinth, in Alcorn County, which was in cultivation in 1885, is now being cut over for ties. A yield of 500 ties an acre on second-growth pine land is not uncommon, and the profit is at least 8 cents per tie, or \$40 per acre for such a stand.

Between Corinth and Iuka the Illinois Central Railroad Company has cut a large number of cross-ties from second-growth pine, which, with a preservative treatment of creosote, will far outlast untreated oak ties. This company pays from 20 to 25 cents apiece for pine and gum ties delivered at the railroad right of way, and from 30 to 32 cents apiece for good oak ties.

Bottom-lands of the Tombigbee River.—The original forest on the Tombigbee River bottom-lands contained the same species as that in the bottom-lands of the Tuscumbia River and Yellow Creek, and in addition a great deal of loblolly pine. Near the streams in low, wet situations the gums now predominate, while on the higher and more sandy and loblolly pine forms the bulk of the stand. After heavy cutting loblolly pine reproduces in dense stands, often extending its range close to the streams. Since this tree grows much more rapidly than the hardwoods, and furnishes material for a number of important uses, it offers large returns on land completely stocked with it. Loblolly pine responds readily to increased light, and in large openings, made by the removal of the first growth, it often grows to an average diameter of 18 inches in thirty years.

The best virgin tracts of hardwood timber are on Bull Mountain Creek, where, in some localities, the stand averages 12,000 board feet an acre.

Practically all the timber land along the Tombigbee River and its larger tributaries has been culled of the best white oak and of most of the cypress and yellow poplar.

Hickory has been cut in small amounts for spokes and handles, but there is a large amount left. Red gum is the most plentiful species, and is being cut on a very small scale because of the low price of its lumber.

The largest mill sawing hardwood lumber in the region is located on the Tombigbee River in Monroe County. The company owns several thousand acres of timber land along this river and its tributaries. Much of this land was bought for from \$1 to \$5 an acre; some of it is now worth \$40 an acre. The company also purchases stumpage and buys logs delivered at the river bank. The logs are floated to the mill during the time of high water, in the late winter and early spring.

East of the Tombigbee River, toward the Alabama line, the country becomes quite hilly, and, owing to the poor, sandy soil and rough land, is sparsely settled. Loblolly pine and upland hardwoods constitute the forest. There are many small tracts of excellent white oak, hickory and other hardwoods in this section.

Stave and Heading Operations.—Through most of the region the choice white oak has been largely cut for staves and heading. This early logging was very wasteful, especially in the case of stave cutting. Twenty years ago only the finest staves were cut for tight cooperage. Since the white oak of the uplands is of very much better quality than that of the overflow bottom-lands, it was the first to be exploited, and was taken from all accessible localities. Whiskey and wine barrel staves 36 inches long and pipe staves often 20 feet in length were split in the woods and hauled long distances to railroad points. They were almost always for export to France, Germany or England. Only the finest white oak (*quercus alba*) trees, 30 inches and more in diameter at the stump, were cut. Stumps were invariably cut 3 or 4 feet high. Seldom as much as 12 feet of the trunk was utilized; the remainder usually contained excellent lumber, but was allowed to decay on the ground. Unfortunately this practice in stave cutting still prevails in localities far from railroads, where timber has little present value.

At Corinth and other towns along the Illinois Central Railroad in Tishomingo County are located stave and heading mills, usually of the portable type. These mills either buy oak stumpage and carry on their own logging, or they purchase heading and stave bolts delivered to them or at railroad points. In purchasing stumpage, they usually offer the owner a definite sum for all the oak above a certain diameter; for heading this diameter is usually 16 inches, and for staves 18 inches. A company sends its cruiser to a tract to estimate the number of cords of heading or stave bolts. His estimate is for the company alone, and the owner, unless he is an expert, does not know how much timber he has. Sometimes a company sends as many as three cruisers to a tract, and then buys according to the lowest estimate. When stumpage is bought by the cord the price varies from 60 cents to \$2.25, according to the quality and accessibility of the timber, and companies generally specify in the contract that they shall be allowed a number of years, usually from three to five, in which to remove the timber.

Management.—In general, owners of timber land in this region have not received full value from the sale of stumpage. This is largely because of the fact that few of them are able to estimate closely the amount and quality of timber on their holdings. Within the past few years there has been considerable competition among the buyers of hardwood timber to secure the choice stumpage on virgin tracts. Owners often receive offers from several timber-using concerns, and are puzzled to know which one to accept. For instance, a buyer of logs for a veneer company will offer to pay for the white oak logs of a quality suitable for veneer use at the stumpage rate of \$10 a thousand board feet. But the company will take only sound white oak and cow oak logs 28 inches and larger in diameter at the top ends. For the timber on the same tract a stave man may offer to pay either a fixed sum or on the basis of an estimate at the rate of, say, \$3 per cord. He will cut trees as small as 18 inches in diameter, and will utilize a greater number of trees, as well as a greater amount of

each tree. A third offer may be made by a sawmill owner, who will perhaps cut all species except gum, and will cut trees down to a diameter of 14 inches. He offers to purchase on the basis of an estimate at the rate of \$2 per 1,000 board feet for oak and ash and \$1 for other species. If the owner of the timber is not an experienced estimator and woodsman, he is often at a loss to determine which offer promises the largest returns.

When it is possible to sell the choice trees or the choice, lower cuts of the trees at a high price, the owner should endeavor also to sell the large tops, in order that a profit may be made, if possible, on material which would otherwise be wasted. Often an owner may most advantageously do his own logging and dispose of the products. The choice, large white oak logs may be hauled to the railroad and sold for from \$20 to \$25 a thousand board feet, and the tops of these trees may be worked up into stave and heading bolts or into cross-ties. If a hardwood mill is nearby the remaining merchantable timber may be disposed of for lumber. An owner may cut timber from the same tract annually and realize considerable returns each year. At each cutting he should take out as many as practicable of the injured, diseased and overmature trees. By so doing he will steadily improve the condition of his forest and keep it productive.

Oftentimes timber owners have failed to realize full value from their timber through selling only one particular grade of material, the removal of which caused a decrease in the value of the remaining timber. For instance, one owner on the Tombigbee River was offered \$1,600 for the oak on 300 acres by a heading company, while a veneer company offered him \$10 per thousand board feet for the white oak logs suitable for veneer use. He accepted the latter offer. So few of the logs met the requirements of the veneer company, and so great was the waste, that only 60,000 board feet were obtained, or \$600 worth of timber. The remaining timber cannot be sold for some time, because its value has been so decreased by the removal of the best trees that it will not pay other timber

operators to buy it. If, however, there had been a greater percentage of large, high-grade white oak on this tract, the veneer company would probably have paid more for the timber than heading, stave or lumber companies. It would seem, therefore, to be well worth while for the owners to inform themselves as to the grade of timber, in order that they may dispose of it in the way which will be most profitable.

Owners of second-growth pine land should realize that such land is a good investment, and that if it is given a little judicious care the returns from it can be greatly enhanced. Young stands of seedlings and saplings should be as thick as possible. As they grow older many of the weaker and suppressed trees will be killed out in the struggle for sunlight, and the lower branches of the survivors will die and drop off, giving a long clear length for lumber. When the trees are 20 to 30 feet tall a thinning, which will take out the small-crowned and unhealthy ones, will be of great benefit to those which are left. In this way, by a small expenditure of labor a stand of second-growth pine may be made to yield a high rate of interest on a small investment. Second-growth pine lands are held at values ranging from \$2 to \$5 per acre in this region. Every effort should, of course, be exerted to keep fires out, for even a light grass fire is apt to kill young seedlings.

There is a large number of portable mills and of mills run in conjunction with cotton gins engaged in cutting second-growth pine. They manufacture principally dimension material and planks, for which an average price of \$12 per 1,000 board feet is obtained. Only sap lumber is cut from old-field pine, and the grain is very coarse. Clear boards are highly desirable for interior finish.

At Iuka one lumberman has cut as much as 15,000 board feet per acre on tracts of old-field pine. He is now cutting sawlogs from a tract which was in cultivation thirty years ago. Some tracts have been cut over three times. Each cutting took out all the merchantable sawlog trees. By the removal of these and the consequent

increase of sunlight, the growth of the remaining trees was greatly accelerated.

Fires are less prevalent in the western part of this region than in the eastern part. This is probably due to the fact that the former is more thickly settled than the latter. Wherever stock laws are enforced, and where there are many farms interspersed with woodland, fires are not apt to be so prevalent as in sections where opposite conditions prevail. Farmers are usually opposed to burning the woods where there is risk of destroying fences and buildings. When stock is allowed to graze through the open woods people are more apt to set out fires for the supposed improvement of the range. Throughout the region, however, there are many fires each year, especially in September, October and November.

Fires hinder the establishment and growth of tree seedlings, and thus cause direct loss to the owners of much of the poor hill land, which can grow good stands of short-leaf pine. They also impoverish the soil by destroying the humus.

2. *Black Prairie Region.*—The Black Prairie region is a strip of country varying in width from about twelve miles on the Tennessee border to about twenty-five miles where it passes into Alabama. It extends in a southeasterly direction from the Tennessee border in Alcorn County along the basin of the Tombigbee River, and enters Alabama through Noxubee and northeastern Kemper Counties. The region is bordered on the west by the Pontotoc Ridge and the flatwoods, and on the east by the sandy, rolling and hilly country of the Northeastern Hill region.

The surface of the Black Prairie region is generally level or slightly undulating. The prairies proper form belts with a more or less north and south direction, and are interspersed with narrow hilly tracts on which the soil is light and pale and as a rule very poor.

Very little of the hill land is in cultivation, but it is usually covered with blackjack, post and Spanish oaks, which are indicative of poor soil. These oaks are short and scrubby, and seldom attain saw-timber dimensions.

The woods on the hill areas have been heavily culled for fuel, posts and timbers for local use and for railroad ties.

The soil of the prairies proper is a very heavy dark-colored clay of limestone derivation. The prairies were never extensively forested, but contained small scattered clumps of crab apple, wild plum and honey locust where the underlying limestone is close to the surface, and isolated blackjack and post oaks where the soil is deep. These lands very closely resemble the great prairies of the West, and many of their shrubs and herbaceous plants are also natives of the western prairies.

The bottom-lands of the large streams of the region were formerly forested with fine oaks, hickories, ash, yellow poplar, cypress, red gum and less important species. The best timber has been cut for lumber, staves, cross ties and other materials, until there are very few tracts of virgin timberland left. Some of the best tracts are located on Mantachie Creek, in northern Lee and Itawamba Counties. On Houlka Creek, in Clay County, there is considerable excellent cottonwood timber, and on Line Creek, near Cairo, in the same county, is the largest body of white oak timber in the region, although it contains only about 100,000 board feet. In the part of Oktibbeha County within the prairie region probably the best timber is located in the bottom-lands of Folsom Creek. The bottom-lands of the Oaknoyubee River contain a few tracts of excellent virgin timber. The hickory on a tract of 6,000 acres, estimated to contain 9,000,000 board feet, was recently sold to a spoke company for \$10,000.

The few mills of the region obtain timber chiefly from the hill regions on the east and northwest. There are stave and heading mills at Columbus, West Point, Aberdeen, Macon and a few other towns in the region. They draw oak timber from small scattered tracts within a radius of fifteen miles. The available supply is so nearly exhausted that it is doubtful if, in five years, a single mill of this character will be left in the region.

Management.—Forestry in this region means the improvement of the stands now occupying the hill areas,

and the stream bottoms where annual floods prevent profitable agriculture. The excellent soil of the prairies proper makes the farms among the most prosperous in the State, and these stands are held principally as farm woodlots. There will always be a demand for a large amount of post and pole timber and fuel for farm use, and it is fortunate that these nearby areas, which cannot profitably be cultivated, can be used to supply the demand. As timber in other regions becomes scarce, and as prices advance, the advantages of devoting these hills and bottoms to the growth of timber will be more appreciated, and better care will be taken of the woodlots as a necessary part of the farms.

The improvement of these stands requires first of all protection from fire. So long as fires are allowed to burn the humus and leaf litter, there can be no increase in the fertility of the hill regions. The fires also kill the seedlings and saplings which are the basis of future timber crops, and frequently do some damage to trees of or approaching merchantable size. Fires also make the surface of the ground more susceptible to washing, while the maintenance of a good forest cover exerts exactly the opposite influence. If fires are kept out of the hill forests there will be far less danger of the poor soil washing from these hills to cover the good agricultural land in the prairies. At present forest fires are frequent in the region during drought periods, and the damage from them is severe. This damage is preventable, and it would be for the benefit of the community and of the State to prevent it.

With the danger from fire reduced, it would pay the owners of woodlots, both in the hills and in the bottoms, to improve the quality of their stands. In cutting wood for use on the farm, it is frequently possible to take trees of slow-growing or inferior species, or trees which are partially diseased or crooked. The removal of these would benefit the young, healthy trees of good species and would enable the owner to cut better material or his own use in the future and to obtain higher prices in case he sells timber.

3. *The Pontotoc Ridge Region.*—The Pontotoc Ridge region is a narrow belt of high land ranging from more or less rolling to rather hilly, which forms the divide between the waters of the Tombigbee and Hatchie Rivers on the north and east and the Schoona and Yalobusha Rivers on the west. The soil is limestone and sandstone very largely overlaid by the orange sand or Lafayette formation which gives the ridge its name—the “red hills” country.

The rich red uplands were formerly covered with a fine forest of white, black and red oaks, hickory, yellow poplar, black walnut and black locust, a type found only on very fertile soil. Naturally, this region was cleared many years ago, and all except the roughest situations were placed in cultivation.

The northern part of the Pontotoc Ridge, which is drained by the Hatchie River, is rather broken and contains a large amount of the pine hills forest type. In this part of the ridge, known as the Tippah Hills, there remains considerable good oak, yellow poplar and red gum timber.

Much of the Hatchie bottom-land is subject to long periods of inundation, and is, therefore, unsuited for agriculture. Eventually much of this overflow land will doubtless be reclaimed, but in the meantime it ought to be devoted to the growth of valuable hardwood species, and should be managed on a rational basis of forestry.

Farther south, between the heads of Hatchie and Tallahatchie Rivers, the country becomes more rolling and less broken in character. The virgin forest, which has been mostly replaced by farms, contained a smaller admixture of pines than that farther north, but a greater amount of red and white oaks, yellow poplar and black locust. The virgin hardwood forests of the headwaters of the Tallahatchie have been exploited by stave and heading companies for the finest white oak, by spoke companies for hickory, and by sawmill men for hardwood lumber, until there are very few tracts containing virgin timber. There is, however, a great deal of young, thrifty hardwood timber, which, if cared for, will form the basis for future cuts. There is also a considerable amount of loblolly and short-

leaf pine in this locality. These species reproduce prolifically on cut-over hardwood lands which are not subject to long periods of overflow.

The red uplands which were once farmed extensively have in many places been abandoned because they have been made worthless by erosion. The soil was originally deep and mellow, and when carelessly cultivated on the rolling surface has washed badly. Much of this abandoned land is nearly barren. It ought to be devoted to the production of valuable timber trees. Forest cover on this land would not only stop further washing of the soil, but it would also heal the great gashes that have been cut in the surface, and build up the soil so that, eventually, with careful, scientific farming methods, parts of it might again be used for agriculture. Furthermore, if devoted to tree growth this land would be a source of timber supply for local needs. Before a great many years the timber needed on farms, which is now largely obtained from southern Mississippi, will become very expensive because of the exhaustion of the supply in that region. This dearth in the timber supply is inevitable, and will be keenly felt within fifteen or twenty years.

Planting.—With protection from careless and ruthless burning of woodland through the enforcement of a suitable forest fire law, it would doubtless prove financially beneficial to plant rapid-growing and valuable trees on badly-eroded hill lands. This can be done at a total cost of about \$10 an acre. Planting is being carried on extensively in several middle western States where timber is very scarce and expensive. In some States it has paid well to devote small portions of the finest agricultural land to the raising of tree crops. In Mississippi this is unnecessary, but it will pay to plant lands which are worthless for agriculture and where natural regeneration of valuable species is not possible because of the absence of seed trees.

4. *The Flatwoods Region.*—The Flatwoods region is a narrow belt of level or slightly undulating country lying west of the Pontotoc Ridge and the Black Prairie and east of the hilly region of the North Central plateau. Its usual

width is from three to six miles, though in places it is ten or twelve miles wide. Its southern limit is the Sucarnoochee River in Kemper County. The eastern border of the region as far south as Houlika Creek is sharply defined by the red hills of the Pontotoc Ridge. The northern portion of the western border is less distinct, the Flatwoods in places being associated with the badly washed uplands of Benton and Union counties. In the southern portion, however, the western limit is sharply defined by the high, sandy, Noxubee hills.

The two principal classes of soil within the Fla woods are heavy clays and fine sands, both of which bear the same forest types though they differ radically in their agricultural value. The heavy soil is most prevalent, especially in the southern portion of the Flatwoods. Very little of the region, however, is in cultivation. Farms as a rule are located close to the streams where the soil is more fertile.

In the northern portion of the Flatwoods, the forests consist of scrubby, stunted, upland oaks with some shortleaf pine. South of Houlika Creek loblolly and shortleaf pines predominate in the stand. In low, more fertile situations such as the headwaters of creeks, the pine in the remaining virgin stands is of large dimensions, but this virgin pine, because of the excellent quality of its lumber, has been cut from practically all parts of the region for twenty years, and only occasional small tracts are left. The same is true of the original forest of hardwoods of the stream bottoms. Probably the largest and finest body of hardwood timber within the Flatwoods region is a tract of 6,000 acres on the Schoona River in northern Calhoun and northwest Chickasaw counties. This was bought nineteen years ago for \$1 an acre and was recently sold for \$20 an acre.

In Oktibbeha County and southward the region is forested largely with young loblolly and shortleaf pine, the loblolly forming from 50 to 80 per cent of the forest. These pines frequently grow in such dense stands as to prevent the growth of the oaks which are usually found mixed with them. Usually, however, there is present beneath the

large pines a growth of stunted and limby oaks (post, blackjack, red and Spanish) and hickory. These trees scarcely ever reach dimensions suitable for any use except for cross-ties, posts, or fuel, but they are extensively cut for these purposes. The farmers cut and haul oak firewood to the towns, selling it usually at the rate of \$1 per load. Loads vary in size from one-quarter to one-half of a cord.

Management.—Located close to the fertile, populous prairie region and to other agricultural sections of northern Mississippi, the timber resources of the Flatwoods will be drawn upon increasingly for pine lumber, cross-ties, posts, and fuel. The Flatwoods are pre-eminently suited to the practice of forestry.

Loblolly and shortleaf pine are the trees which should be favored by forest management in this region, since they grow very rapidly and can be used for many purposes. Fortunately, they are abundant, and loblolly is especially aggressive in taking possession of cut-over land. In the southern part of the Flatwoods, the pines are steadily seeding up the land from which the oaks have been removed. Each year loblolly pine produces an abundance of light, winged seed which is widely distributed by the wind. The seedlings grow rapidly for the first few years, soon becoming high enough to escape death from light surface fires.

Thickets of pole size trees may be thinned with advantage to the stand. The time is not far distant when returns will be obtained from the product of such thinnings which will pay for the labor and yield, at least a small profit. These pines need a great deal of sunlight for rapid growth, and respond vigorously when the suppressed trees and some of the large-topped ones are removed from thick stands. Under favorable conditions of light and moisture, pines in this region often grow at the rate of an inch in diameter a year for several years. An average annual growth of from 500 to 1,000 board feet per acre may be counted on in fully-stocked pine stands. With the steadily increasing stumpage values, a growth even of 500 board feet per acre will, within a few years, mean the addition of from \$1 to \$2 to the value of each acre every year.

In the northern portion of the Flatwoods, where the upland hardwoods predominate in the stand, forest management is a simple matter of selection. The old, slow-growing, and diseased trees should be removed so that the young ones may have ample sunlight and grow rapidly. The better kinds of oaks should be favored through heavy culling of the less valuable trees.

The item of chief importance in the management of the forests of this region, particularly of the pines, is the protection of the young stands from fire. Every year during the dry autumn months, practically every acre of woodland is burned over at least once, and often two or three times in the same season.

Market Conditions and Land Values.—There are many portable sawmills and cotton-gin sawmills in this region working in loblolly and shortleaf pine. Pine stumpage usually sells for \$1 per thousand board feet, and land covered with second-growth timber of saw-log size can be purchased for from \$5 to \$10 per acre. The pine stands average about 5,000 board feet per acre. As a rule, the lumber manufactured in the Flatwoods is not graded, and mill men seldom attempt to improve the grade by careful sawing. The lumber is sold locally or shipped short distances to points within the State. The usual price is \$12.50 per thousand feet, f.o.b., though it is sometimes as low as \$10. The oaks are chiefly cut for cross-ties, which sell at an average price of 32 cents apiece.

5. *North Central Plateau Region.*—The north central plateau region comprises the country between the Flatwoods on the east and the Yazoo Delta on the west. It slopes gently southward to the Yalobusha River.

The chief soil of the region is a yellow or brownish-yellow loam, known as the Columbia loam, which varies in depth from a few inches to several feet, with an average depth of 3 feet overlying the orange sand of Lafayette formation. Because of its exceeding fertility and because it occurs in a region of high land and healthful climate, it was among the first soils of the State to be widely cultivated. It was especially suited to cotton culture. For many years

previous to the Civil War, this region was the most prosperous in Mississippi, and the plantations were often of large size.

Where the loam soil is underlaid with loose sand, as between the headwaters of Wolf and Hatchie Rivers, the washing has been especially rapid and disastrous. The exposed sand is carried down and deposited during flood periods on the fertile bottom-lands, many thousand acres of which have been rendered worthless by this sterile covering. On large areas, from which the mantle of brown loam has been washed away and the orange sand gullied, the appearance is that of miniature barren mountains with sharply serrated ridges and steep narrow ravines and valleys.

In the northern part of the region the original forest on the better upland soils consisted of red, black, post, Spanish, and blackjack oaks, and hickory of rapid growth and large size. This fertile land was cleared early for farm use. The poorer upland soils, in which the orange sand either appeared on the surface or was mixed to a considerable degree with the surface loam, produced the same species, but their stunted appearance plainly denoted soil of inferior fertility. These soils, therefore, have never been cultivated extensively.

There is very little shortleaf pine north of the Tallahatchie River in the tableland region, but southward from this river in Lafayette County, as the hills become rough and more broken, and the ridge soils very sandy, pine occurs with increasing abundance.

The hills extending north and south through Lafayette, Yalobusha, Calhoun, and Grenada Counties, a few miles east of the Illinois Central Railroad, are forested mostly with shortleaf and loblolly pine, accompanied by the usual upland oaks which are seldom large enough for saw-timber. The major part of this hilly country is too rough for cultivation, but the fertile lower slopes and bottom-lands are farmed extensively. The virgin pine has been almost entirely cut from these hills, and there are only occasional small patches left. One of the largest in Lafayette County contains only 400,000 board feet.

There is, however, a vast amount of young second-growth pine, which has come in on the old cut-over areas. A great many small, portable mills are now operating in second-growth timber. The lumber is rough because of the knotty and sappy timber and careless methods of sawing, and is, for the most part, used locally.

The worn-out and badly eroded fields in the southern part of the plateau region very frequently become covered with stands of old-field pine. These lands can be put to no better use, for a forest cover prevents further erosion and keeps the land productive. They should be protected from fire and the timber harvested in such a way as to insure the continuance of a healthy forest cover.

The narrow line of bluffs which border the Yazoo Delta are, in most places, too hilly and rough for cultivation. Their average elevation above the Delta is about 200 feet, and the streams, flowing into the Delta, have cut deep, narrow ravines through them. The soil is a deep, fertile loam containing a great deal of calcareous silt. The finest of yellow poplar, basswood, red gum and white oak have been obtained from these bluffs. The white oak was especially prized for ship-building and, before the civil war, thousands of trees were cut for this purpose. Though the best of the timber has been taken from the bluff section, there still remains a great deal of excellent hardwood timber. A common practice among lumbermen is to operate in the Delta close to the bluff region until the winter rains make logging there impracticable, when they transfer their operations into the high, well-drained bluffs.

Planting.—The worn-out hills of the northern portions of the north central plateau region are in many localities too steep and badly eroded to permit agricultural development. With care, however, trees can be made to grow on such sites. Pine is especially adapted to poor, sandy soil. It is remarkable how rapidly a forest cover will stop the washing of the soil and smooth over the gullies with a deep layer of humus and litter. Fields on which erosion is not too far advanced might, after a few timber crops have been harvested, be again cleared for cultivation.

Before planting can be undertaken, however, owners must have reasonable assurance of fire protection. They will not expend from \$8 to \$10 an acre in planting when there is a strong possibility that the young trees will be destroyed by fire.

6. *South Central Region.*—The south central region includes the portion of central Mississippi lying between the north central plateau and the longleaf pine region. The greater part of this region, as has been pointed out, lies in the same geological division as the north central plateau. It is desirable to distinguish between these regions chiefly because of the difference in their economic development. The north central plateau is an old agricultural section, while a large part of the south central region is covered with forest growth and has never been in cultivation. The western boundary of the south central region is the Yazoo Delta, and its eastern boundary the Flatwoods and the Alabama border. The southern portion includes the Jackson prairies, a rolling country forested in places with hardwoods and pine, but for the most part under cultivation. North of the Jackson prairies the drainage is toward the Pearl River, while southward the streams contribute to Strong, Leaf and Chickasahay Rivers.

In general, this region is rolling, though in many sections the surface is broken or even hilly. The light loam soils prevail as in the north central plateau.

There is a great deal of high ridge land where the soil, a deep, light sand, is liable to erode badly if cleared of forest cover. An example of this is found on the ridge lands in western Kemper County, where the sandy soil is not underlaid by a retentive stratum of hardpan. Erosion in these localities is ruinous to the adjacent bottomlands upon which the sand is deposited, and many fertile fields have been rendered worthless for all time. These sandy hills ought always to be covered with forests, which will help to prevent erosion, and the owners of such land should be shown the necessity for such forests. When protection from fires is assured and the forests are managed

conservatively, this land will become a source of continued revenue.

The bottom-land soils of the Pearl River and its tributaries, as well as of many other streams in the region, are light and sandy, being derived from the sandy hills of the region. The bottom-lands are, as a rule, subject to annual overflow, and therefore a very large part of them is still forested, although most of the finest white oaks have been cut for staves.

The prevailing type in the uplands consists of loblolly and shortleaf pines mixed with post, blackjack and Spanish oaks. On the lower, more fertile slopes red and black oaks enter into the mixture. The bulk of the hill land has been culled of the virgin loblolly and shortleaf pine timber, though in Leake, Neshoba, Winton and Kemper Counties there are large tracts of original pine forest. Probably 75 per cent of the upland type has been cut over. The bottom-lands of the Pearl, Yalobusha, Schoona and Big Black Rivers, on the other hand, contain thousands of acres of the finest hardwood timber, those of the Big Black River having been cut over somewhat more extensively than the others.

One company which operates a large mill in Neshoba County has 44,000 acres of timber land extending along the bottoms of the Pearl River and its tributaries. Forty per cent of the timber is hardwood and the remainder pine. The pine is chiefly loblolly, the most favorable site for which is on the sandy hummock soil near the outskirts of the overflowed areas. Loblolly pine in this region is particularly fine, and contains a large percentage of the upper grades of lumber. When grown in the thick forest there are often six or seven 16-foot 'ogs in a tree.

Three other companies, not operating now, own between 90,000 and 95,000 acres altogether, chiefly of hardwood lands, in Leake, Neshoba and Winston Counties. One company owns practically all of the hardwood timber land on Pearl River for a distance of about thirty miles above Jackson.

Along the Pearl River there are virgin timber lands

extending for a distance of fully eighty miles above Jackson, and as this land is controlled almost altogether by a few large lumber companies there is an absence of the small portable mills so common in most parts of northern Mississippi.

One of the best tracts of virgin pine is located in the northwestern corner of Neshoba County. It was purchased a few years ago for \$4.50 per acre. The land is too hilly to clear for farm use, and the owners intend holding it for the production of timber.

Another tract of excellent virgin timber is located in the southernmost township of Choctaw County, and contains 1,000 acres. The average stand of pine and oak on this tract is 8,000 board feet per acre.

In Winston County three companies own approximately 60,000 acres of timber land. The land is very hilly and for the most part covered with loblolly and shortleaf pines. The stand averages 3,000 board feet of pine and 1,500 board feet of oaks and other hardwoods per acre.

One of the chief reasons that the region immediately north of the Jackson prairies contains so much virgin timber land is that only within a few years has a railroad passed through it. There was very little activity in the sawmill business in Newton, Neshoba and Winston Counties until the advent of the Mobile, Jackson & Kansas City Railroad. Choctaw, Webster, Montgomery, Carroll and Holmes Counties, on the other hand, contain very little virgin timber land, and the holdings are of small size and owned by farmers.

The largest mill in Choctaw County cuts an average of 20,000 board feet a day of yellow poplar and oak logs, shipped from nearby points along the Southern and Mobile, Jackson & Kansas City Railroads. Although the company is able to obtain all the logs needed now to keep the mill running at full capacity, it will probably not be able to do so many years longer.

Market conditions and Stumpage Values.—Practically all the the yellow poplar has been cut within a distance of from 8 to 12 miles of the older railroads in the region. The

price paid for yellow poplar logs delivered at the railroad varies according to the quality of the timber from \$8 to \$20 per 1,000 board feet.

There are many stave mills along the railroads, which cut the timber from small holdings. Companies usually buy the stumpage or purchase stave bolts at the mills. The usual stumpage price for oak is \$2 per 1,000 feet; for stave bolts delivered at the mills, the prices are \$5 per cord for red oak and \$8 for white oak. Many thousand carloads of choice white oak staves have been shipped from the region for export to Europe. Occasional small tracts as far as 30 miles from a railroad are even yet exploited for staves. High prices are paid for these choice staves, but the waste in cutting them is so large and the expense of marketing so great that only meager profits are obtained.

Veneer companies generally secure the best oak and poplar timber from small tracts.

There is considerable hickory in the bottom-lands of the streams, but the spoke companies have bought most of it that is good hickory and accessible to the railroads. One spoke company recently purchased the hickory suitable for spokes and wheel rims on two tracts of 1,000 and 800 acres on the Big Black River, paying \$1,400 for the timber on the former and \$800 for that on the latter. From the largest tract 225,000 spokes were obtained and from the smaller 140,000 spokes. The value of spokes delivered at the railroad is \$16 per 1,000.

The average value of first-class virgin loblolly and short-leaf stumpage is \$2 per 1,000 board feet, while second-growth sap pine can usually be purchased for \$1 per 1,000 feet.

7. *Yazoo Delta Region.*—The Yazoo Delta region, the great alluvial flood plain of the Mississippi River, covers an area of about 6,000 square miles. Its eastern boundary is the line of high bluffs which form the border of the north central plateau. The topography of the region is remarkably level, the highest lands being the immediate banks of the streams. There are a great many large, sluggish, and

meandering streams and numerous bayous, sloughs, and lakes.

Before the completion of the levees along the Mississippi River, the entire region was a wilderness unpenetrated by roads and having no towns except along the river and at the inland border of the high bluffs.

The delta country was acquired by the State of Mississippi under the Swampland Act of September 28, 1850. Before the settlement of the region, thousands of the finest cypress trees growing along the lower water courses were annually cut and floated out. The timber was considered as having no value then and State authorities made little attempt to stop this cutting.

With the reclamation of the greater part of this vast fertile country, the land was rapidly cleared for agriculture. The State was anxious to have the country developed as soon as possible, and by selling the land very cheaply encouraged pioneers to establish homes. The first lands were sold for the accrued taxes, which amounted usually to a sum not exceeding 25 cents per acre. The Yazoo & Mississippi Valley Railroad Company bought about 700,000 acres from the State for from 7 to 14 cents an acre. After it had built a railroad through the country, the company began selling the land at very low prices in order to encourage settlement. The first lands were put on the market at \$1.25 per acre. To-day many tracts of this land containing virgin timber are worth \$50 an acre, and only occasional small areas are for sale.

An estimate on 49,000 acres in the eastern part of the delta shows an average stand of 7,000 board feet per acre. Red and tupelo gum form a little more than 50 per cent of the stand. The other species, in the order of their abundance, are red, white, and overcup oaks, elm, cypress, ash, pecan, hickory, and miscellaneous species such as cottonwood, maple, and birch. This estimate probably represents the best forest conditions existing in any section of the delta. An estimate on a tract of similar size within Sharkey and Washington Counties showed an average stand of only 4,000 board feet per acre.

On areas between the Mississippi River and the levees the species of greatest commercial importance is cottonwood. The best stands of cottonwood contain from 10,000 to 15,000 board feet per acre, while a stand of 6,000 feet is generally considered good. Lumber and box companies seldom cut cottonwood trees smaller than 25 inches in diameter after logging operations.

Reproduction in the delta is generally unsatisfactory. The failure of the forest to reproduce more rapidly is not due to a lack of seed production, but very largely to long periods of inundation at the season of the year when the seed should be germinating. Lumbering creates ideal conditions for regeneration, but these conditions are also favorable for fast-growing shrubs and weeds so that promising seedling stands are often choked out on cut-over lands. In many localities a dense growth of cane retards reproduction. The reproduction following lumbering operations is often composed mainly of undesirable species, owing to the lack of seed trees of the valuable species.

The delta probably suffers less from fires than any other forest region in the State. During the dry summer and autumn months, extensive fires are prevented by the abundance of green growth, and during the winter season the ground is too wet. During prolonged periods of drought, however, fires are frequently started by sparks from engines and by careless hunters and campers, when young gum and ash suffer badly because of their thin bark. When fires burn in old logs and debris piled against large trees, great scars are made which afford places of attack for worms and decay.

Management.—It is the general opinion among large timber land owners and sawmill operators in the delta that during the past fifteen years fully 30 per cent of the merchantable timber has been cut. Probably half the cut-over land has been placed under cultivation. Upon the remainder of these cut-over lands practically all the red and tupelo gum timber has been left. Most large operators intend to go back over the old cutting areas and log the timber which was unmerchantable at the time of the first

cutting. The minimum diameter to which the oaks and other valuable species are cut is 16 inches breast high. Gum, when cut at all, is seldom taken below 20 inches in diameter.

It will be seen, therefore, that a great deal of timber is left standing after the ordinary logging operations. A few companies with large holdings have adopted the policy of closer utilization of wood material by a varied output of products. For instance, one large company in Tallahatchie and Quitman Counties, besides sawing lumber, cuts material for wagon manufacture, operates a box factory and also a factory for producing dimension furniture stock. This company cuts practically all trees to a diameter of 12 inches.

The greater part of the lands of this company are valuable for agriculture. Instead of selling in small tracts, as many companies do, it holds the farm lands and grows field crops upon them. Last year several hundred bales of cotton and a great deal of sugar cane and corn were produced. The absolute forest land along sloughs and bayous belonging to the company and to individuals who are pursuing a like policy of managing their cut-over lands should be handled under a careful system of forest management.

While probably at least 80 per cent of the delta will eventually be reclaimed for farming use, it is likely that a large percentage of swamp land will not be fit for agriculture for several decades. In large drainage projects plans are seldom made to reclaim all the land within the district to be drained. The cost would in most instances be prohibitive under present economic conditions. When land values warrant very costly drainage systems, they will be constructed. The land which will never be placed under cultivation includes cypress sloughs and the land between the levees and the rivers.

It is not improbable that with the inevitable decrease in the supply of hardwood timber in the future, people will find it profitable to plant valuable species, to a limited extent, on high-priced agricultural soil. For the present,

however, forestry in the delta must be confined to those lands for which there is no prospect of sale for agricultural purposes.

Conservative forest management aims to encourage the most valuable species. Since in the delta region undesirable trees occupy ground space on which the best trees should be growing, and, by their shade, check the growth of the valuable trees, one of the most important aims in forestry is to reduce the reproduction of the less desirable or weed trees. In logging operations in the situations unfit for future agricultural use, the less desirable trees should be cut to the smallest diameter limits at which they can be handled profitably, while provision should be made for the reproduction of the valuable species by leaving thrifty seed trees scattered over the cutting areas. Much of the suppression of young trees through too dense shade can be overcome by judicious thinnings and improvement cuttings.

The localities in which forestry will probably pay better than agriculture are (1) sandy ridges now covered chiefly with sycamore and (2) lands in the sloughs along the rivers and bayous covered by water for many months of the year. The thin, silty soil covering the sand ridges will produce fair agricultural crops for a few years, but then becomes exhausted. It is excellent forest soil, however, for trees are not dependent on the thin top layer of soil for nutriment, but send their roots deep into the subsoil. With the coming shortage of hardwood timber and the consequent high stumpage values, land of this character containing fast-growing oaks, yellow poplar and white ash cannot fail to yield its owners reasonably large returns. Most of the sloughs would be difficult to drain, and very little of the badly-inundated lands will be reclaimed for many years. Cypress usually occupies such situations, and gums will also grow on the outskirts of the cypress ponds, where better drainage conditions prevail.

Cottonwood is undoubtedly the tree to be favored in the region between the levees and the river, since it grows very rapidly, reproduces naturally and abundantly, and

is uninjured by long periods of inundation. Its wood is valuable for many uses. With plenty of sunlight and deep mellow soil, cottonwood will grow at the rate of an inch a year in diameter for about the first ten years. It may be cut for saw-timber at an age of about thirty-five years, when the trees will have an average breasthigh diameter of 24 inches. To obtain the best results in the management of cottonwood stands, thinnings are advisable when the trees are about ten years of age. The material removed by this thinning will in most instances be too small for use, but the expense of the work will be more than offset by the future benefit to the stand. When the trees are fifteen or twenty years old there should be a second thinning, to leave the largest and healthiest trees standing about fifteen feet apart. After these thinnings the stand will grow very rapidly. The material removed by the second thinning can be utilized for pulpwood, match manufacture and other purposes.

Growth studies of oaks, hickory, ash, red gum and cypress show that these species can be grown to an average breasthigh diameter of 20 inches in from forty-five to fifty years in the delta region.

The chief points of forest management in the Yazoo delta may be summarized as follows:

1. The sandy ridges now chiefly covered with sycamore and the swampy areas which will not be reclaimed for agriculture should be kept as forest lands.
2. These lands should be devoted to the valuable trees, and so far as is practicable the undesirable trees should be removed in logging operations.
3. Rapid growth of young stands should be induced by improvement cuttings and thinnings.

Ownership and Values of Land.—In the Yazoo delta the large areas of timber land where there are very few farms are, for the most part, controlled by large lumber companies. It has been the policy of these companies to buy up all the good timber land which could be obtained, cut the valuable species, such as the oaks, cypress and ash,

which can be handled profitably now, and hold the gums and other inferior trees for future operations. One company owns 150,000 acres in Washington and Sharkey Counties, and another owns 50,000 acres in Tallahatchie and Quitman Counties. Several other companies own from 5,000 to 20,000 acres apiece. There are no longer any tracts as large as 2,000 or 3,000 acres on the market.

The value of timber land depends upon its accessibility, the quality and amount of the timber, and the value of the land for agriculture after the timber has been cut. The best timber land can seldom be bought for less than \$20 an acre, while much of it can not be bought for less than \$50. Land covered with an ordinary stand and situated eight or ten miles from a railroad is worth about \$20 per acre. The value of timber land has increased enormously in the past few decades. In Yazoo County there are several tracts ranging in area from 3,000 to 20,000 acres which were purchased shortly after the completion of the Mississippi River levees for an average of ten cents per acre. Most of this land is now worth at least \$20 per acre. A company recently refused an offer of \$25 per acre for the 16,000 acres of land which it purchased two years ago for \$18 per acre.

Small mills which pick up scattered small tracts of stumpage are often able to purchase at very low prices. In Sunflower County a millman is cutting choice cypress and oak logs for which he paid \$10 per thousand board feet, delivered at the mill. For poorer logs of these species he pays only \$5 per thousand feet. The owners of this stumpage are receiving little more than half its value.

Cottonwood stumpage above 28 inches in diameter, breast high, sells for from \$5 to \$7 per thousand feet in accessible localities. Twenty years ago timber of the same quality could be purchased for twenty-five cents per thousand. It was used then only to float heavy logs of the valuable hardwood species.

Although the tax rate in the delta is higher than in other regions, the assessments on timber land are not excessive. In addition to the regular State and county levy of from \$1.30 to \$1.80 on a \$100 valuation and the general levy of

twenty-five cents on \$100 for the maintenance of the Mississippi River levees, there is an acreage tax on land in the various special drainage districts which usually amounts to seven or eight cents per acre per annum.

8. *Longleaf Pine Region*.—This is the most extensive as well as commercially the most important forest region in the State. Its western boundary is formed by the narrow loess hill or bluff section bordering the flood plain of the Mississippi River. Its northern boundary extends across the State from the vicinity of the loess hills in Claiborne County through Copiah, Rankin, Smith, Scott, Newton, Lauderdale, and Kemper Counties. Southward it continues into Louisiana and to the Gulf of Mexico.

The region is uniform in soil and vegetation, but is somewhat varied in topography. The greater part of it is gently rolling, but west of the Pearl River much of the land is extremely hilly. The rolling pine uplands of Alabama continue into the eastern counties of Mississippi often for a distance of several miles. West of these uplands there are frequent extensive plateaus which are level or gently undulating. A narrow strip of country bordering the Gulf consists of level, sandy plains.

The Lafayette formation of orange-colored sands and clays is common throughout the entire region. This formation is usually overlaid by a yellow sandy loam, while the soil overlying the loam is generally a fine, grayish-white sand. In places the light, sandy soil covers the loose orange sand directly, resulting in land of poor quality. Cultivation on these sandy lands is apt to have ruinous effects, for, when exposed, the orange sands will wash and gully badly.

The forests of the longleaf pine region may be divided into a large number of types according to the topography, soils, and various other influences. In this report, however, only the prominent features will be described under the three following types:

1. Piney woods type.
2. Mixed pine and hardwoods type.
3. Bottom-land type.

Piney Woods Type.—This type occupies fully 75 per cent of the longleaf pine region. The stream bottoms, the belt of hills bordering the lowest bluff section in southwest Mississippi, and the narrow transitional belt of mixed pine and hardwoods along the northern border of the region constitute the other types. In this type longleaf pine grows in practically pure stands. While requiring plenty of sunlight it thrives on soil containing very little plant food. It occupies the ridges and low tablelands, but never the swampy areas. At the borders of its range in moist localities it grows very slowly and never reaches the dimensions attained on the dry upland situations. Isolated black gum and dogwood trees are usually found in the piney woods, and low, brushy post and blackjack oaks are almost invariably present. The oaks are most noticeable in openings, and where large clearings have been made by logging operations or hurricanes, they soon claim the ground in thick stands.

The mature forest of longleaf pine is park-like in appearance. The trees are tall and cylindrical and free from branches to an average height of 40 or 50 feet. There is practically no reproduction and the forest floor is usually bare of shrubby growth. Grass, however, covers the surface, often forming a close sod.

The average stand of longleaf pine varies with localities and according to the damage from turpentine, fires, and windstorm. While the finest trees and the largest stands on small areas are found in parts of the hilly interior section, the heaviest stands over extensive areas occur near the Gulf coast. As a result of turpentine and the subsequent burning of the land a large amount of timber has been destroyed. The pitchy boxes burned deeply, and many trees were so weakened at the stumps that they were easily blown down. The turpentine timber also suffered greatly from the attack of bark beetles. On a tract of several thousand acres near the Gulf where all the timber has been boxed, the average stand per acre is 6,000 board feet, while on another extensive tract in the same section where turpentine has not been practiced, the average stand contains between 9,000 and 10,000 board feet per acre.

After logging operations on longleaf pine lands, loblolly pine often regenerates extensively. This is due chiefly to its large annual production of seed and to its rapid height growth at the start, which enables it the better to get beyond reach of fires. Experience has shown that young pines are not usually destroyed by fire after they have reached a height of about 12 feet. Longleaf pine, on the other hand, produces a seed crop only at intervals of from four to eight years, and its height growth is very slow during the first four or five years. The odds, then, are clearly against the longleaf, notwithstanding that its seedlings are more fire-resistant than the loblolly. Hogs also destroy a great many longleaf seedlings by digging up and eating the tender roots.

Windstorms do the most serious damage to standing trees in the longleaf pine forest. This is especially the case near the Gulf coast. In September, 1906, owners of forest land in the southeastern part of the State suffered enormous losses from wind-thrown timber. From 30 to 90 per cent of the merchantable timber was blown down on a strip of country about 50 miles wide and 150 miles long. Fortunately, the storm occurred in the fall, a season when insects and fungi do not work in fallen timber. The owners, therefore, had six or seven months in which to work up the wind-thrown trees, and probably 30 per cent of the timber was saved. A heavy storm during the autumn of 1909 caused a great deal of loss in the southeastern part of the State. This storm was most destructive in Louisiana.

Mixed Pine and Hardwoods Type.—This type occurs along the western and northern borders of the piney woods. In southwest Mississippi it extends from western Amite and eastern Wilkinson Counties through central Franklin and southwestern Copiah Counties. On the north it is found in a narrow strip of country which is transitional between the piney woods and the shortleaf and loblolly pine uplands of the south central region.

West of the Pearl River the country occupied by this type is usually rolling, though in some sections the surface is extremely hilly. The level portions have long been under

cultivation, but the abrupt slopes and narrow ravines are still covered with forest growth.

On the upper slopes and ridges longleaf and shortleaf pines predominate, mixed with upland hardwoods and some loblolly pines. On the lower, more fertile slopes, the pines give place to oaks, hickory, ash, and sweet gum. Longleaf pine steadily becomes less abundant toward the west until in the loess bluff country, bordering the flood plain of the Mississippi River, it disappears altogether. The best stands of shortleaf in the type contain from 8,000 to 12,000 board feet per acre, while an average would be from 5,000 to 7,000 feet.

The original forest in the loess hills was composed entirely of hardwoods. Since logging operations began, loblolly and shortleaf pines have extended their range into these hills, and most of the old fields are now covered exclusively with these trees. The soil of these hills is very fertile and the level portions were among the first lands in the State to be cultivated. The forest cover now, therefore, is confined chiefly to the very steep slopes and narrow ridges. Practically all of the virgin timber has been cut except in the most inaccessible locations, but cut-over areas have generally grown up with thrifty young timber.

At the northern border of the longleaf pine region the surface is usually rolling, but in no place is it as hilly as in the country bordering the piney woods on the west. Longleaf occurs in more or less isolated tracts on the high, sandy flats and ridges. It is usually accompanied by shortleaf pine and a small admixture of oaks, hickory, and sweet gum. The forest of the lowlands is comprised of hardwoods and loblolly, shortleaf, and spruce pines. The soil of the lowlands is usually a loam of considerable fertility, while the ridge soil is almost invariably light and sandy. The steep slopes and ridges, when tilled, often become badly eroded.

Bottom-land Type.—The bottom-lands of the larger streams of the region often contain two distinct soil and forest types. In many localities, close to the rivers, the surface is covered with water for several months of the year. Only species able to endure wet conditions can exist

here. Cypress is the prominent tree of the type and is usually accompanied by sycamore, ash, and tupelo gum. On the higher, better-drained hummock lands or second bottoms, the stand is composed of loblolly and spruce pines, water willow, and cow oaks, sweet gum, magnolia, and beech.

The estimate on a tract of 20,000 acres of virgin timber land in the bottom-lands of the Pascagoula River in Jackson County shows an average stand of 8,000 board feet per acre. Tupelo and red gum are about equal in numbers, and together form 70 per cent of the stand. The oaks are not so abundant or of as good quality in the river bottoms of southern Mississippi as in those of the northern part of the State. Extensive cane brakes in the bottom-lands afford excellent pasturage for cattle during the entire year.

The forest of the river and creek bottoms of southern Mississippi differs from that of the Mississippi River flood plain chiefly in the absence of willow and cottonwood and in the presence of loblolly pine. Tupelo and red gum form a much greater percentage of the stand in the bottoms of the interior rivers and creeks than in the delta forest.

A great deal of bottom-land forest is included in the holdings of the large lumber companies, but very few of these companies cut hardwood lumber. As in all other parts of the State, the finest cypress, yellow poplar and white ash trees have been cut and floated down the rivers to the mills, and much of the best oak has been taken for stave and heading manufacture.

General Economic Conditions.—When the great white pine forests of the northern States began to be exhausted many lumbermen went south to the yellow pine forests and acquired extensive holdings. As a result the greater part of the timber land in southern Mississippi is controlled by large lumber companies, and the lumber is cut almost entirely in large mills. Before the advent of these lumbermen this land had been held chiefly for grazing and the production of naval stores, and the value of the timber was

not considered. The land was, therefore, sold at very low prices. Twenty years ago large tracts covered with the best timber were sold for from 50 cents to \$1.50 per acre. This land is to-day valued at from \$20 to \$40 per acre, according to its location. Within a few years southern Mississippi has developed from a great, sparsely-settled forest region, where turpentine and stock raising were the chief industries, into one of great commercial activity.

A few years ago, when lumber prices rose rapidly, many small sawmills were established along the Alabama & Vicksburg Railroad. Their owners purchased timber on the small holdings close to the railroad. This supply soon became exhausted in most localities, and the mills have disappeared. Many portable mills are now operating from four to eight miles from the railroad. The lumber is hauled by ox and mule teams to the railroad for shipment. As a rule, owners of portable sawmills employ very wasteful methods of logging, because, with their simple mill equipment and comparatively high logging and manufacturing expenses, they can afford to market only the high-grade material. Their unnecessarily wasteful logging methods often incur for them a direct financial loss. They leave in high stumps and large tops from a fourth to a third of the actual amount of timber cut. The large companies, on the other hand, log much less wastefully. Stumps are not cut higher than 14 inches, and all trees are utilized into the tops to a diameter of 8 inches.

West of the Pearl River the lumber industry was developed many years ago, and is now rapidly declining. East of the Pearl River, however, in almost every county the lumber industry is flourishing, and the forests are being cut very rapidly. Large lumber companies, owning as much as 250,000 acres distributed through several counties, have established one or more mills in places most accessible to their holdings and with good shipping facilities.

In Clarke and Wayne Counties, which are traversed by the Mobile & Ohio Railroad, lumbering has been carried on much longer than in any except the Gulf Coast counties and the counties traversed by the Illinois Central Railroad

west of the Pearl River. The greater part of the timberland in Wayne County is held by one company, whose lumber output averages 75,000,000 board feet per year. The company has been operating for eighteen years, and owns a great deal of cut-over land. Practically none of this land has been sold for farm use, though the company is anxious to dispose of it at low prices. At present the land is virtually unproductive. It affords only a meagre amount of grazing. The reproduction of pine has been impossible, owing to the frequent summer and fall fires. Undoubtedly this land will eventually be largely placed under cultivation, but until changed economic conditions render its use as farm land profitable, it ought to be producing wood crops. If the land had been given fire protection it would to-day be covered with a healthy growth of longleaf pines, many of which would be large enough for cross ties, piling and telephone poles.

The largest company operating in Clarke County controls about 300,000,000 board feet of stumpage, which will last ten years at the present rate of cutting. This company, and most other large companies of the region, purchase a considerable amount of stumpage in small bodies, as their logging railroads penetrate outlying districts.

Most of the timber in Clarke and Wayne Counties was boxed many years ago for turpentine. This class of timber has suffered greatly from windstorms and insect injuries. A great deal of waste is incurred in its utilization, for the butt logs are often left on the ground and stumps are invariably cut very high. Large lumber companies do not now box their trees in these counties.

Three large companies have mills at Laurel in Jones County, and they, together with two other companies which have mills in other parts of southern Mississippi, own most of the timber in Jones, Jasper, Smith and Covington Counties. The estimate on about 150,000 acres belonging to one of these companies shows an average stand of 10,000 board feet per acre. A great deal of the cut-over land of this company has been recently placed

in cultivation, with excellent success. The same company has already sold 10,000 acres for from \$3 to \$5 per acre, and has recently placed another block of 25,000 acres on the market at \$7.50 an acre, which is being rapidly sold. The country is for the most part gently undulating, but contains much hill land where many slopes will never be cultivated. With the development of this section into a populous farming country there will be need of woodlots to supply the farm with fuel, posts, poles and other materials. In logging on these steep slopes and narrow ridges lumbermen would do well to leave several healthy pines for seed trees. With protection from fires, these lands would soon become fully covered with young longleaf pines.

Northern Greene County contains unbroken forest cover over many townships. The timber land is practically owned by less than half a dozen lumber and investment companies. Along the line of the M. J. & K. C. Railroad, which was recently built from Hattiesburg to Mobile, almost all the timber within a few miles of the right of way has been cut. During the first few years after the completion of this railroad, a great many small mills were engaged in cutting the timber held in small bodies by the farmers. Meanwhile the lumber companies bought all the available large tracts of timber, and as soon as the owners of small mills had cut a short distance away from the railroad they came to the holdings of the big companies.

In south Greene County, a considerable amount of the level land is in truck farms, and it is probable that this industry will be extensively practiced within a few years. The best improved farm land is valued at from \$100 to \$150 per acre. Much of the land in the eastern part of the county, however, is exceedingly hilly and will probably not be used for agriculture for many years. In Greene, Perry, Jones, and Wayne Counties a few investment companies own more than 200,000 acres of virgin timber land. A great deal of this land was bought for \$1.25 per acre fifteen years ago, and is now valued at from \$15 to \$30 per acre.

A company owning the largest mills in Lamar and Forest

Counties controls 300,000 acres of timber land, of which 40,000 acres are stump lands. In common with other large timber land owners, this company has had under consideration various plans for handling cut-over lands. They desire to sell all that is suitable for agriculture, but thus far have been able to dispose of only a very small portion of the stump land. It is the usual type of longleaf pine uplands. The soil contains little plant food, but it is usually capable of being built up by careful scientific methods of farming. Eventually, the greater part of it will probably be used for farms, but in the meantime these lands ought not to remain unproductive. If the lands were protected from fire for a period of ten years, it is safe to say that fully fifty per cent of them would be completely stocked with healthy young tree growth.

With the advent of the Gulf and Ship Island Railroad a great many mills sprang into existence along its route between Hattiesburg and Gulfport. Within a few years all of the merchantable timber within sight of the right of way was cut and most of the small mills had disappeared. A small number have located a few miles from the railroad, but most of the available timber has been cut and only the great tracts belonging to the large companies remain.

In the counties bordering the Gulf, a considerable part of the timber land along the large water courses and near the coast has been exploited for a great many years. Most of the choice pine, cypress, and hardwood lumber has been exported. Far from the railroads and streams vast bodies of virgin timber land still remain in these counties, but large lumber companies are rapidly extending their operations into these timber lands.

Near the Gulf Coast occasional small areas of cut-over lands and old fields are covered with dense stands of young Cuban and loblolly pines and 500 small poles per acre is not uncommon on such lands. A very large number of poles with an average length of 16 feet and a top diameter of 4 inches are annually used for piling for bath houses and small piers in front of the numerous homes on the Gulf Coast. These poles are worth from twenty to twenty-five

cents apiece and owners of pole timber have often netted as much as \$50 per acre by supplying this demand. It is unfortunate that most of the cut-over lands and old fields of this section, because of frequent burning, do not contain a cover of young pines.

Pike County is for the most part a gently rolling country and lies entirely within the piney woods type. The eastern half of the county still contains large areas of excellent timber which is owned by a few large lumber companies. Turpentine is practiced more extensively in Pike County than in any of the other counties in southwestern Mississippi.

Western Marion County still remains heavily timbered and the timber is owned by several large lumber and realty companies. The original extensive pine forests of Lincoln County have been practically exhausted. About half the land is classed as uncleared, but only about 18 per cent of the uncleared land contains merchantable forest cover, while the remainder is chiefly unproductive stump land.

In Copiah County practically all the pure longleaf pine forest has been exploited. Most of the virgin timber is in the southeastern townships.

In Franklin County there is a great deal of extremely rough land covered with longleaf pine and hardwood timber. Until the building of the Mississippi Central Railroad there was very little lumbering in this county because of the inaccessibility of the timber and the high expense of logging it. Now, however, many mills are operated along the line of the railroad, and large companies have been buying all the available timber land. The narrow ridges and very steep slopes will, for the most part, be always unfit for farm land. In these situations lumbering should be so conducted as to insure the perpetuation of the forest. Four or five thrifty seed trees of longleaf pine should be left standing on each acre and every effort should be made to keep fires from burning over the ground and destroying young growth.

In Amite County about one-half of the longleaf pine uplands have been cut over and are now mostly stump

lands. The remaining timber land, which is located for the most part in the eastern half of the county, is being rapidly exploited.

In Wilkinson, Jefferson and Adams Counties the pure type of longleaf pine does not exist, but the mixed pine and hardwood type is found on the roughest hill lands. Much of this forest has been culled of the merchantable longleaf pine, so that loblolly and shortleaf pines often predominate in the stand.

The chief timber industries in the counties bordering the Mississippi River are those which use hardwood timber. Stave and heading mills and sawmills cut a great deal of oak and other hardwoods from the bottom-lands of the river.

FOREST MANAGEMENT.

The Approaching Exhaustion of the Timber Supply.—According to the Census Report for the fiscal year 1908, Mississippi ranks third in the production of lumber in the country. It ranks third also in the production of yellow pine lumber, being surpassed in this respect by Louisiana and Texas. In the production of hardwoods it ranks tenth in oak, second in gum, fifth in tupelo, eighth in hickory and ash, tenth in yellow poplar, and first in cottonwood.

In general the average prices received for lumber in Mississippi are higher than in other States. The average price for yellow pine, cypress and hickory lumber is higher than in any other State. For oak lumber higher average prices are received only in New York and Indiana, where oak is very scarce and therefore expensive. This indicates both that the quality of the lumber in Mississippi is better than in most States, and that the transportation and market conditions are unusually good.

The Census Reports for 1907 and 1908 further demonstrate that the great timber resources of Mississippi are being rapidly depleted. In 1907 more lumber was manufactured in the State than ever before, and Mississippi held fifth place among the States in its production. In 1908, in common with all the great lumber States, Missis-

Mississippi produced less lumber than in the preceding year, owing to the general business depression, but it advanced from fifth to third place. It is interesting to note that, while in 1907, 823 mills reported a cut of 2,094,485,000 board feet, in 1908 there were 905 mills which cut only 1,861,016 board feet. This perhaps indicates that the number of small mills in the State is increasing, which is generally the case in regions where the timber supply is being exhausted. The large mills are forced to go out of business for want of a supply, but the small isolated bodies of timber are capable of sustaining numerous small portable mills, most of them.

Most of the longleaf pine land is held by large lumber companies, many of which operate mills cutting from 35,000,000 to 200,000,000 board feet a year. Comparatively little timber land is being held by companies or individuals as investments, because it would be necessary for stumpage prices to double within the next ten years if the owners were to realize an income of even eight per cent. Usually these large mills are heavily bonded, and the interest on the bonds must be paid. This is the chief reason for the extensive exploitation of the timber.

For the past two years the average lumber prices have been so low that longleaf operators have barely met expenses. This was caused chiefly by the decrease in lumber consumption, due to the general business depression of 1907 and 1908, but partly, also, by an overstocking of the market, since the large mills, on account of their bonded indebtedness, were compelled to continue operating as long as lumber could be sold at any profit whatever. It is apparent, therefore, that the large mills will continue to log their holdings as rapidly as it can be profitably done. The majority of large lumber companies do not count on operating longer than from twelve to fifteen years. Only a few mills control enough stumpage to last twenty-five years, and in the entire longleaf pine region in Mississippi there are not more than two mills which can continue cutting at the present rate for forty years.

Problems in Forest Management.—The various problems of forest management were briefly discussed as they came up under each regional description, but a few are of particular importance and affect the whole State. The State must deal with these through legislative action and through an educational campaign. The most important problems of forest management are:

1. Forest fires.
2. Grazing.
3. Turpentineing.
4. Waste in logging.
5. Establishment and care of young tree stands.
6. Assessments and taxation of timber lands.
7. Management of tax and school lands.

Forest Fires.—In Mississippi, as in other Gulf States, the belief has long been prevalent that forest fires do little damage except when buildings, fences and like property are destroyed. This general indifference to fires is probably the chief cause for the extensive annual burning of the forests. The enormous loss caused by the boll weevil is not greater than that from forest fires, nor is the extermination of the cotton pest of more vital importance to the future wealth of Mississippi than the prevention of such fires.

At least 75 per cent of the woodland in Mississippi is burned over once every year, and many localities are burned over twice or more in one year. Fires are especially prevalent in the longleaf pine belt where they are set in order to expose the tender young grass with the idea in improving the pasturage. As a matter of fact, however, annual fires have almost caused the extermination of the best forage grasses, and only the hardy wire grasses and broom sedge of little value for pasturage, have been able to survive. As long ago as 1850 Dr. Hillgard, State Geologist at that time, in discussing pasturage in the pine woods, said: "The beautiful, park-like slopes of the pine hills are being converted into a smoking desert of pine trunks on whose blackened soil the cattle seek more vainly every year the

few scattered sickly blades of grass whose roots the fire has not killed.”

The forest fires, to be sure, are usually only surface fires, because there is no great accumulation of leaf and branch litter, and they rarely get into the tops of the trees and destroy them, but such fires are particularly injurious because they are the cause of the almost total absence of pine reproduction on cut-over land.

A single fire seldom seriously injures large, healthy longleaf pines because of the fire-resisting properties of the bark, but if this bark has been injured, as often happens, by insects or other causes, the fire obtains entrance and eats into the bases until the trees become so weakened that they are easily blown down. Fire, moreover, retards the growth of large pines by impoverishing the soil and heating the growing layer which is immediately beneath the bark. When trees have been boxed for turpentine, great injury is done by fire.

In hardwood forests, fires are less prevalent owing to the moist soil conditions. Wherever they do occur, they injure the large, valuable hardwood trees by burning them at the base and causing large scars. These scars open the way for the attack of insects and fungi which causes the decay and finally the death of the trees. Here again the greatest damage is the destruction of the reproduction.

Forest fires in Mississippi are mainly attributable to the general indifference to the results. In addition to the fires set for the supposed improvement of pasturage, which probably cause the most extensive burning of the woods, many are started by careless hunters and men engaged in forest occupations, while many others are due to wood and coal-burning locomotives.

If a system of forest-fire prevention had been inaugurated fifty years ago, the resulting increase in the wealth of the State would have been tremendous. In most localities where lumbering has been going on for half a century or longer, there would still be a plentiful supply of second-growth timber, and the cleared lands in most parts of the State would be vastly more valuable than they are for

agriculture because the soil would not have been impoverished by decades of annual fires.

To decrease forest fires in the State, what is needed most is a vigorous educational campaign, planned and conducted by a State Forester or a forestry commission. This campaign should be carried on through the newspapers and other periodicals which reach the mass of the people; by lectures and addresses before Farmers' Institutes and other societies, and in the schools and colleges. In all schools the children should be instructed in the care of forests and taught the vast damage which is annually done by forest fires.

Until a State-wide sentiment against forest fires has been awakened and an organized system of fire protection has been established, the railroads, to which so many fires are attributable, can not be expected to initiate plans for their prevention. Fires are the direct cause of a great deal of loss to railroads through suits for damage to private property and through the destruction of their own property such as bridges, fences, and buildings. The use of spark arresters and improved ash pans, cleaning the rights of way of all inflammable material, and an effective system of patrol during drought periods would do much to lessen the forest-fire evil.

A forestry commission should encourage the formation of associations of timber land owners for the purpose of guarding against fires. In some of the northwestern States large timber land owners have formed associations of this kind in which each member pays toward the cost of fire protection on a pro rata basis. In northern Idaho, 1,257,000 acres were protected in 1908 at a cost of \$52,000, or an average of about 4 cents per acre. The cost was divided as follows: Patrolling, 2 cents; fighting fire, 4 mills; making trails, cleaning old trails, and other items, a little more than one and one-half cents. In Mississippi the expense should be very much less because of the lower cost of labor and because very little expense would be incurred for trail building.

Grazing.—The chief injury in connection with the grazing of live stock in the forests has resulted from the fires

which are set with a short-sighted purpose of improving the pasturage. This is especially the case in the longleaf pine region, in practically all parts of which the grazing of live-stock is unrestricted by stock laws. Aside from the enormous damage to the forest through the destruction of seedlings, injury to large trees, and impoverishment of the soil, fires have steadily defeated the purpose for which they are set, the improvement of range conditions, by killing out the best forage plants and grasses.

The grazing of live stock in the forest has a greater or less influence on the reproduction of trees according to the kind and amount of stock grazed and the type and character of the forest. In the longleaf pine belt cattle and sheep do little damage to young growth. Hogs, on the other hand, do a great deal of damage by eating the pine nuts and the roots of seedlings and saplings. In the hardwood forest grazing does much less damage. Here, as in the piney woods, hogs do the greatest injury by devouring the seeds, as acorns, and by digging up the roots of seedlings and saplings. On lands where dense canebrakes exist, hog ranging is beneficial, since it reduces the cover of cane and helps the young tree growth to get established.

With the increased settlement of a region and the introduction of more intensive methods of farming, it is usually found necessary to require that live stock be kept within enclosures. In most of the older agricultural parts of the State stock laws have long been in force. At present it would be a considerable burden on the farmers of southern Mississippi to require that cattle be kept under fence, but the restriction of hogs to fenced pastures would cause less hardship and would ultimately prove a benefit as a means of eradicating infectious diseases.

Turpentineing.—Turpentineing is nowhere extensively practiced in Mississippi. Most of the companies which control the greater part of the longleaf stumpage consider it financially inadvisable for the following reasons:

1. Boxed timber suffers greatly from fire, wind storms and fungous and insect injury. In localities where all the timber has been boxed, the average stand contains about

30 per cent less timber than in places where turpentine has not been practiced.

2. The quality of the lumber obtained from boxed timber is very much poorer than that from unboxed timber. Pitch pockets, streaks and wormholes are frequent in the butt logs, from which, in unboxed timber, the best lumber is obtained.

These objections to turpentine operations are based chiefly on the effects of the common practice of chopping deep boxes in the trees. The deterioration of the quality of lumber in boxed trees is chiefly due to fires. Fires, by still further weakening the trees at the base, are, together with box cutting, the cause of a great part of the damage from wind storms. With proper protection from fire the damage would be greatly lessened. If with fire protection a cup system is used, and logging follows turpentine promptly, the present objections to turpentine would be removed and the added profits could be obtained without materially lessening those from the lumbering proper. Under a cup system the growth of the trees is scarcely influenced and the damage from fires (with proper safeguards), wind storms, insects and fungi is almost eliminated; and by shallow chipping of the trees a crop of 10,000 trees may be expected to yield an annual profit from turpentine of from \$1,500 to \$1,800, according to the market conditions and the care used in conducting the business. Under these conditions turpentine can be highly profitable on a tract for from three to five years. Logging should follow the abandonment of turpentine promptly, before there is damage by insects. By thus properly organizing the work, the highest profits from the forest as a whole can be obtained.

Under no circumstances should the box system be used, not only because of the loss of timber due to damage by the box, but also because, as has been proved, this system is much less profitable than the cup and gutter system.

One of the greatest injuries from turpentine arises from orcharding young longleaf trees too small to be

promptly logged afterwards. These young trees are checked in growth and so weakened that they soon die or are blown down. Great tracts of cut-over pine lands sparsely covered with small, pole-size trees have been converted into oak brush barrens through turpentine operations. In no instance should trees be turpented which will not be cut for lumber within four or five years after the first turpentine operation. A great many people in the State believe that a law should be enacted making it illegal to turpentine trees smaller than 15 inches in diameter, breast high.

Waste in Logging.—Waste in logging has to a certain extent been a result of economic conditions which made the complete utilization of trees unprofitable. When timber was cut at long distances from railroads and its exploitation was very expensive, only the best material from the most valuable trees could be used profitably. This has been especially true in the production of staves and heading, the industries which have been responsible for more waste in proportion to the wood consumed than any of the other timber-using industries. A vast amount of such waste, however, has been unnecessary.

Waste in logging in Mississippi consists in leaving sound material in high stumps and large tops, and in the injury and destruction of young trees and seedling growth through careless logging methods.

Except in the case of badly burned or otherwise defective trees, the best material is usually contained in the stumps. The cutting of high stumps has been and is now commonly practiced in hardwood operations. Lumber companies in all parts of the State are beginning to realize that it pays to cut low stumps, but the farmers, who own and market timber, continue almost without exception to cut stumps 3 or 4 feet high and to leave a great deal of sound, merchantable material in tops.

The lumbering operations of the large yellow pine companies in southern Mississippi seldom present examples of waste in the utilization of the trees which are cut. Except in the case of trees boxed for turpentine or other-

wise badly defective at the base, stumps are seldom cut higher than 16 inches, and the trees are utilized to small diameters in the tops. One company whose cut-over lands have had a ready sale for farming purposes has learned that cutting stumps 8 instead of 16 inches high results in a saving of almost 50 per cent in clearing the land, because of the lessened expense for powder and boring holes in the stumps.

In almost all parts of the State it is a matter of poor business management to leave large, sound tree tops to decay on the ground, for with the high values of cross-ties, poles and posts trees can usually be used well up into the tops with profit.

Young trees of the desirable species should be protected and encouraged in every possible way, in order that they may contribute to future logging operations. Care should be taken to do as little injury as possible to saplings and poles in felling, and instead of cutting young trees of the valuable species for such uses as cross-ties and skid poles, the inferior species should be used.

The Establishment and Care of Young Stands.—All the problems of management which have been discussed thus far have a greater or lesser influence on the regeneration of forests. Above all fires are destructive to forest growth, and, in Mississippi, have been the chief cause of the meagre amount of young tree stands on logged-over areas. In addition to these factors, the manner of harvesting a tree crop bears a great influence on the character and quality of the succeeding stand.

Each forest type requires certain methods of treatment to secure the best results, but, in general, certain principles of management are common to all regions:

1. Unless a new stand is to be established by planting, provision should be made for seeding up the ground by leaving a portion of the stand.

Clear cutting is usually practiced only in pine stands. In southern Mississippi most large lumber companies cut to a minimum breast high, diameter limit of about 12 inches.

In the mature longleaf forest the proportion of trees smaller than this diameter is very small, so that the tracts are cut practically clear. Clear cutting is advisable when land has a high value for farm use, but in sections where there is little or no prospect of selling stump lands because of the rough surface or poor soil, the policy of clear cutting is unwise. Small trees are generally utilized at little profit, and often at a loss, because of the high expense of handling them as compared with the value of the small amount of lumber they contain. Moreover, there is a smaller percentage of the better grades of lumber in small trees than in large ones. By raising the minimum diameter limit to about 15 inches on tracts which are not salable for farms, as a rule from 1,000 to 2,000 board feet would be left standing on each acre. With fire protection these trees would seed up the ground and would themselves form the basis for future logging operations. With the admission of a great deal of sunlight by the removal of the greater part of the stand the growth of the trees left would be greatly accelerated. The inevitably large increase in stumpage values which will accompany the exhaustion of the greater part of the timber in the region will assure owners of land of this character a good profit on their investment.

2. The species to be encouraged should be those which combine to the greatest degree the quality of valuable material and the silvicultural properties of successful regeneration on cut-over lands, and rapid growth. In the bottom-land forests the valuable oaks, yellow poplar, white ash, hickories, and cypress should be favored as against the gums, beech, maple, and sycamore. Loblolly pine combines to a remarkable degree the qualities desirable in forest management. It is found in most parts of the State and is especially desirable as a tree crop in central Mississippi. It should be encouraged on cut-over longleaf lands as well as in the moist situations near streams.

For the first few years of seedling growth after logging, the only measure needed in management is fire protection. In the sapling stage most stands are dense. Close stands

induce rapid height growth, but retard diameter growth. A light thinning in such stands, therefore, will usually prove beneficial to their development. In the pole stage the stands are likely to become dense again, and if because of this condition the trees are spindling, a thinning which will leave plenty of space for the crown development of the healthiest specimens of the desirable species, will be followed by greatly accelerated volume growth.

While this discussion of cutting methods has dealt especially with pine stands, the principles are equally applicable to hardwood stands. As was previously stated, however, each type requires individual methods of handling in order to secure the best results, and under the regional descriptions the individual recommendations for management were briefly given.

Clauses Suggested for Logging Contracts.—A great deal of logging in Mississippi is done by contractors. Naturally, they desire to clear as much money on a piece of work as possible, and they cut high stumps and leave a great deal of merchantable material in large tops. A binding contract between the timber owner and the logger is very important as a means of protection to the owner in securing not only the largest immediate profit, but also the best forest conditions practicable after logging. The following clauses are suggested for inclusion, so far as they apply in each case, in such contracts:

1. The location of the cutting area should be definitely described by relation to some well-known landmark, such as a stream, and by legal subdivisions.

2. No timber will be removed until it has been scaled, measured, or counted by the owner or one of his employees

3. All merchantable timber used in buildings, skidways, bridges, construction of roads, or other improvements will be paid for at the contract price.

4. All cutting will be done with a saw when possible.

5. No unnecessary damage will be done to young growth or to trees left standing, and no trees will be left lodged in the process of felling.

6. The approximate minimum diameter limit at a point $4\frac{1}{2}$ feet from the ground to which living trees are to be cut is———(limits or all species involved).

7. Stumps will not be cut higher than———inches—lower when possible—and will be cut so as to cause the least possible waste.

8. All trees cut will be utilized to a diameter of———inches in the tops—lower when possible—and the log lengths so varied as to make this possible.

9. Unless extension of time is granted, all timber will be cut and removed on or before, and none later than———(a definite date).

10. Timber will be scaled by.....(Insert the log rule to be used).

11. During the time that this agreement remains in force the contractor and all his employes, sub-contractors and employes of subcontractors will, without any charge or expense to the timber land owner, do all in their power to prevent and suppress forest fires.

Assessments and Taxation of Timber Lands.—That assessments of timber lands in Mississippi are not as a general rule burdensome, and seem to be fair, as compared with assessments on farm lands, is due to the fact that such assessments are not in any sense pushed to the strict limits called for by the Constitution, viz., that they shall be based upon the actual value of the land. Nevertheless, in some counties where there is very little farm land lumbermen complain that the taxes are burdensome, and that they find it necessary to cut as rapidly as possible in order to realize returns from the timber and thus reduce the value of the land so that the taxes will be reduced likewise. As a result of this, in some portion of the longleaf pine region, where the greater part of the merchantable timber has been cut, the loss to the counties on account of the reduced taxes has been keenly felt. Both the counties and the State would have a much more steady income if some method of timber land taxation be devised which would tend rather to encourage than discourage timberland owners in managing their property according to prin-

ciples of forestry; for wherever such taxation is administered with anything like a proximity to the principles of the general property tax, as required by the Constitution, the tendency is toward premature cutting.

The problem of timber land taxation is receiving very serious attention in many States, some of which have already taken steps to amend their Constitutions so as to permit the enactment of more just principles of taxation such as are in force in the European countries, where forest management is most highly developed. It is quite widely held now, and is strongly advocated by the United States Forest Service, that the true principles of forest taxation are (1) exemption of the growing timber from taxation; (2) annual taxation of the land upon its value apart from the timber growing thereon; and (3) a tax upon the value of the crop of timber when cut, which should be comparatively high (10 or 15 per cent) because this would be a tax on income and not on principal. (1) and (2) as thus set forth would be legal under the Mississippi Constitution, but (3) would not be legal, and until the Constitution is amended so as to remove this restriction the principles above set forth cannot be put into practice in this State. Therefore, instead of a clearly defined method of taxation, which would place investments in timber lands on an equal basis with other investments, timber land owners must continue to look for comparative justice in the greater or less leniency of the assessor when estimating this class of property.

Management of Tax and School Lands.—In order further to promote an interest in forest preservation and increase the amount of forest land under conservative management, consideration should be given to the tax and school lands of the State.

In most counties there are small bodies of land which have reverted to the State for nonpayment of taxes. A former owner of such land may, at any time during two years following the date when the taxes were due, recover title to the land by payment of the accrued taxes, together

with interest on the amount. After two years the land may be sold by the sheriff.

A forest law should be enacted which would provide for examinations of lands of this character by a State Forester, and reports regarding their suitability for forest purposes. There should be a provision in the forest law whereby certain tracts can be retained and managed as forest lands, if the report of the State Forester indicates such action to be for the best interests of the people. The counties should be reimbursed for such lands from a fund which should be established from fines and penalties originating under a forest fire law and from receipts obtained from the management of the State forests.

The Chickasaw and Choctaw school lands were given to Mississippi by the United States for school purposes. The Chickasaw lands lie north of the Chickasaw boundary. These lands were sold in fee simple in 1857, and the purchase money kept in the State Treasury. The interest, which in 1908 amounted to approximately \$61,000, is annually disbursed for school purposes in the counties included within the Chickasaw boundary. The Choctaw school lands include the sixteenth section of every township lying south of the Chickasaw boundary. These lands were never sold, but have been leased. Prior to 1890 the usual term of lease was ninety-nine years. A great deal of the lease money was lost following the war, and to diminish any further risk, it was decided, in 1890, to limit the term of lease to five and ten-year periods.

In the counties of the longleaf pine region, school lands were leased for a nominal sum for ninety-nine-year periods. Before the development of the lumbering industry, these lands were exploited for naval stores and used as pasture lands. With the invasion of the region by great lumbering concerns, and the consequent rapid rise in timber values, the leases of school lands were eagerly sought, and their holders began to exploit the timber. The State authorities claimed that the lessees of school lands had no right to cut and sell timber from the lands, and the Court of Appeals has rendered a decision upholding this opinion.

Suit is now pending in the United States Court for a sum aggregating \$1,000,000. If the United States Court upholds the decision of the Court of Appeals, further exploitation of these timber lands will be prevented.

A conservative system of management of the school lands in Mississippi is most advisable. Sixteenth sections should be carefully examined by the State Forester and an agriculturist, and classified as to their best use, whether for agriculture or for forestry. The agricultural lands should be leased to farmers. The forest lands should be managed for the purpose of making them grow successive timber crops. The returns from the sale of timber and other privileges should go to the counties for school purposes.

SUMMARY.

1. Mississippi lies almost entirely within the Coastal Plain, and though the surface is generally rolling, comparatively little of it is hilly. Its climate is mild and very favorable for agriculture and for tree growth.

2. Eight forest regions are distinguishable.

The northeastern hill region is extensively forested, though the virgin timber has been cut in most localities. There are many thousand acres of second-growth, short-leaf pine stands which have come up on old fields and cut-over lands.

The black prairie region contains comparatively little forest land, and forestry there is a matter of woodlots on the poor hill areas and the overflow bottom-lands.

The Pontôtoc Ridge region was extensively cleared of forest cover many years ago for agriculture. In parts of the "red hills" the soil has washed badly, and forest planting is most desirable.

The flatwoods region is a country of poorer soils than most of the State, and is for the most part covered with forests. It is a region pre-eminently suited to forestry because pines and some hardwoods flourish there, while the land is of comparatively little agricultural value.

The north central plateau was once the richest agri-

cultural part of the State, but the silty soils of the uplands have been worn out on extensive areas which could be greatly improved by planting with forest trees.

A few counties of the south central region contain a great deal of virgin timber land, which is chiefly held by large lumber companies. In the counties traversed by the older railroads very little merchantable timber remains.

The Yazoo delta is a country of exceedingly fertile soils, and the original hardwood forest is being rapidly cleared by large lumber companies to make way for farms.

The great longleaf pine region, which was once covered with unbroken pure pine forests over vast areas, is being rapidly exploited by large lumber companies. The lumber industry has probably reached its height, and its decline will be almost as rapid as its rise.

3. In all regions of the State the timber wealth is being depleted at an astonishing rate. Little attempt has been made to manage timber lands conservatively, and, because of very frequent forest fires and clear cutting, only a small amount of young tree growth is coming up to take the place of the virgin stands on lands unfit for agriculture.

4. The following problems of forest management are of particular importance: forest fires, grazing, waste in logging, turpentine, assessments and taxation of timberlands, and management of tax and school lands.

The prevention of forest fires is by far the most important measure to be considered in a State forest policy. The general indifference to forest fires in the State is probably the chief cause for the extensive burning of the woodlands. This can be remedied through educational work conducted by a forestry commission and a State Forester, and through the enactment of wise forest fire laws.

The chief injury to the forest in connection with grazing is from the annual fires which are set for the supposed improvement of pasturage. Hogs also do a great deal of damage by digging up seedlings and eating tree seeds.

There has been an enormous amount of waste connected with logging in Mississippi. This waste is of two kinds; through sound material left in high stumps and

large tops and through clear cutting. A Forestry Commission through a State Forester and by other means should educate the people in the conservative management of timber lands.

Turpentine operations are nowhere practiced extensively in the State. The greatest damage to the forest in connection with turpentine is through fires. By the use of a cup system, turpentine would undoubtedly yield large profits when carried on in connection with lumbering operations.

The manner of harvesting tree crops has a very great influence on the character and quality of the succeeding stand. Where forest lands are more valuable for forestry than for agriculture, a portion of the stand should be left for seeding purposes, and the most valuable species should be favored as against the undesirable species.

Forest taxation has a great influence on conservative forest management. The principle that the land should be taxed annually apart from the timber growing upon it, and that the timber crop should be taxed when cut, is one which has been long recognized in the tax laws in those European countries where forest management is most highly developed. Such a law would be unconstitutional in Mississippi, and timber land owners must look for justice to the leniency of the assessor in estimating the value of this class of property.

School and tax lands should be managed conservatively, in order to yield the highest returns possible and to serve as practical object lessons in forest management to the people of the State.

LEGISLATION.

Past Legislation.—Past legislation concerning the forests was enacted at a time when economic conditions in the State were quite different from present conditions, and when the chief problems seemed to be in connection with the theft of timber. The fire law has proved to be quite inadequate, because it did not provide for a definite organ-

ization to enforce its provisions. The various laws in Mississippi relating to forest lands are briefly summarized as follows:

1. A person destroying in any manner live oak trees belonging to another shall pay to the owner for each tree thus destroyed the sum of \$50.

2. The same penalty shall be paid to an owner in the case of cypress, white oak, black oak, or other oak, pine, poplar, black walnut, cherry, pecan, hickory, chestnut, birch, ash, or beech, and for every other tree not mentioned a penalty of \$5 shall be paid.

3. A penalty of imprisonment for not more than five months or a fine of not less than \$10 nor more than \$1,000, or both such fine and imprisonment, is imposed in case a person shall cut or raft certain trees belonging to another without first securing the permission from the owner.

4. A fine of not less than \$5 nor more than \$25 is provided for each box cut in a pine tree growing on land belonging to another without the consent of the owner, or imprisonment in the county jail for a period not exceeding three months, or both such fine and imprisonment.

5. A penalty of \$5 payable to the owner for each box cut in a pine tree.

6. It is the duty of the Land Commissioner to investigate and prosecute all suits arising from trespass cases on State lands.

7. There is a penalty of \$2 per acre in every 40-acre subdivision of land in which trespass was committed, in addition to the statutory damages; but this does not apply to a person renting public lands and having license of the Land Commissioner to take trees for fuel or like purposes from contiguous land.

8. A penalty of not more than six months' imprisonment or a fine of not less than \$100 nor more than \$1,000, or both such fine and imprisonment, is fixed for cutting or rafting certain enumerated species from land belonging to the State.

9. There is a law providing that whoever shall wantonly, negligently or carelessly allow fire to get on land of

another shall be liable to the owner for the value of the timber, trees and grass destroyed, and, in addition, shall pay to the owner a penalty of \$150.

NEEDED LEGISLATION

State Forestry Commission.—Of great importance in the inauguration of a forest policy for the State is the establishment of a State Forestry Commission, and of first importance is the creation of the office of State Forester or Chief Forest Firewarden. The Forestry Commission should be composed of the following members: The Governor, the Commissioner of Agriculture, the Attorney-General, the State Geologist, the Professor of Forestry at the State Agricultural College, and a practical lumberman engaged in the manufacture of lumber in the State. The State Forester should be appointed by the Governor upon the recommendation of the State Forestry Commission.

The Forestry Commission should have general supervision of the forest interests of the State, and carry on through the State Forester and in other ways investigations of all matters pertaining to forestry within the State. A vigorous educational campaign in the interests of forest conservation should be one of the commission's most important duties. The commission should in a general way direct and supervise the work of the State Forester, who should annually prepare for it a detailed report on the progress of forestry within the State. The commission should prepare a report for each session of the Legislature, including such recommendations for improvements in the forest laws as may from time to time become necessary.

State Forestry.—The appointment of a State Forester who should also be the Chief Forest Firewarden, is of paramount importance to the State. The States in which forestry commissions have been established, but where there are no technically trained foresters who devote their entire time to promoting forestry in the State, have found that they cannot obtain the most effective results. Some of

these States have recently created the office of State Forester. Many States now employ trained foresters, some of these being the naturally treeless States where forest planting and the better management of farm woodlots are important.

There is probably no State where a trained forester is more needed than in Mississippi. The expense of maintaining this office would be small compared with the benefit to the people of the State through education in forest economy and through the better enforcement of the forest laws.

His chief duties would be as follows:

1. To carry on an educational campaign through correspondence, the publication of forestry literature of interest in the State, and lectures before farmers' institutes, various societies, lumber and other manufacturers' associations and schools and colleges.

2. As Chief Forest Firewarden, to superintend the work of the forest firewardens and deputy forest firewardens in each county.

3. To co-operate with timber land owners in the preparation of plans for the management, protection and replacement of tree growth in so far as other duties will permit.

4. To examine and report upon land given to the State by individuals for State forests.

5. To examine and report upon lands which have reverted to the State for non-payment of taxes, in order to ascertain the practicability of managing them as State forests.

6. To examine school lands and college grants, and to manage conservatively the portions best suited for forest growth.

7. To recommend the purchase of tracts of absolute forest land in various parts of the State for State forests, and to manage such tracts when purchased.

8. To examine and make expert studies relative to State forest conditions and to conduct experimental investigations pertinent to forestry.

The State Forester should be a graduate of a recognized school of forestry, and should have had experience in practical forest work. To be most effective, he should be absolutely free from political influence. He should be assured of the position as long as he continues to fulfill the duties of the office in a competent, conscientious manner. The salary of such a man should be at least \$2,000 a year, and the sum of \$1,000 should be annually available for his traveling and other expenses in connection with the office.

If the necessity of curtailing expenditures makes it advisable to create the office of State Forester and Chief Forest Firewarden at this session of the Legislature, it is suggested that, so far as possible, the State Forestry Commission attend to the duties which would devolve upon a State Forester. The Commission, through its secretary should direct the forest firewardens in their work, and should investigate and prosecute all violations of the forest laws.

State Forests.—In Europe many countries have had forest reserves for several hundred years. Most of them were established at a time when a general famine of timber was threatened through the rapid exploitation of private forests. By conservative management these forests have been made to yield remarkably high returns and at the same time, since they are located in the mountainous regions whence the larger streams originate, the effect of preserving a steady stream flow, and to a large extent preventing floods has been of incalculable benefit to the people. Several States in this country have established State Forests and the Federal Government controls and manages conservatively nearly 200,000,000 acres of national forests in the West.

The State of Mississippi inaugurates such a policy of managing certain absolute forest lands as State forests. Such lands may be obtained by the retention of lands which have reverted to the State for non-payment of taxes, and by gifts from individuals. The chief purposes of these forests would be (1) to help furnish a future supply of timber for

local needs; (2) to serve as practical object lessons in forest planting and management. Within the State forests it might be well to establish preserves for the protection and propagation of deer, wild turkey, quail, woodcock, and other game birds.

These forests should be in all parts of the State, and they should comprise absolute forest land, such as localities unfit for agriculture because they are annually inundated or are too hilly to allow of profitable permanent cultivation. Many thousand acres of such lands are held at values of from \$1 to \$5 per acre in the rough hills of north-east Mississippi and the cut-over swamp areas in all parts of the State.

The State Forester should be empowered to sell timber on terms most advantageous to the State, and the revenue derived from the forests, together with all money obtained from penalties in connection with the forest-fire law, should be placed in the State Treasury in a fund which should be drawn on only for purposes of forestry.

Forest Fire Legislation.—The chief lack of the forest-fire law in Mississippi is, that it does not provide for a fire-warden system to fight fires and to apprehend and prosecute offenders against the law. During the past few years the majority of forest laws enacted in the various States have been for protection against forest fires. A study of these laws and a knowledge of the results which have followed their enforcement, have indicated that certain provisions are essential to the successful solution of the forest fire problem.

The firewarden system should have as its head a State Forester who should also be chief forest firewarden. He should direct the county firewardens in their work and prosecute for all violations of the forest-fire laws.

In each county there should be one forest firewarden, appointed by the Governor upon the recommendation of the State Forester, who, in addition to doing all in his power to extinguish fires, should report to the State Forester as soon as possible, all fires and violations of the forest laws, together with all data which might aid in convicting

guilty persons. Firewardens should be paid by their respective counties. The plan of paying them according to an hourly rate for time spent in the discharge of their official duties has usually proved satisfactory. Since the enforcement of a fire law will cause the improvement and increase in value of property, the counties will find that the small expense of maintaining a firewarden system will be more than offset by the increased returns from taxes.

Besides the forest firewarden in each county the sheriff, deputy sheriffs, constables, marshals, justices of the peace, and other officers of the State should be declared *ex-officio* deputy firewardens, with power to enforce the laws and arrest violators.

Owners of timber land and associations of timber land owners who desire special protection of their holdings from fires should be allowed to recommend employees for appointment as deputy forest firewardens. Such officers should be paid by their employers.

APPENDIX.

Suggested Forest Law.—The following law is suggested as being applicable to conditions in Mississippi. It is based chiefly on the recommendations given under "Needed Legislation."

SECTION 1. *Be it enacted by the Legislature of Mississippi,* That there is hereby created and established a State Commission of Forestry to consist of the Governor, the Attorney-General, the Commissioner of Agriculture, the State Forester, the State Geologist, the Professor of Forestry in the Mississippi Agricultural and Mechanical College, and one practical lumberman engaged in the manufacture of lumber in this State, who shall be appointed by the Governor to serve for a term of two years. The members of said commission, with the exception of the State Forester, provided for in Section 3 of this Act, shall serve without compensation save for actual necessary expenses incurred in the performance of their official duties as members of this commission.

SEC. 2. That the Governor as *ex-officio* chairman of the Commission of Forestry shall call a meeting of said commission within thirty days after the approval of this Act. The commission shall meet at least twice in each year in the city of Jackson and at such other times and places as the Governor may designate.

SEC. 3. That there shall be appointed by the Governor a State Forester, who shall have a practical knowledge of forestry, and who shall be a graduate of a recognized school of forestry. His compensation shall be \$2,000 per annum together with reasonable traveling and field expenses incurred in the performance of his official duties. He shall act as Secretary of the State Commission of Forestry. He shall, under the general supervision of the State Commission of Forestry, have direction of all forest interests and all matters pertaining to forestry within the jurisdiction of the State. He shall have charge of all forest firewardens in the State, and aid and direct them in their work; take such action as is authorized by law to prevent and extinguish forest fires; enforce all laws pertaining to forest and woodland, and prosecute for any violation of such laws; collect data relative to forest destruction and conditions; direct the protection and improvement of State parks and State forests; and co-operate with counties, towns, corporations, and individuals in preparing plans for the protection, management, and replacement of trees, woodlots, and timber tracts under an agreement that the parties obtaining such assistance shall pay at least the field expenses of the men employed in preparing such plans. He shall carry on an educational course of lectures on forestry at the Farmers' Institutes and similar meetings within the State. He shall prepare for the State Commission of Forestry annually, a report on the progress and condition of State forest work and recommend therein plans for improving the State system of forest protection, management, and replacement.

SEC. 4. That it shall be the duty of the commission, provided for in Section 1 of this Act, to publish annually a report upon the forest conditions in Mississippi, with reference to the preservation of forests, the effects of the

destruction of forests upon the welfare of the State, and all other matters pertaining to the subject of forestry, and to promote so far as they may be able a proper appreciation in this State of the benefits to be derived from forest preservation. It shall further be their duty to report to each session of the Legislature the results of their investigations, and to recommend desirable legislation with reference to forestry, and to perform such other duties as may be imposed upon them by this or other acts relating to forest preservation.

SEC. 5. That the State Commission of Forestry shall have the power to purchase lands in the name of the State suitable for forest culture and State forests, at a price which shall not exceed \$5 per acre, using for such purposes any surplus money not otherwise appropriated which may be standing to the credit of the forestry fund; and to make all rules and regulations governing the State forests; and that the Governor of the State is authorized upon the recommendation of the State Commission of Forestry to accept gifts of land to the State, the same to be held, protected and administered by the State Commission of Forestry as State forests and to be used so as to demonstrate the practical utility of timber culture and as a breeding place for game. Such gifts must be absolute except for the reservation of all mineral and mining rights over and under such lands, and a stipulation that they shall be administered as State forests, and the Attorney-General of the State is directed to see that all deeds to the State of lands mentioned above are properly executed before the gift is accepted.

SEC. 6. That the boards of supervisors of all counties shall, as soon as may be after this Act takes effect, recommend to the State Forester the names of such persons as may, in their estimation, be fit to fill the office of forest firewarden in their respective counties. After investigation, the State Forester shall choose from the persons recommended as above prescribed, and recommend to the Governor for appointment not more than one competent person in each county to be forest firewarden for that

county, subject, however, to removal by the Governor at any time in his discretion. Upon the termination in any manner of the term of office of any forest firewarden, a successor shall be appointed in the manner hereinbefore provided for the appointment of such officers originally. Forest firewardens shall receive compensation at the rate of 30 cents an hour for all time spent in the discharge of duties connected with the office, to be paid monthly by the board of supervisors of the county in which the forest firewarden holds office; provided that in no instance shall more than \$3 be paid for work done during any one day. Forest firewardens thus appointed shall, before entering upon the duties of their office, take the proper official oath before the clerk of the court of the county in which they reside; after which they shall, while holding office, possess and exercise all the authority and power held and exercised by constables at common law under the statutes of this State, so far as arresting and prosecuting persons for all violations of any forest laws and of the laws or rules and regulations enacted or to be enacted for the protection of the State forests, or for the protection of the fish and game contained therein.

SEC. 7. That all sheriffs, deputy sheriffs, constables, marshals, justices of the peace and other officers of this State are hereby declared ex-officio deputy forest firewardens, who shall serve as such without further compensation, and who shall enforce all the forest laws of this State, and who shall have the same powers as are vested in the forest firewardens by the provisions of this Act. And the Governor may, on the recommendation of the State Forester, appoint as deputy forest firewardens any persons who may desire to act without compensation.

SEC. 8. That it shall be the duty of the forest firewardens to enforce all forest laws of this State, to protect the State forests, and to see that all forest laws, rules and regulations are enforced; to report any violations of forest laws to the State forester as soon as possible after their occurrence; to assist in apprehending and prosecuting offenders, and to make an annual report to him as to

forest conditions in their respective counties. When any forest firewarden shall see or have reported to him a forest fire, it shall be his duty to repair immediately to the scene of the fire and to summon such persons and means as in his judgment seem expedient and necessary to extinguish said fire. If any person fail to respond to the warden's call for his assistance or for the use of his property, he shall be liable to a fine of not exceeding \$10. The owners of all property which is used in the extinguishment of a forest or brush fire under requisition of a forest firewarden shall receive reasonable compensation therefor. In case the forest firewarden and the persons called to assist him or to furnish the use of property shall at any time fail to agree upon the terms of compensation therefor, the dispute shall be referred to the board of supervisors of the county in which the fire occurred for final settlement.

SEC. 9. That the expenses incurred in fighting or extinguishing any forest or brush fire under the direction of a forest firewarden shall be borne by the county in which the fire occurred, and shall be payable in full by the board of supervisors of each county immediately upon the receipt of an itemized account, provided that the total sum so expended by any county shall not exceed \$200 in any one year.

SEC. 10. That the State Forester shall furnish notices printed in large letters upon cloth calling attention to the dangers of forest fires and to forest fire and trespass laws and their penalties. Such notices shall be distributed by the forest firewardens and deputy firewardens and posted by them at the courthouses, stores and postoffices, and in conspicuous places along the highways. Any person who shall destroy, deface, remove or disfigure any sign, poster or warning notice posted under the provision of this Act, shall be guilty of a misdemeanor and punishable upon conviction by a fine of not less than \$10 nor more than \$100, or imprisonment in the county jail for a period of not less than ten days nor more than three months, or both such fine and imprisonment.

SEC. 11. That every individual or corporation that

wilfully, maliciously or with intent sets on fire or causes or procures to be set on fire any woods, brush, grass, grain or stubble on lands not their own shall be guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than \$25 nor more than \$500, or imprisonment for not less than thirty days nor more than one year, or both such fine and imprisonment.

SEC. 12. That it shall be unlawful for any person, firm or corporation as landowner to set fire to or to procure another to set fire to any woods, logs, brush, leaves, grass or clearing upon their own land without giving adjacent landowners five days' written notice unless they shall have taken all possible care and precaution against the spread of such fires to other lands not their own by previously having cut and piled the same or carefully cleared around the land which is to be burned, so as to prevent the spread of such fire. The setting of fire contrary to the provisions of this section, or allowing it to escape to the injury of adjoining land shall be prima facie proof of wilfulness or neglect, and the landowner from whose land the fire originated shall be liable in a civil action for damages for the injury resulting from such fire, and also for the cost of fighting and extinguishing the same.

SEC. 13. That logging and railroad locomotives, donkey or threshing engines, and other engines and boilers operated in, through, or near forest or brush, which do not burn oil as fuel, shall be provided with appliances to prevent the escape of fire and sparks from the smokestacks thereof and with devices to prevent the escape of fire from ash-pans and fire-boxes. Failure to comply with these requirements shall be a misdemeanor punishable upon conviction by a fine of not less than \$10 nor more than \$100 for each and every offense thus committed.

SEC. 14. That all individuals or corporations causing fires by violations of Sections 11, 12 or 13 of this Act shall be liable to the State and to the county in which the fire occurred in an action for debt to the full amount of

all expenses incurred by the State or county in fighting and extinguishing such fires.

SEC. 15. That justices of the peace for this State in the county wherein the offense shall have been committed shall have jurisdiction to hear and determine all prosecutions for the purpose of enforcing fines and penalties collectible under the provisions of this Act not exceeding the amount of \$100, and of holding the offender under proper bail if necessary for hearing before the circuit court, committing him to the county jail until such hearing if the required bail is not furnished. It shall be the duty of the State's attorney of the several counties to prosecute all violations under Section 12 of this Act.

SEC. 16. That all money received as penalties for violations of the provisions of this Act, less the cost of collection, together with any amount obtained from the State forests, shall be paid into the State treasury to the credit of the forestry fund, which fund is hereby created; and the moneys in said fund are hereby appropriated for purposes of forest protection, management, replacement and extension, and for the purchase of lands for State forests, as provided for in Section 5 of this Act.

SEC. 17. That there is hereby appropriated the sum of three thousand dollars (\$3,000) annually for the fiscal years 1909 and 1910 for carrying out the provisions of this Act and for the payment of salaries and expenses herein provided for.

SEC. 18. That all acts or parts of acts inconsistent with the provisions of this Act are hereby repealed.

SEC. 19. That this Act shall take effect from the date of its passage.

A STUDY OF
FOREST CONDITIONS OF
SOUTHWESTERN MISSISSIPPI

BY
THE UNITED STATES FOREST SERVICE

IN CO-OPERATION WITH
THE MISSISSIPPI STATE GEOLOGICAL
SURVEY



BY
J. S. HOLMES, FOREST EXAMINER.
J. H. FOSTER, FOREST ASSISTANT.

JANUARY, 1908.

LETTER OF TRANSMITTAL.

JACKSON, MISSISSIPPI, March 17, 1909.

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

GENTLEMEN: I submit herewith a report of the forest conditions of Southwestern Mississippi, by J. S. Holmes and J. H. Foster, of the United States Forest Service, and respectfully recommend its publication.

This is the only official report of the forest conditions of Mississippi, and while it deals with only a small area of the State, it throws much light on the subject and shows the need of further investigations.

Very respectfully,

ALBERT F. CRIDER,
State Geologist of Mississippi.

A STUDY OF FOREST CONDITIONS OF SOUTH-
WESTERN MISSISSIPPI BY THE UNITED STATES
FOREST SERVICE, IN CO-OPERATION WITH
THE STATE GEOLOGICAL SURVEY.

BY

J. S. HOLMES, *Forest Examiner*,
J. H. FOSTER, *Forest Assistant*.

INTRODUCTION.

In 1907 the Geological Survey of the State of Mississippi requested the co-operation of the Forest Service of the United States Department of Agriculture in a study of the forest resources of that State, and made an appropriation of \$500 for the purpose. It is the policy of the Government to assist States in investigating their resources, and the Forest Service duplicated the State appropriation and made a total of \$1,000 available for the work, which was begun in November, 1907. The study was necessarily limited in scope, but with further appropriations by the State, which the Forest Service will be glad to duplicate, the study may be gradually extended to cover the entire State.

The longleaf pine region in the southern part of the State offered the most important field for a beginning. The future usefulness of the large areas of cut-over longleaf land, and the rapidly diminishing supply of timber were timely subjects for study and investigation.

This report deals with the forest conditions in the southwestern counties of the State, and includes a description of the several types of forest, a summary of the forest and economic conditions of each of the counties covered, and a review of the timber industries in the region. Plans for the conservative management of private and public forest lands are outlined, and recommendations are made for a definite forest policy for Mississippi.

The map which accompanies this report defines the

western limit of longleaf pine in Mississippi and shows the location and extent of the different forest types in the region covered. The shaded portions of the map show roughly the location of the areas on which the largest bodies of pine timber are still standing. It must not be inferred that all this area is heavily timbered, but the greater part of the remaining pine timber in this region does occur in these shaded areas.*

The area included in this study is approximately 6,200 square miles and consists of the following counties: Pike, Marion (west of Pearl River), Lincoln, Lawrence (west of Pearl River), Copiah, Franklin, Amite, Wilkinson, Adams, Jefferson and Claiborne.

THE REGION.

Geology and Soil.—The region consists of a rolling, more or less broken plateau which varies from 100 to 500 feet in elevation and falls off precipitously in the vicinity of the Mississippi River to the level bottom-lands.

The formations of this portion of the State are included within the later Cenozoic period of geological history and consequently represent the most recent deposits. These formations consist largely of Lafayette, Loess, Columbia, and the recent river deposits in the bottom-lands.

The Lafayette deposit consists of sands, gravels, clays, etc. It occupies the greater portion of southern Mississippi, and coincides with the longleaf pine belt. The thickness of the formation rarely exceeds fifty feet.

In the southeastern and southern portions of the State, the Lafayette clays occupy most of the uplands close to or on the surface of the ground. Toward the west they become deeper seated and are covered by brown and yellow Columbia loams. These loams are of considerable depth in the hill country and often represent the deposit since the clays were laid down.

Extending approximately northeast and southwest at

* A preliminary report on "The Condition of Cut-Over Longleaf Pine Lands in Mississippi," has been issued as Circular 149 of the Forest Service.

varying distances, up to several miles, from the Mississippi River, there is a chain of bluffs which fall off rapidly toward the river on the west. This line of bluffs is made up of the Loess formation of very fine-grained silt of a brownish color. The Loess area forms a narrow tract along the eastern border of the Mississippi Valley, widest towards the bluffs and gradually narrowing to the east until finally blended with the brown loams.

Between the Loess bluffs and the Mississippi River is the true Mississippi flood plain or "delta." This river level is narrow in the southern portion of the State, but widens to thirty miles or more toward the north.

From east to west across the State, then, the character of the soil changes, and in general, increases in value toward the Mississippi River. The nature of the tree growth is governed by the change in the character of the soil.

Transportation.—The transportation facilities throughout this region are excellent. Main lines of railroad penetrate each county, and bring the producer within fairly easy reach of New Orleans and Gulfport on the south, and Memphis, St. Louis and Chicago on the north. New lines are being completed which will further increase the facility for handling agricultural and forest products. The line traversing the region east and west from the Pearl River to Natchez will soon be in operation. These railroad lines have opened up the country for ten miles or more on each side of their rights of way. Beyond that, long and difficult wagon hauls are necessary. Along the Mississippi River transportation is entirely by steamboats and barges.

The large lumber companies located their mills along the main lines of railroad and began operations almost beside their mill yards. As the timber close at hand became exhausted, tram lines or dummy roads were extended toward the interior and the logs were hauled to the mills. These roads are now so extended that in many cases operations are being carried on thirty miles or more from the mills. Each county has been penetrated by numerous logging railroads, some of which are now permanent and of extreme value to the communities.

Except in certain portions of the hill country, railroads are not hard to construct and in no case is transportation a difficult problem. Railroad freight rates are not excessive and river transportation is still cheaper.

During the greater part of the year the principal wagon roads are good, but during the wet winter months the roads in many of the counties are in bad condition, and in some cases they become almost impassable. Each county decides on its own method of road maintenance, and most of them are not alive to the importance of keeping the roads in good condition. Adams County has excellent highways, which greatly benefit its citizens by cheapening the haul to market and by bringing trade from surrounding counties.

Good roads are a necessary part of conservative forest management, for by cheapening the means of transportation, the value of the products are proportionately increased.

Labor Conditions.—The farmer and the lumberman rely upon negro labor since the negro population varies from 40 to 60 per cent in the uplands and pine country, to 90 per cent in some sections along the Mississippi River. The lumbermen, as a rule, experience little difficulty in getting all the labor needed, since they can afford to pay more than most farmers. Wages for farm labor range from 75 cents to \$1.50 per day. In the various lumbering operations the ordinary laborer gets \$1.00 to \$2.00 per day.

THE FOREST.

The whole of southwestern Mississippi was originally under forest growth. The first large clearings were made along the rivers, and the strip within reach of the Mississippi River was fairly well settled before any railroad entered the State. It was not until the Illinois Central, and later the Yazoo & Mississippi Valley railroads were built, that the country back from the river was extensively cleared and settled, but since then, especially within the last fifteen or twenty years, the removal of the forest has been carried on at an ever-increasing rate. At present about one-third of this region is classified in the tax lists of the various

counties as cleared, and fully one-third more has been cut-over and left to grow up in oak scrub or anything else that can resist the frequent fires.

The forests of this region fall naturally into five divisions or types, according to the nature of the trees and the various conditions under which they grow. These types are: pure longleaf, longleaf hills, hardwood hills, Mississippi flood plain, river and creek bottoms.

Pure Longleaf Type.—The pure longleaf pine forests occupy the drier and poorer soils of southwestern Mississippi. These soils are in the Lafayette clay formations, in which pebbles are often found in more or less stratified beds; the area includes the entire southern portion of the State as far north as Copiah County west of Pearl River. The pure longleaf type gradually merges into a mixed type of longleaf and shortleaf pine in Franklin and Amite counties to the west. East of the Pearl River the type is general over the entire southern region, extending nearly to the Gulf of Mexico. The region occupied by the "piney woods" is generally a rolling country, characterized by broad, dry plateaus occasionally cut by creek bottoms. The red or yellow clay is close to the surface over most of the uplands.

Longleaf pine, in pure, and mostly mature stands, is the chief merchantable tree. It grows tall and straight, without side branches for fifty feet or more from the ground.

In a mature dense forest of pure longleaf pine there is usually no reproduction. The ground is burned almost every year and no undergrowth will live. The mature trees do not appear to be injured by such fires, but their growth is undoubtedly checked, because of the destruction of the vegetable covering of the soil and the injury to the base of the trees.

Occasional small saplings or seedlings of oak are found growing beneath the pines, and often the ground is interlaced with roots of oak, although shade and fires prevent any material growth of brush. When the pine is cut off, this oak at once takes possession of the ground.

Loblolly and Longleaf Subtype.—On the moister situations throughout this region loblolly pine is found in mixture with the longleaf, forming a distinct variation from the main type. Loblolly, because of its more rapid growth in early life, survives on land where the surface water, at certain times of the year, would kill out the slower growing longleaf. In such places there are open stands, usually with varying proportions of the two pines and sometimes a small admixture of stunted hardwoods. There is often an imperceptible gradation to the river and creek bottoms type, where the loblolly is an important tree.

The pine is of excellent quality, and the mature timber is mostly heartwood, which remains sound for many years. Except for a few twisted, or young, and inferior trees, nearly the whole forest is merchantable, and present operations leave few young trees standing on the ground after logging.

The stand varies. Severe winds have destroyed large numbers of the best trees in the forest, and culling the best trees for shingles or boards through many years has left most of the stands in an impaired condition. Over extensive areas old growth averages only about 5,000 board feet per acre, but occasional stands may average more than 30,000 feet per acre over limited areas. The general average over large areas of the best timbered counties does not exceed 10,000 to 12,000 board feet per acre.

Within this region naturally come the largest lumbering operations. Mississippi ranks third among the states producing yellow pine. Lumbering is on a gigantic scale. Each of six mills cuts more than 150,000 board feet per day, and there are many other mills cutting for local and export use.

Turpentine is carried on in several places, although the industry has not been developed so extensively as in similar forests farther east.

The enormous demand for longleaf lumber has resulted in the cutting of immense areas, so that from one-half to three-fourths of some of the counties have been cut over, and these are now burned and blackened stump lands. On

some of these occasional longleaf pines have been left, but the ground is partly covered by worthless scrub oak, and in many places is littered with burned and partly rotten logs. Over large areas of the stump land there are enough remaining longleaf pines to seed the ground if fire is kept out. Still other areas are culled only, and there is enough timber left to pay for another logging.

Longleaf Hills Type.—The longleaf hills type occupies a strip of country west of the pure longleaf pine area and runs northeast and southwest, from southwestern Copiah County through central Franklin County to western Amite and eastern Wilkinson counties. It is, for the most part, a rolling, hilly country, with deep ravines and steep slopes. Some parts are level or gently rolling, but most of it is made up of narrow abrupt hills. The streams have cut deep channels, and erosion is much more extensive than in the pure longleaf region.

In these hills roads can be constructed only along the tops of the sinuous ridges, which are sometimes only wide enough for the purpose and drop away each side to narrow ravine bottoms. The soil is usually thin and not as rich as farther west, and the subsoil is a red or yellow clay often mixed with gravel. The more level portions have been extensively cultivated for many years, though the ravines and abrupt slopes are still covered with native forests.

The ravine and lower slopes for the most part are covered with hardwood forests. Oaks predominate, associated with hickory, sweet gum, ash, and others. Loblolly pine is scattered over these lower slopes, and the upper slopes and summits of the ridges are covered by shortleaf and longleaf pine with some loblolly and hardwoods. The more level portions originally had extensive forests of pine, with longleaf predominating to the east, but decreasing toward the west until it finally disappears entirely, giving way to the shortleaf, loblolly and hardwoods.

Shortleaf pine is generally tall and straight, with but very little sapwood, and stands of this sort sometimes average 8,000 to 12,000 board feet per acre; but a general

average for the type would be from 5,000 to 7,000 feet per acre.

These forests have been culled extensively for such products as whiteoak staves, and fence rails, but this practice has not everywhere prevailed, and splendid forests that average from 10,000 to 15,000 board feet per acre, still exist in remote localities. The longleaf pine in mixture in the northeastern part of this belt has largely disappeared. The country has long been settled and the easily accessible timber removed. Some good stands of longleaf mixed with shortleaf and loblolly pine are still owned by small lumber companies, which are operating along the Yazoo & Mississippi Valley Railroad. In Franklin County there are extensive inaccessible areas not yet exploited, but which with the completion of the Mississippi Central Railroad, will be made accessible. West of the Yazoo & Mississippi Valley Railroad are large tracts of hardwoods and shortleaf pine owned by lumber companies. These have not yet been extensively lumbered because of the difficulty in constructing tramroads into the hills.

No extensive areas of this region show the evil effects of recent logging. Reproduction of shortleaf and loblolly pine is generally good, and often a carpet of seedlings is conspicuous under the mature trees. Longleaf, however, does not reproduce very well. Only in a few places, where some of the old timber has been removed by lumbering or other causes, and where fire has been kept out, is there satisfactory reproduction of this species. There is seedling and sprout reproduction of the hardwoods all through the forest, but the shade of the pines, where they are plentiful, keeps this growth suppressed. Fires do much damage to reproduction, but owing to the broken nature of the country they are not so extensive or disastrous as in the pure long leaf type.

Hardwood Hills Type.—Between the hilly country occupied by mixed pine and the flood plain of the Mississippi River is located the hill and bluff region of loess or silt formation. This falls off abruptly to the Mississippi bottom-lands on the west and on the east pass by im-

perceptible gradations into the pine hills. The soil is extremely fertile and increases in depth toward the cliffs. The slopes are usually steep and the ridges, especially in the western part, are very narrow. One of the chief functions of a forest on such situations, therefore, is to prevent erosion. This was among the first sections of the State to be settled and cultivated. Many years before the Civil War the forests on the more level and rolling land had been cleared for plantations, and today this is still one of the best agricultural regions of Mississippi. The forests are now confined almost entirely to the slopes and ridges too steep for cultivation and to the abandoned fields now growing up with pine and hardwoods.

The original forest was entirely of hardwoods, and many persons living in the region remember when no pines were seen anywhere. The principal commercial species of this type are white oak, yellow poplar, ash, hickory, sweet gum, water oak, magnolia, beech, tupelo gum, and walnut. At the present time at least half of the area of the type contains a mixture of loblolly and shortleaf pines with the hardwoods while the old fields are usually occupied by pine to the exclusion of merchantable hardwoods. Heavy stands are found in some places, but the whole region will not average over 2,000 to 4,000 feet per acre for all the forest land. The forests have been culled to such an extent for local and export use that there is practically no virgin timber left, except in the most inaccessible situations. The young growth comes up rapidly, however, and is tall and straight, so that there is often a good stand of small thrifty trees where cuttings have been made sometime ago.

Reproduction of the better species is usually excellent. Ash, sweet gum, water oak, and hickory are especially abundant. Both species of pine seed reproduce freely where seed trees are present, so much so that in some places there is a probability that the hardwoods will be eventually crowded out. A dense undergrowth of cane, often found among the river hills, seriously hinders reproduction, but furnishes excellent winter pasturage for cattle.

The second growth forests, which come up on abandoned

fields, vary considerably from those of original growth, almost justifying their separation into a different type or subtype. Two variations of the oldfield growth are found, hardwood and pine. The hardwoods come in on abandoned fields more slowly than the pine. They are usually of the poorer species, such as sassafras, hackberry, plum, and the inferior oaks, and it is only after many years that a stand of the better species, such as yellow poplar, white oak, and hickory becomes established. Black locust comes in naturally and is one of the most valuable and fastest growing trees in this type, but it is liable to serious damage by fire and insects.

Where seed trees are near enough, old fields usually seed up with loblolly and shortleaf. These grow faster than the hardwoods and form a much denser stand. Their relative proportion in mixture varies according to the available seed trees and to the quality and moisture content of the soil, the loblolly preferring the deeper, moister soil. These old fields are frequently used for pasturage, and the grass is burnt off to improve the range. As a result the pines are often sadly injured and the soil impoverished.

Mississippi Flood Plain.—All the bottoms and swamps lying between the Mississippi River and the "cliffs," or loess hills, are subject to overflow or would be overflowed were they not protected by the levees. The most extended areas lie about the mouths of the larger rivers, such as the Big Black and Homochitto, where water from the Mississippi often backs up these streams for many miles, flooding the country on either side. The greater part of this area is submerged only in times of high water, but much of the low swamp land is under water the greater part of the year.

The soils of these overflowed lands are alluvial deposits of sandy loam, varying to clay loam. Where a stream carrying sediment overflows its banks, the water begins at once to lose its velocity and deposit the sediment. The coarser and heavier particles of its suspended matter are deposited near the streams, while the finer particles are

carried longer in suspension and are dropped farther from the main channel. It is for this reason that the land nearest the river is often higher and better drained than that farther back. The former is probably the richest land in the country and, where it can be drained and protected from overflow, it is being rapidly cleared for cultivation.

As the currents of the Mississippi tear away the banks and make new deposits, the course of the river is constantly changed. Much of the newly-formed soil seeds up with cottonwood and willow, the seeds being carried with the overflow on the surface of the water and deposited as the water receded. This results in even-aged and pure stands of these species over large areas of the Mississippi River country. Later many of these areas seed up underneath with sycamore, elm, red oak, and other hardwoods, which in time replace the cottonwood and willow. Overcup oaks, gums and cypress finally take possession of the poorest drained soils. Cypress and tupelo gum are found mostly on land that is flooded throughout the year.

Originally, the timber on these flood plains was of magnificent size. Even yet cottonwood is being cut which yields 2,000 board feet per tree, and stands of mature cottonwood often yield from 20,000 to 30,000 feet per acre. Undoubtedly some of the original cypress and gum stands averaged 50,000 feet per acre. At present, however, there is little virgin timber in this type, much of it having been culled over several times. Often all timber that will float, such as cypress, cottonwood, willow, ash and oak has been taken, and only the gum and some inferior species left. On many of the plantations some cypress has been reserved for home use, as this furnishes the material most used for fencing, barn building and general repairs.

On most of these bottom-land swamps there is little reproduction because of the excess of water through the greater part of the year. On the better-drained soils, such undergrowths as cane, green brier, and dwarf palmetto, and the density of the forests, greatly interfere with the reproduction of the species that cannot endure shade. The rate of growth is generally rapid, especially on the

better drained soils, but cypress always grows slowly. Fire sometimes runs over the drier land in the summer season, but the fire danger is not serious.

River and Creek Bottoms.—The chief rivers of this region are the Pearl, Homochitto, Black, Bogue Chitto, Amite, Bayou Pierre and Buffalo Bayou. The soil and moisture conditions of the bottom bordering these streams, their tributaries and other creeks vary so much from the surrounding country, and even from the Mississippi flood plain, with a consequent variation in the nature and composition of the forest, that these bottoms give rise to a practically separate type. In many cases, however, they are so narrow, often only a strip on one or both sides of the stream, that this type cannot be accurately marked on the map.

The soils of these bottoms vary according to the size and location of the stream, the elevation of the land above the stream level, and the rate of the streamflow; all contain a considerable amount of organic matter and are quite fertile. For this reason much of the type has been cleared, and the rest of it will undoubtedly be used for agriculture as soon as the land can be successfully drained.

The forests are composed mostly of hardwoods and differ from those of the Mississippi bottoms chiefly in the entire absence of cottonwood and willow stands, and in the presence of loblolly pine on all but the lowest ground. Cypress, tupelo gum, ash, sycamore and elm flourish on the lower, poorer-drained soils, while loblolly, oaks, sweet gum, magnolia and beech do better on the warmer soils. Growth is rapid, especially on the well-drained soils. Most of this bottomland type has been culled over, especially for cypress, the greater part of which has been cut and floated down stream to market. There is some old growth loblolly of large size still to be found, chiefly along the smaller water courses, and young growth comes in very rapidly on abandoned old fields, as in the other hardwood types. Oak and gum now form the larger part of the commercial timber in this type, as there has been very little demand for these species for local use, and they can

only be used for shipment where transportation facilities are good.

Reproduction on these bottoms is usually excellent, especially of the smaller seeded species, such as loblolly, tupelo and sweet gum, ash and sycamore. Much oak seed is eaten by the hogs that range over the bottoms and are fattened altogether from the mast of oak, hickory and beech. Fire, though rarer in the bottoms than on the dry uplands, often does great injury, especially to the reproduction.

CONDITIONS BY COUNTIES.

The question of the method of management to be employed in any certain case depends upon the forest type, the local markets and means of transportation, the present condition and ultimate purpose of the forest and other minor considerations. In the following description of conditions in each of the counties included in this study, these points are touched upon in order that local conditions may be understood and that the recommendations given elsewhere in this report may be intelligently applied in individual cases. In these descriptions the proportion of cleared to forest land in the various counties was, in most cases, taken from the county records and checked up as closely as possible by the personal investigations of men in the field.

Pike County.—Pike County, with an area of approximately 450,000 acres, of which about 30 per cent is cleared, lies entirely within the pure longleaf area. It is for the most part a gently rolling country with a variation in elevation of not more than from 100 to 150 feet. Originally the county was covered, except for the bottomlands, with pure longleaf pine. The Bogue Chitto River, the bottomlands of which once contained magnificent hardwoods and cypress, passes through the center of the county. The Illinois Central Railroad passes through the western portion, and at frequent points along this line lumber companies have established sawmills and built tram lines east and west from the main line of railroad. Longleaf pine is lumbered almost exclusively.

There are only two types of forest in Pike County, the longleaf uplands and the bottomlands. The former covers extensive areas, probably 80 per cent of the county, of which at least one-third is still well forested. The bottomlands have been extensively cleared for cultivation, and there is little merchantable hardwood now found there.

The eastern half of the county still contains large areas of excellent pine. All this timber, however, is in the hands of a few lumber companies which are rapidly exploiting it. Three lines of logging railroad penetrate the timber from the Illinois Central Railroad, and another is reaching up from the mills at Bogalusa, Louisiana. Small mills are lumbering isolated areas, or removing the timber left on areas that were lightly culled some years ago. Many of these culled stands contain 2,000 to 3,000 board feet per acre. Virgin stands in the eastern townships yield from 10,000 to 30,000 feet per acre on small areas. Farmers are getting an average of \$20 an acre for pine lands. Some acres have sold for \$50. Stumpage is about \$2 per thousand, or from \$5 to \$20 per acre. Approximately 420,000 board feet of longleaf pine are cut daily for export use from mills located along the line of the Illinois Central. Some of this timber, however, comes from other counties.

In the past two or three years great damage has been done to the standing longleaf pine of this county by windstorms, especially in moist sags within the plateau regions. Probably 100,000,000 feet of fine timber have been destroyed.

Much of this pine land is valuable for agriculture, but it may not be cultivated, because not needed, for many years to come. So far, cultivation has been carried on chiefly within from six to ten miles of the railroad.

Turpentine is practiced more extensively in Pike County than in any of the other counties west of the Pearl River. Tylertown is the center for the orchards of the Fernwood Lumber Company, and considerable turpentine is also done in the northern townships. Railroad ties are cut from old field pine and also from standing dead trees or heart pine. They are sold at 25 cents each at

the railroad. Cordwood sells at about \$1.25 per cord where there is demand for it.

Years ago most of the school lands were leased and the lessees disposed of the standing timber. The schools of the county have thereby been deprived of a good source of revenue which would now be coming in from these pine lands.

Marion County (west of Pearl River).—Western Marion County, between Pike County and the Pearl River, is one of the few areas in Mississippi which still remains heavily timbered. It is a continuation of the longleaf region of eastern Pike County not yet lumbered, and consists of longleaf upland and narrow intervening creek bottoms covered with hardwoods, mostly of second growth. Considerable areas of bottom-lands skirt the Pearl River, although along some portions of it the banks are more or less precipitous.

There are approximately 63,000 acres of cleared land and 137,500 acres of uncleared land in this county west of the Pearl River. Of the uncleared area probably 60 per cent consists of merchantable timber, mostly longleaf pine. It is estimated that there are only 800 to 1,000 acres of true stump land in this area at the present time. Many thousands of acres of pine land, however, have been culled over in the past, and cannot now be classed as first quality pine land. Extensive areas have been boxed for turpentine, and the trees left to blow down or burn up, because of the absence of any lumber industries to use the boxed trees. There is comparatively little of the old field pine type.

This western portion of the county is largely a high, dry plateau, extending eastward from McGee's Creek, in Pike County, and falling off more or less abruptly to the Pearl River bottom-lands. Lumbering has scarcely begun over this longleaf plateau land. The timber is owned by several lumber and realty companies which will eventually log the land from the tram lines approaching from the Illinois Central Railroad, and from the New Orleans Great Northern Railroad, recently constructed northward from

New Orleans along the Pearl River. A branch of this line running to Tylertown from Louisiana will carry out much of the timber.

The timber has suffered severely from cyclones within recent years, but there are stands which still run 30,000 board feet per acre.

As yet there are few timber industries in the county. Turpentine will increase greatly as logging commences. Ties are cut from the townships bordering on the Pearl River that are most accessible to the railroad now being built.

The longleaf pine land is assessed at from \$10 to \$15 per acre and stump land at from \$3 to \$5 per acre. Agriculture has been but little carried on in these uplands, and the population is scattered. There is much fine agricultural land along the Pearl River and at the base of the uplands, and the larger part of the cultivated land is naturally there. The new railroad through this county will develop the agricultural resources of this section as well as afford transportation facilities for the large undeveloped timber supply.

Lincoln County.—Lincoln County lies almost entirely within the longleaf belt. It was once heavily timbered, but today its timber is practically exhausted. The topography is gently rolling to level, and the changes from upland to stream bottom are seldom abrupt. The region is well drained by numerous streams. About 113,600 acres are classified as cleared land, while 259,000 acres are uncleared. Of this uncleared area only about one-quarter, or less than 18 per cent, of the entire area now supports a growth of merchantable timber, while the rest has been culled or remains as unproductive stump land, blackened by repeated fires and produces, at best, only an inferior quality of oaks and other hardwoods. The cleared lands consist of cultivated creek bottoms, the more level portions of the uplands and old fields. These old fields are abandoned because of erosion or impoverishment of the soil, and are now growing up to loblolly pine, which is frequently mixed with young hardwoods. There are no extensive areas of hardwood bottoms which have not been

culled for more valuable oaks, hickories, poplar and cypress. Second-growth loblolly on old fields frequently attains considerable size, and is being cut for lumber. A growth of 12 inches in diameter in twenty-five years is not at all infrequent.

The Illinois Central Railroad passes through the county from north to south, and many years ago opened up the country for farming and lumbering. Logging has been done on the most extensive scale. The total estimated capacity of the principal mills operating along the Illinois Central Railroad in this county amounts to 700,000 board feet of longleaf pine per day in the form of lumber, shingles, laths, etc. Lumbering on such a scale has taken almost all the longleaf pine in the county. Operations are now chiefly confined to small bodies of timber in the southeast townships.

Recently the Mississippi Central Railroad has been constructed through the county from the east, which will give direct connections between Hattiesburg and Natchez, and this will greatly foster the agricultural developemnt of the county. Tram lines have penetrated every portion of the county and many of them now are hauling logs from adjacent counties to the mills along the Illinois Central Railroad.

The region has no valuable reproduction. Barely one per cent of the stump land is free from annual fires, and new growth is confined almost entirely to old fields. Much of this land will in time undoubtedly be brought under cultivation, but a great deal of the stump land will remain idle until intensive methods of farming are more generally practiced.

Lawrence County (west of Pearl River).—The topography of the western part of Lawrence County is similar to that of Lincoln County, except for the strip of bottomlands adjacent to the Pearl River. With an approximate area of 156,000 acres, only about 34,000 acres, or a little more than 20 per cent, is listed as cleared land. In portions of the Pearl River bottom-lands and the vicinity of creeks the cleared land is extensive, and upland cultivation is

also considerable. The uncleared land consists of hardwood bottoms, isolated stands of longleaf pine, and stump land. A large proportion of the longleaf uplands has been logged within recent years. In this county the lumber industry is nearly gone. The only remaining longleaf pine stands are in the four southern townships and a few isolated holdings in the northern part of the county.

The New Orleans Great Northern Railroad passes through the county close to the Pearl River, and the Mississippi Central crosses it from east to west. These railroads, with the line connecting Monticello and Brookhaven, greatly facilitate the development of the county. The lumbering is done over dummy lines extending from the Illinois Central Railroad. The longleaf pine timber remaining will be exhausted within a few years, and possibilities for agriculture are excellent.

Pine land is assessed at \$15 per acre, cultivated land at \$10 per acre, and stump lands, old field and hardwood land at \$5 per acre.

Copiah County.—The forests of Copiah County vary from pure longleaf in the southeast to the hardwood hills in the northwest, but the greater part of the county is occupied by the longleaf hills type. This variation in forest type corresponds to the change in the character and formation of the soil. While the southeastern portion of the county contains the Lafayette red clays, the northern part consists of silts or loess of great fertility. Between these extremes, the soil changes gradually. This change marks the limit of longleaf pine as a pure type, for in the fertile soils of the silt formation the species is rare. North of this transition area, hardwoods formerly occupied much of the land. The county is nearly level or gently rolling, and much of it has been cultivated for many years. It comprises an area of 442,000 acres, of which nearly 70 per cent is cleared. A considerable amount of the land classed as "cleared," however, contains old field pine and second-growth hardwoods. The uncleared area contains pure and mixed longleaf pine and hardwoods. Very little of the merchantable hardwood is left. Practically all the

pure longleaf pine in the county is now held in the four southeast townships, which contain 65 per cent of the virgin pine of the county. It is being lumbered from the vicinity of Wesson, on the Illinois Central Railroad. The New Orleans Great Northern Railroad will be the means of opening up the region along the Pearl River. In the southwestern portion of the county the longleaf is of poorer quality and in mixture with shortleaf. South of Hazlehurst, along the Illinois Central Railroad, was once a longleaf country, but the timber has been removed. Local sawmills scattered about the county are cutting old field pine and scattered virgin timber, both pine and hardwoods. Agricultural land is extremely valuable, and is often worth \$30 to \$50 an acre. Northern Copiah County is devoted largely to agriculture and is becoming noted as a truck-raising district.

Franklin County.—Franklin County has an area of about 380,000 acres. Less than one-fourth of it is listed as cleared land, much of which is now reverting to a second growth of pine. The western border of the longleaf pine region runs in a southwesterly direction through this county. The pure longleaf type, which covers about 10 per cent of the total area of the county, extends only into its extreme southeast corner. This has nearly all been cut over within the past five years. The greater part of it is now practically denuded of pine and is supporting only a scrubby growth of the inferior species of oak. Very little of this land has as yet been cleared for agriculture. If seed trees of pine had been left when the lumbering was done a good growth of pine might now be coming in, to take the place of the forest removed. This corner of the county is so far distant from lines of railroad that it will probably be many years before much of it will be much needed for agriculture, and a second crop of valuable timber coming on the land would have been of great profit to its owners and to the county.

The longleaf hills type covers over half of the county. Owing to the mixed character of the forest, the broken nature of the country, and its remoteness from the rail-

roads, the greater part of the timber is still standing. Longleaf is the predominant species, and forms from 50 to 70 per cent of the stand over large areas. The timber is sound and healthy, but it is not as tall as the longleaf farther east. It is for the most part confined to the top and upper slopes of the hills. Shortleaf and loblolly pine in varying proportions make up about 30 per cent of the forest. On the average about 10 per cent of the stand is hardwood, such as white oak, yellow poplar, sweet gum and hickory, which occur mostly in the hollows and lower slopes of the hills. On some areas, however, more than half the timber is hardwood. Lumbering, except for local use, has been confined to the pure longleaf type and to several places along the Yazoo & Mississippi Valley Railroad in the hardwood hills type, reaching into the longleaf hills in only one or two places. But with the construction of the Mississippi Central Railroad and with the gradual exhaustion of longleaf in other sections, a good many mills are starting up, while several large companies are buying all the timberland available. Franklin will in a short time be one of the largest lumber-producing counties in the region. The greater part of the longleaf hills type is possibly better fitted for the growth of forest than for field crops, and so in all logging operations care should be taken to perpetuate the forest by leaving seed trees, by preventing injury to young growth, and by fire protection.

The hardwood hills type lies along the western and northwestern borders of the county and covers barely one-third of its total area. This part of the county has furnished most of the stave timber which has been, in the past, one of its chief timber outputs. A large portion of this section has been cleared for agriculture, but much land has been allowed to revert to forest. These areas, now grown up in loblolly pine, are furnishing practically all the railroad ties of the county. In the past year this industry has more than doubled its output, and now there are five or six mills for cutting ties in this part of the county.

The Homochitto River runs through the county, and there are considerable areas of bottom-lands along this

stream and its tributaries, though probably not over five per cent of the county is in this type. Some good blocks of timber, consisting of oak, gum, loblolly, etc., are found, though lands which are dry enough are being cleared for agriculture. Cypress, which was once plentiful through these river swamps, has mostly been cut out and floated down the river to market.

Franklin County is developing its agricultural resources year by year, but for some time there will be considerable land on which it will be more profitable to grow timber. With the great increase in the lumber output, which has already begun, especial care should be taken to log such land conservatively, while fire protection should be undertaken by the owner and encouraged in every way by the county.

Amite County.—Amite County includes all of the forest types except the Mississippi bottoms. The pure longleaf type extends over the eastern half of the county. The western half, except for the southwestern townships, is covered by the longleaf hills type. The southwestern part of the county is largely cleared, and resembles the more level topography of Wilkinson County. It is classed as hardwood hills. The county has an area of 443,000 acres, of which only about one-fourth is listed as cleared land. The greater part of the land under cultivation is in the western half, where the soil is much more fertile, and agriculture has been engaged in for many years. The soil here is influenced to a great extent by the loess silts. The eastern half of the county consists of dry longleaf pine uplands with frequent narrow creek bottoms. Pure longleaf pine formerly covered these uplands, and lumbering began many years ago on a small scale. Dummy lines were constructed from points on the Illinois Central Railroad. At first only the finest timber was removed, but present operations leave practically no pine timber on the land. There is still some good timber not yet lumbered, and there are other large areas which have been culled.

It is estimated that one-half of the longleaf uplands have been cut over and are now mostly stump lands. Prob-

ably one-fourth of the timber was culled out or destroyed years ago, and today these lands either still retain some longleaf pine or have grown up to hardwoods and loblolly pine. The remaining one-fourth of the original longleaf pine is still uncut and will last probably from ten to fifteen years.

West of the center of the county the longleaf pine is largely mixed with loblolly and shortleaf. The country is rough and extremely hilly in places. Farming is carried on extensively toward the western county line and in the southwest. The northwestern portion extending into Franklin County is heavily timbered with mixed pine and some hardwoods. This is in the hands of large companies.

There are over thirty small mills in the county cutting lumber, mostly for local use. Some hardwoods are being cut for foreign export. There is very little hardwood remaining in the county outside the northwest section. Turpentining is carried on to some extent east of Gillsburg.

On the longleaf uplands, areas cut over several years ago, often containing 1,000 to 3,000 board feet of timber per acre, can be bought for \$5 per acre. Small mill owners often buy these areas from the big companies. This county is being rapidly stripped of its timber, and the largest companies will cut their supply in a comparatively few years.

Tie cutting is general. In the east the ties are largely disposed of to the Liberty White Railroad, and in the west they are hauled to the line of the Yazoo & Mississippi Valley Railroad. Most of the county is accessible to one of the other of these railroads.

The county shows considerable interest in the care of its school lands. Most of the timber on the sixteenth sections was cut many years ago, when pine was considered valueless and its removal a benefit. These old cuttings are past redemption now, but where school timber still remains it is being preserved. Three recent cases are reported where the county has been reimbursed for timber removed on rented lands. Eight townships in this county are receiving money from their school lands.

Wilkinson County.—Wilkinson County, with an area of a little more than 400,000 acres, occupies the extreme southwestern corner of the State. It is essentially an agricultural county, 63 per cent of the land being listed as cleared. All types but the pure longleaf, which does not extend as far west as this county, are represented. The longleaf hills type covers the northeast corner of the county north of Buffalo bayou. The stand on this type averages 5,000 to 7,000 feet per acre. The soil is not as fertile as that in the other parts of the county, and the hills, though short, are steep and liable to wash, so that the greater part of this area is more suitable for forest growth than for any other purpose. Longleaf pine is the principal timber tree, though in some areas, especially near the railroad on the eastern boundary, most of this species has been cut out, leaving loblolly and some shortleaf the predominating trees. Where fire has not passed over the ground lately, the reproduction of loblolly and shortleaf is excellent, and on some old cuttings longleaf also is reproducing very satisfactorily. It is probable, therefore, that with careful management no trouble would be experienced in keeping any part of this corner of the county in a permanently producing forest.

The greater part of the county is covered with the hardwood hills type. In the western half of the county the hardwoods are in almost pure stands, while in the eastern part they are mixed with loblolly and some shortleaf pine. The land produces excellent crops of cotton, so that only the steep slopes from which the soil will wash away, if cleared, should be kept in permanent forest growth. The trees to be encouraged are yellow poplar, ash, hickory, and sweet gum.

On the Mississippi flood plain, and on the river and creek bottoms, the only land more suitable for forest growth than for agriculture is that which is too wet to cultivate. It will eventually be drained and put to its highest use, but in the meantime it should be kept in forest and the young growth protected when the mature timber is cut.

Lumbering has not been carried on extensively in Wil-

kinson County, and practically all the lumber cut has been for local use, except on the Mississippi bottoms, where it has been floated or shipped on the river. One line of railroad enters the county, a branch of the Yazoo & Mississippi Valley Railroad coming up to Woodville. Along this branch, and near the eastern border of the county close to the main line, ties are being cut in considerable quantities, mostly from loblolly. The production of white oak staves has for some years been the largest lumber industry in the county, but now there is little accessible timber left suitable for this purpose.

Adams County.—The eastern part of Adams County is rough and hilly, and characterized by the steep ridges and narrow ravines of the hardwood hills type. To the west the land becomes more rolling, cut by deep ravines and marked by excessive erosion. Bordering the Mississippi River the general level of the land drops abruptly to the bottomlands by a range of steep hills, or "cliffs," extending through the county. The overflowed Mississippi bottoms are chiefly in the southwest part of the county where the river backs up into the Homochitto River and floods large areas, sometimes during the entire year. The soil of the county is everywhere influenced by the silt or loess loams which increase in depth near the cliffs. Alluvial soil occupies the area between the cliffs and the Mississippi.

Much of the hill section of the county is still heavily timbered with pine and hardwoods. The difficulty of logging the inaccessible ravines and ridges has thus far prevented lumbering, except for selected logs for export. West of the hill section, once entirely hardwoods, the county has been largely cleared and cultivated. Immense plantations are common surrounding Natchez, and much of this land is without much tree growth. Old field pine, however, as elsewhere on similar lands, takes possession of abandoned fields. The bottomlands along the Mississippi are either in cultivation or occupied by stands of cottonwood, oak, gum and other hardwoods. Throughout the Homochitto overflowed lands, there are still some splendid bottom-land forests of cypress, gums and oak.

A considerable amount of this type has been cultivated and many of the forests culled of their best timber. At present 27,000 acres along the Homochitto River are being drained for cultivation. Approximately 132,000 acres, or half the area of the county, is listed as cleared land. The uncleared land is confined to the eastern hills and the river bottoms. The assessment of the best agricultural land is sometimes as high as \$33 per acre, with an average of \$10. The uncleared land ranges from 50 cents to \$7, with an average of about \$5.

The timber of the hills type is mostly owned by a few companies, two of which are about to begin extensive operations. The merchantable trees, both hardwoods and pines, average about 5,000 board feet per acre. Reproduction is excellent, both of pine and hardwoods. Lumbering is being carried on in the Homochitto and Mississippi bottomlands. About 85,000 board feet of cottonwood lumber are being cut daily by small mills along the Mississippi, besides about 60,000 board feet of logs which are taken from the Homochitto region and rafted to Louisiana. Cypress and gum are also being lumbered from the bottoms. The growth of cottonwood is extremely rapid, and the tree reaches merchantable size in from 15 to 25 years. Many cottonwood stands will cut from 12,000 to 25,000 board feet per acre. Natchez is the great center of export for most products, and the Mississippi River offers the cheapest outlet for lumber. The Mississippi Central Railroad, when completed, will facilitate export through the center of the county.

It is estimated that 85 per cent of the swamp lands are still uncleared, though it is probable that all eventually will be cleared for agriculture. The steepest parts of the hill section are absolute forest land, being too steep ever to become available extensively for farming. The remainder of the county will always be more valuable for agricultural purposes.

Jefferson County.—Except for the extreme southeastern part, Jefferson County is agricultural, and a large part of it is under cultivation. A high, somewhat broken pla-

teau extends westward into the county and is occupied by mixed longleaf and shortleaf pine. This longleaf hills type quickly passes into the hardwood hills type as the land becomes lower and more level, and as the soil becomes influenced by the silty loams. The section west of the longleaf uplands, which comprises practically the whole county, was originally covered with hardwood of fine quality, much of which has long since been cleared. A large part of this section, however, has grown up again to loblolly and shortleaf pines. Approximately 146,000 acres, or nearly 52 per cent of the county, is classed as cleared land. The assessment of cleared land averages \$4.50 per acre and uncleared land \$4.

This was once a region of magnificent hardwoods, but much timber was cut and destroyed in clearing the land. Fifty years ago the whole region, except the swamps and longleaf uplands at the extreme southeast, was in a thorough state of cultivation, and plantations covering thousands of acres were common. But since the war much of the land has grown up to old field pine. Reproduction is prolific, and the growth exceedingly rapid, so that land once cleared but not now actually in cultivation, is covered with old field pine, either scattered or in fairly even stands. The average stand is about 2,000 to 3,000 board feet per acre, though some stands exceed 10,000 board feet. This land is being bought up by lumbermen and others for purposes of speculation.

Small mills have been operating for many years where the haul to the railroad is not too long. A great development of lumbering is about to take place in eastern Jefferson County, with the opening up of the Mississippi Central Railroad through Franklin County and a possible branch line into Jefferson County. It is probable that within a few years lumber companies will be logging extensively throughout the eastern half of the county. Until recently there was no market for shortleaf or loblolly pine, but with the scarcity of longleaf pine and the consequent rise in prices of lumber, practically all the pines will be extensively logged in the future.

The only longleaf pine in this county is in the two southeast townships. This has been logged in a small way and the lumber hauled to McNair, on the Yazoo & Mississippi Valley Railroad, about twenty miles distant. The tie industry is important along the railroad lines. Small tie camps are established near good stands of loblolly and shortleaf pine, and are moved whenever the adjacent supply is exhausted. Many hardwood logs are hauled by farmers to the railroads and shipped to New Orleans and other points for special manufacture and for export.

Though the county is essentially agricultural, there is much land that should be kept permanently in forest. Such land would include the longleaf hills type and any other land that will wash badly when cleared. Much land in the hardwood hills type is very steep, and washes so badly when cleared with an incident loss of soil and fertility that it has to be abandoned in a few years to grow up to pine or hardwoods. On these situations the better quality of hardwoods, such as yellow poplar, ash, hickory and oak, should be encouraged, and also loblolly where it is abundant. This timber, in time, will be extremely remunerative.

Claiborne County.—Claiborne, with a total area of something like 320,000 acres, is essentially an agricultural county. Owing to its situation on the Mississippi River, settlement began early, and now probably 80 per cent of the area is cleared. A larger proportion of the cleared land is being regularly cultivated than in any other county in the region. With the exception of a narrow strip of overflow land along the Mississippi and the river bottoms, the whole of Claiborne County lies within the hardwood hills type. It is probable that the longleaf type at one time reached over into the southeast corner of the county, but with the clearing of most of the upland and the increased local demand for lumber, practically all of this species has now disappeared. The southern and central part of the county is comparatively level or rolling and has been well cleared. Old field pine, therefore, forms the larger part of the present forest growth. To the north of Bayou

Pierre and extending to the Big Black River, the hills are steeper and the country more broken, and there is a larger portion of forest land.

The old growth forest with an average stand of about 4,000 feet per acre is all hardwood, the chief species being white oak, hickory, yellow poplar, sweet gum, water oak, and elm. Occasionally some old trees of loblolly are mixed with the hardwoods, which, together with the second growth shortleaf and loblolly already established, furnish seed for the reforestation of abandoned fields. The hills run out so close to the rivers both north and west that there is a relatively small area in bottom-lands, and hence there is very little cottonwood. Most of the bottom-land that is dry enough has been cleared for agriculture.

Local lumbering by small mills does not exceed an annual cut of two and a half million feet—nearly all old field pine. An average stand for old fields will not run over 3,000 to 4,000 feet per acre. An average stumpage price for second growth pine is about \$1 a thousand, and the product sells for from \$10 to \$11 at the mill. The cutting and shipping of hardwood logs for export is the largest timber industry of the county. Many carloads go out each month over the two lines of railroad. Nearly the entire county is accessible to either rail or water communication, and at the present rate of cutting it cannot be very long before all the export timber is cut out. White oak staves are being cut to a considerable extent, and good, accessible stave timber is becoming scarce. Stumpage for stave wood runs from \$1 to \$2 a cord, and a stand of 1 to 2 cords to the acre is considered fair.

The only land in this county which can profitably be kept in permanent forest growth is that too steep for cultivation—the land which is now furnishing most of the export and stave timber. These two industries demand only the larger trees, so that, as a rule, all the smaller trees are left standing. With proper care in felling the timber and adequate protection from fire, these forests should yield a sufficient supply of timber for all local needs.

TIMBER INDUSTRIES.

Lumbering.—The lumbering of yellow pine is the most extensive forest industry in the State. As carried on by large concerns, it involves tremendous outlays for mills, machinery, railroad lines, locomotives and other miscellaneous equipment, besides an army of men. In 1906 the production of yellow pine lumber in Mississippi was 1,509,554,000 feet, the total value of which was \$24,387,901. Unfortunately this enormous industry is rapidly consuming its capital, the standing timber, without taking any steps to insure the production of a second crop. With the decline of the industry the southern part of Mississippi will gradually lose the most important of its present sources of wealth. Agriculture will develop as the country becomes more settled, but much of the land which will eventually be used for farming and which is now yielding nothing, can profitably be kept in forest growth for many years to come. Simple, conservative methods of forest management, such as leaving of seed trees and protection from fire, would undoubtedly pay the owners of yellow pine lands. The large operations are confined almost entirely to the pure longleaf type. Large mills are located only on important lines of railroad, from which the logging railroads or tram lines are constructed into timber. These often extend 25 miles or more from the mills.

Choppers are paid by the log or by the thousand feet. The logs are hauled to the spurs by steam skidders, or, if in inaccessible places, by team. They are left anywhere within 150 feet of the railroad, where the steam loaders pick them up. One steam skidder and one loader will usually handle about forty cars of logs a day. The cost to put logs at the mill varies from \$2 to \$4 per 1,000 B. F., exclusive of stumpage, divided about as follows:

Cutting.....	\$ 50	\$ 80
Hauling.....	60	1 30
Loading.....	20	40
Railroad haul.....	70	1 50
	<hr/>	<hr/>
	\$2 00	\$4 00

The cost of manufacturing varies according to the size of the mill, equipment, etc. Large mills can manufacture more cheaply than the smaller ones, because they have equipment for utilizing the slabs and other waste in shingles and laths. The planing mill also lessens the cost by saving weight in the shipment of lumber. Lumbering by small mills often necessitates long hauls and requires a ready local market. Hundreds of such mills in the State supply the farmers with lumber and furnish employment for many local residents. Undoubtedly there will come a time when lumbering will be on a smaller scale than at present, when small stationary or portable mills will be used, as is now the case in many other parts of the United States.

The logging of extremely rough country is expensive, and it naturally is the last to be logged. It is often necessary to make long hauls with mule or ox teams, and operations must be on a relatively small scale. With such conditions conservative methods are most easily put in force, because the smaller trees will often not pay for the long haul, and the absence of engines in logging eliminates the most serious cause of fire. Methods of bottomland logging vary with the location of the mill. In some cases, as with cottonwood along the Mississippi, the logs are hauled by team to the banks of the river, where the mills are located. Sometimes railroads are constructed into the swamps from the river. The lumber when manufactured is shipped in barges to important points, as Cairo, Cincinnati, or New Orleans.

The cost of cottonwood lumbering varies about as follows:

	Per 1,000 B. F.
Cutting and hauling to the mill.....	\$3 50 to \$4 50
Sawing	3 00 to 3 00
Piling and loading on barge.....	50 to 1 00
	—————
Total	\$7 00 to \$8 50

A certain percentage of willow is often cut with the cottonwood, but it is worth considerably less. Willow stumpage is about one-third that of cotton-wood, which

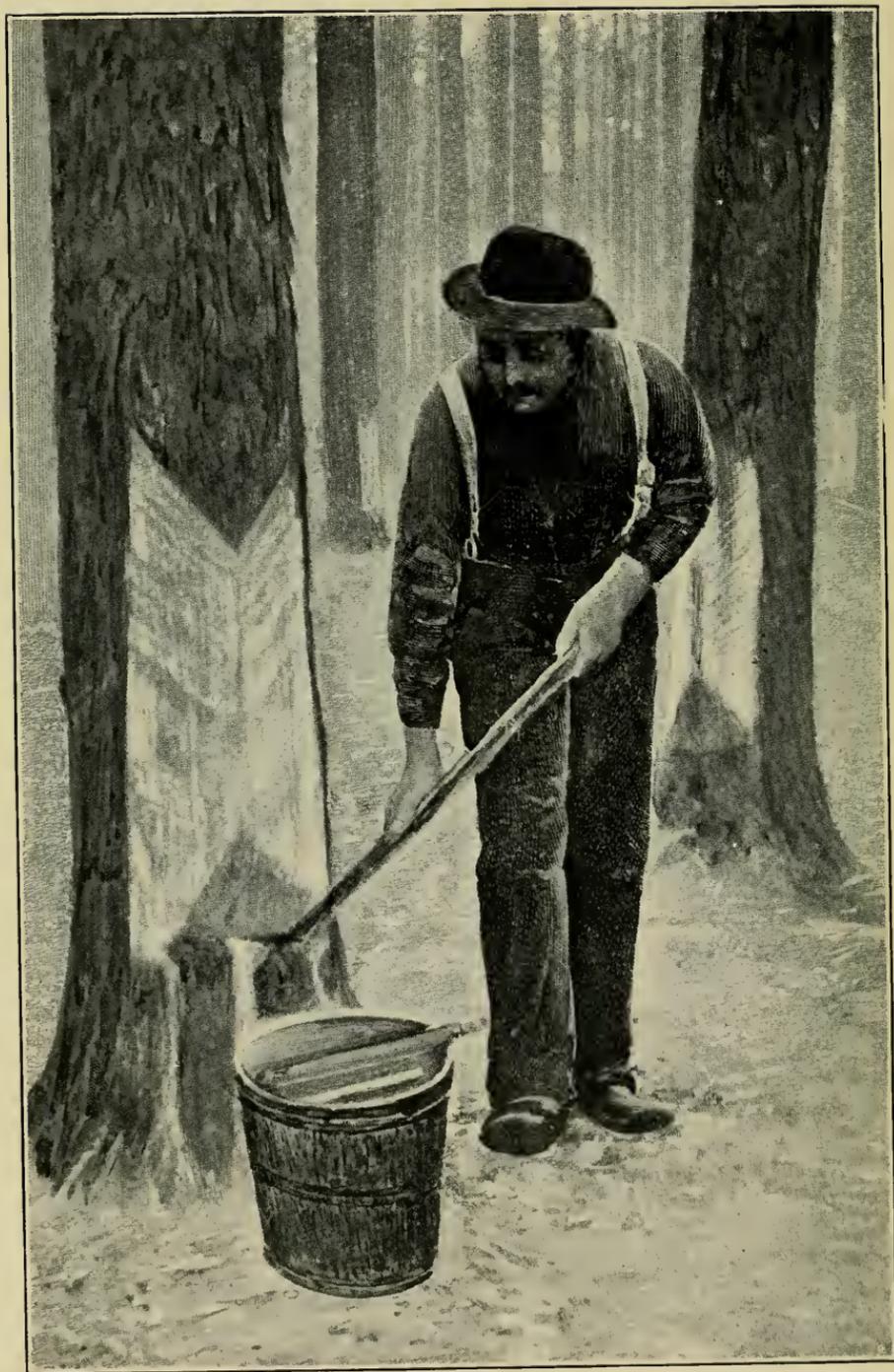


FIG. 5.—Turpentine Orcharding. Dipping the Crude Resin.—From Mohr's Timber Pines of the Southern United States.

varies from \$3 to \$5 a thousand feet. The manufactured product sells for \$12 per 1,000 and up, loaded on the barges.

There is more or less waste of wood in the lops and tops in all cottonwood operations, which might be very profitably utilized if there was a market for pulpwood near by. Above Memphis, pulpwood sells for \$4.50 or more a cord. A plant for the manufacture of paper pulp, if erected at some point on the river between New Orleans and Memphis, would certainly have a large supply of raw material to draw from. A good market would thus be created for valuable material that is now wasted.

Many of the small holders of timber-land do not yet realize the value of stumpage, treating it as an asset like coal or iron, which, after it is once used up, is gone forever. Instead, it should be regarded as a crop and harvested in such a way that another crop would be assured. In selling standing timber, unless the intention is to clear up the land at once for crops, there should be some provision for the care of the young growth of the valuable species. It is a mistake to assume that timber cannot be sold unless the buyer is allowed to cut clean if he so desires. There is very little money in sawing small poles below say 10 or 12 inches, and so they are not usually cut where sold by the thousand board feet. Where, however, timber is bought by the acre, no stumpage charge is reckoned, and every tree is cut which will yield a profit over the cost of manufacturing alone. Cutting restrictions, providing for leaving the young growth, have been insisted on in several sales of timber in this region, and there is no reason why this should not be done in every sale.

Turpentining.—Turpentining should go hand in hand with lumbering longleaf pine. The forest should be so managed that trees may be boxed for several years ahead of the logging. Many companies have never turpented their pine, because they were not sure how soon it would be logged. If lumbering follows the turpentining too quickly, the cost of erecting a still and boxing the trees is greater than the returns warrant. On the other hand, when logging does not follow the turpentining, the boxed trees are

usually badly injured by fire and often blown down, so turpentine is most profitable when it can be started three or four years before logging begins.

The Fernwood Lumber Company turpentines its holdings about Tylertown, Pike County. There are also stills located in the northern part of the county and in Amite County. The largest operations in southwestern Mississippi are located in this region. The cup and gutter system is used extensively, though operators complain that the metal cups and gutters corrode and cause a discoloration of the resin, which reduces its grade. Malicious persons, and cattle, frequently knock off the cups. Much less injury, however, is done to the trees when the metal cups and gutters are used.

While the injury to lumber, which often results in lowering the grade of certain boards, and sometimes in butting off the first logs, is considerable, the profits from turpentine orcharding, in conjunction with lumbering operations, greatly overbalances the loss in lumber.

Tie Production.—Tie production is an important industry in southwestern Mississippi. In the longleaf belt, heart pine ties have been cut and used for many years, and many railroads use no other ties. But with the increase in the value of longleaf timber and the successful treatment of old field pine with creosote, the tie industry in the State is taking possession of the old field areas in the western counties, where the hauls to the railroad do not exceed four or five miles.

Loblolly and shortleaf pines are the principal trees used for ties in this section, though occasionally hardwoods of nearly every species are cut also. Timber for this purpose is largely second growth, since old growth is, for the most part, too far from the railroad to be cut into ties, and where close, it is usually too valuable for lumber. In good bodies of old field pine 250 ties per acre can be obtained, but from the immature stands, such as are usually cut, a yield of 50 to 100 ties per acre is more common. Probably more ties are now being sawed than hewed, and the proportion of sawed ties will no doubt increase owing to the

adaptation of sawmill machinery to this special work, thereby cheapening the cost of production. At present, however, the two methods cost about the same, as follows:

	Per Tie.
Stumpage.....	2 to 4 cents.
Stumpage.....	2 to 4 cents
Cutting and making.....	12 to 13 cents
Hauling to railroad.....	3 to 5 cents

	17 22

The price per tie delivered along the right of way ranges from 24 to 28 cents. At this price the tie-men are only getting about \$8.00 per M board feet for their lumber, and the owners of the timber only from 50 cents to \$1.00 per M for stumpage. This is too low, and timberland owners should realize that old field pine has a greater value, and is not, as so many people seem to think, a tree of no value or even a hindrance to the development of the country. The waste incident to this industry is very great. In Bulletin 64* of the Forest Service, United States Department of Agriculture, the two methods of tie-making are compared, and its conclusions apply to conditions in southern Mississippi. In the regular tie mills, logs are cut single-tie lengths, and this practice makes the "siding", which is cut off in the manufacture of the ties, so short that there is very little market for it at present. At some mills the best of it is cut off and sold locally at \$5.00 per M., but more often it is all thrown away in the slab because there is no market for it even at this low figure. Siding is cut from the best part of the log and ought to make excellent ceiling or sheathing. It should make good boxboard material and could no doubt be used for this purpose if freight rates to the larger markets would justify it. As long as there is this waste, it will probably pay owners of old field pine to hold their timber until better prices are assured and more conservative methods are thereby justified.

* Loblolly pine in Eastern Texas, with Special Reference to the Production of Railroad Ties, pp. 40 and 42.

Hardwood Logs for Export.—The export of hardwood logs is quite extensive in the Mississippi River counties, where old growth yellow poplar, hickory, ash and white oak are within hauling distance of the railroads. The best of this material goes to New Orleans, and is there shipped to Europe for veneer and other purposes. Most of the merchantable hardwoods now left in this region are in the steeper, more inaccessible places. The usual method is to pull the logs to the tops of the small ridges by means of a portable steam skidder or by block and tackle with teams. Wagons then haul the logs directly to the point of railroad shipment. They are now hauled with profit as far as eight or ten miles. At the station the ends of the logs are painted to prevent checking, and the bark peeled from all species but hickory to prevent mildew or other injury to the sapwood. Yellow poplar, ash, hickory and white oak are the chief species exported, though much of the white oak of export quality has been, and still is, taken out for staves. Usually the soil in which the hardwoods grow is suited to agriculture, but the rough character of the ground makes its use for this purpose difficult. When cleared, this land usually washes away rapidly, so that in spite of the good quality of the soil it will in many cases pay better to keep the areas permanently in forest. This should be profitable, because only the larger timber is taken, and fire may easily be prevented. Owners of this land, in selling timber, should stipulate that no young trees of valuable species should be cut, that all unnecessary injury to young timber shall be prevented, and that fires shall be kept out.

Besides large logs, other wood materials for various uses are exported. Dogwood and holly for bobbins, turnery and inlaid work are exported where a sufficient number of cords can be collected in one place to fill a car, for which from \$6.00 to \$8.00 a cord is obtained at the railroad. Per-simmon for reels, bobbins and golf sticks is shipped in small amounts at \$5.50 to \$6.00 per cord along the Mississippi River, and sassafras for boat construction is frequently shipped to Michigan.

Stave Production.—Stave production has been a large though scattered, industry for many years. Large quantities of split pipe staves, 5 feet long and over, have been taken out in the past, but the supply of timber suitable for this material is now practically exhausted. At present only the short staves are made, the longest being about 36 inches, and the production of these is constantly diminishing.

White oak is used principally for staves, but red oak is cut out to some extent, especially into oil staves. Willow and cottonwood are occasionally used, although they are too valuable for lumber to warrant their extensive use for this purpose at the present prices. Oak trees fit for staves are very scattered, there being rarely more than one or two per acre, even in good hardwood stands. Much of the timber is defective, and among the trees that are cut only a small part can be actually used, because of knots and blemishes. Most of the staves are produced in Wilkinson and Claiborne Counties; the former furnishes beer staves mainly, which go to New Orleans; the latter whiskey, oil and turpentine staves, which go to Louisville and other Northern and Eastern markets.

Stave mills are portable or semi-portable. In some cases they are set up in the center of a good supply, where they depend largely on farmers to bring them timber in the form of bolts. In other cases, a tract is bought and exploited by the millmen themselves. Stumpage prices vary from \$2.00 per cord upward, according to the size and quality of the timber. These prices are equivalent in board measure to from \$2.00 to \$2.50 per M. For the quality of the timber demanded, this price seems low, although it is doubtful whether the owners at the present time would realize any more for their timber if the logs were sold for export. As timber suitable for staves is nearly always mature or overmature, its removal should benefit the forest, and this will certainly be the case where the young growth of the valuable species is protected and encouraged. The mature trees of the other species should be disposed of as soon as there is a market for them, other-

wise the less valuable species will be favored by a preponderance of seed trees and by a suppression of the most valuable young growth by the old trees.

The future of the stave industry cannot be foretold. The supply of timber of the size and quality now required cannot last very long. White oak grows comparatively slowly, and cannot attain large sizes rapidly enough to make its use for staves alone profitable. There is no doubt, however, that unless substitutes are found, smaller trees will have to be used in the future. Higher prices will then be paid for stumpage, and white oak will be a most profitable tree to grow.

MANAGEMENT.

The present methods of handling the forest lands of this region are wasteful and destructive, and little or no provision is made for their future care and usefulness. This is especially true of the longleaf pine areas. Township after township has been cut over and burnt until there is practically no pine left standing on the ground and a useless growth of scrub oak takes the place of valuable pine forest. The only hope for such land is the expensive process of reseeding or planting. The forests that are not already cutover should be so lumbered that the mature timber will be harvested with the least possible waste. The land will then continue to yield the largest amount of timber of the highest value.

Conservative lumbering consists of two fairly distinct operations, namely, the proper selection and complete utilization of the trees cut, and the proper protection and care of those left standing. Conservative lumbering is an investment. A certain amount of timber is left on the ground in order to increase the future value of the property. By leaving from 500 to 1,000 board feet of thrifty, immature trees, and cutting off the mature timber, a stand which is growing rapidly and adding volume at an increasing rate per year is substituted for one which decays as fast as it adds volume, because mature.

Cutting by Types.—The future usefulness of a forest depends in a large measure on the way the present crop of timber is removed. The selection of trees to be reserved to seed up the area, and the reservation of young growths now on the ground to form the basis for the next crop of timber are two of the most important considerations in forest management, and require the exercise of great care and judgment. The selection of seed trees should be made before cutting commences. As these trees are to seed the area after the mature timber has been removed, they should be in such a position that an even reproduction is secured in the shortest possible time. The number of seed trees needed depends on the size and kind of trees and on the lay of the land. An ideal yellow pine seed tree is a young, barely mature tree with a full pyramidal crown coming well down to the stem, so that there is a large twig surface for seed bearing. It should have a straight, tall trunk, and a strong, well-developed root system, so that it will not be thrown by the wind. Trees 15 to 20 inches in diameter are usually better than larger ones. Trees even smaller can be used for seed, but more of them are required.

Pure Longleaf Type.—It is known from experience that under present methods the longleaf pine forests are not being and cannot be perpetuated. It is also known that under natural conditions these forests have been reproducing themselves up to the present time. It is impossible to lumber a tract and not change the forest conditions in some way. The slighter the change from natural conditions, however, the more likelihood is there of reproducing a forest. The prevention of fires, the exclusion of hogs, and the leaving of seed trees are essential to reproduction, and these things can be brought about if proper precautions are taken. Other influences which probably deter longleaf reproduction are the presence of oak brush, the formation of a dense turf, and the change in the mechanical condition and moisture content of the soil. These influences are not so well understood, and study and experiment will be necessary before their full effects can be determined.

The selection of seed trees and the amount of young

growth which should be retained will vary according to the nature of the stand, even within one type. Much of the longleaf pine occurs in pure stands of mature timber with little or no young growth or reproduction. In such stands mature seed trees should be left, but it is a question whether as little timber as possible should be left standing, or whether enough should be left to justify a second lumbering in fifteen or twenty years' time when a good stand of reproduction has been secured. This will depend to a large extent on present and prospective transportation facilities, and on the nature of the stand. Three methods of cutting are here given, all of which can be modified to suit local conditions. They may be called the selection, the seed tree, and the strip methods.

The Selection Method is most practical on areas where there is any young growth of pine. This contemplates the selection of mature timber only for cutting. The thrifty immature timber, often called "sap pine," should not be cut, because it is growing and increasing rapidly in value. The larger sap pines, say from 12 to 15 inches, will be seed trees, and with the smaller ones, will form the basis of a second crop. At least six seed trees should be left to each acre, even if mature trees have to be reserved to make up any deficiency in immature trees. All suppressed, crooked, forked, or otherwise defective trees should be cut out with the mature timber, as these are unprofitable trees to leave for future growth. In some cases, however, where there are no better seed trees available, such trees may be left for this purpose. The young timber that is left to grow would, if cut, make timber of the lower grades and would be the most expensive to log and saw. Therefore, the investment involved in this method is much smaller than one would at first imagine.

In many stands the young growth and the reproduction are chiefly in groups, having come up in openings where trees have died or been thrown by the wind. These groups as a rule, should not be thinned, because in taking out the larger trees from such groups, the faster-growing trees, or those with the greatest promise of future value, are

removed, and the suppressed and slow-growing trees are left. If a use can be found for these slow-growing trees some of them may be cut out to advantage, but care should be taken not to open up the groups too much. If the groups consist mostly of small trees, with only a few of the larger sizes scattered here and there, the latter may sometimes be cut down to advantage; the groups would then consist of trees of more even size, and more trees might reach a useful maturity. In such a stand there is need for seed trees scattered well between the groups, as in other variations of this type.

The Seed Tree Method is suited to mature stands of longleaf where there is little or no reproduction or young growth on the ground. In such cases the sole dependence for the future forest is on the seed trees that are left. These should, therefore, be chosen with great care. Four to six trees per acre should be left, distributed as evenly as possible over the acre. The rest of the timber may be removed.

Seed trees should be sound and healthy, so that in fifteen or twenty years they will have increased instead of depreciated in value, for by that time it will probably pay to lumber the area again for seed trees. The chief objection to this method is the very serious risk of the seed trees being wind-thrown. Storms are very severe in this region, and when trees are blown down, there is not only serious loss of timber, but also the only chance of reseeded the ground is gone.

The Strip Method is used to a large extent in Europe and has also been used with modifications in some of our national forests. It seems admirably adapted to certain conditions in southern pineries, wherever the ground is level enough for a railroad. Especially in mature stands with no young growth, this method could be used to advantage. In such situations it is now customary to locate railroad spurs about 1-8 mile apart and skid the logs in from each side. In the strip method the spurs should be located as they are at present, but the trees should be cut from only half the area, thus leaving strips of forest alternating with strips of cutover land of equal width. The cutover

strips should be logged clean, with the expectation that young growth will start up from seeds from the strips of forest land on either side. When a sufficiently dense stand of reproduction is secured and the young trees have begun to bear seed, in fifteen to twenty-five years' time, the remaining strips should be lumbered in the same way, when the area would in turn be seeded from the young trees. The advantages of this method are: the stand can be cut clean, the trees left in the strips will be less likely to be wind-thrown, and the cost of the second cutting will not exceed the cost of the first. The cost of logging will be lessened, as the logs will be skidded only half the distance, but this may be counterbalanced in certain cases, by the increased cost of spur construction per 1,000 feet of timber logged. The chief objection is that so much timber must be left for the second crop.

Loblolly and Longleaf Subtype.—In this type loblolly pine should be encouraged in every way possible, the object being to substitute this rapid-growing tree for the slower growing longleaf on all suitable areas. Wherever there is any young growth the selection method of cutting should be practiced, leaving all young, rapidly-growing trees on the ground. This is advisable, because young loblolly pine grown in an open stand, makes a poor quality of lumber. It produces good lumber only when grown in a dense stand, and it will grow in this way only if fire is kept out. Where three or four well-distributed seed trees per acre of loblolly can be secured, no longleaf seed trees need be left. The seeds of the loblolly being much lighter than those of the longleaf are scattered farther by the wind, and seed years being so much more frequent, fewer seed trees are necessary.

In all types which contain longleaf, considerable foresight is necessary where turpentineing is practiced. This operation usually commences three or four years ahead of the lumbering in order to include the most profitable period for boxing the trees. Trees necessary for seed trees and all second growth that is to be left should be selected before turpentineing begins, or else a diameter limit should be set large enough to include the trees to be saved. These trees

should not be boxed or tapped for turpentine, for otherwise their value will be impaired. It is best to mark the trees to be removed in the lumbering which will follow, and allow only the trees so marked to be boxed.

Longleaf Hills Type.—In this type there is the same necessity and perhaps a greater opportunity for conservative management of forests than in any other. Considerable areas of the type are still in an almost virgin state, and owing to the steepness of the hills and the consequent danger from erosion, and the general unsuitability of much of the soil for agricultural purposes, they should be kept in a thrifty and profitable forest growth. The three commercial yellow pines—longleaf, shortleaf and loblolly—grow well, and reproduction, especially of shortleaf and loblolly, is assured if fire is kept out and proper provision made for seed trees. The chief aim should be to reproduce a mixture of loblolly and shortleaf, with a preference to the former because of its more rapid growth. The longleaf is a poorer seeder, grows more slowly, and seems to be gradually giving way to its more vigorous competitors. In the hardwood hollows loblolly usually reproduces successfully. The more valuable hardwoods, as yellow poplar, ash and hickory, should be favored against all other trees but loblolly pine by leaving seed trees and protecting the young growth.

Young growth of pine is much more frequent in these hills than it is over most of the pure longleaf area, and so the selection method of cutting, already described, should be practiced in most cases. As much immature pine as possible should be left on the ground, in order that it may have the advantage in the struggle with the poorer species of hardwood. In selecting seed trees, shortleaf should be preferred to longleaf, since it grows faster, and forms denser stands. Loblolly, however, in all situations favorable to its growth, is a more desirable tree than either. Young growth of all species should be left, not only to form the basis of a second crop, but to prevent erosion.

Hardwood Hills Type.—A considerable part of this type is still in the forest, and on account of the steepness and general unsuitability of much of it for cultivation, it should

be permanently used for the growth of trees. Of course, with improved methods of farming and a denser population more land will be cleared and cultivated, but in all agricultural regions at least part of the land should be used for the production of cordwood, posts, poles and lumber for local needs. The steep hillsides and narrow ravines found throughout this type are better adapted to this purpose than to any other. The deep, fine, silty soil begins to wash badly as soon as cultivation is attempted, and under ordinary circumstances the steep slopes have to be abandoned in a very few years. A mixed growth, usually of very inferior quality, gradually takes possession of these areas, but the erosion goes on until the under clay is reached, often 50 to 100 feet below. Such land should never be cleared, but should be kept in a thrifty growth of timber, and made to yield, by wise management, the greatest possible returns as a long time investment. The soil being rich and the moisture conditions generally good, tree growth is rapid, and where the better species are encouraged, the owner might expect returns in a comparatively short period.

In cutting these mixed stands of trees of all ages, the selection system is by far the most practical. The old, mature and overmature trees should be removed, leaving the young, thrifty, immature saplings and poles with plenty of room to develop and grow. If possible, the less valuable species should be removed with the better kinds, for otherwise the quality of the forest will have a tendency to deteriorate. Seed trees of yellow poplar, ash, walnut, hickory, and white oak should be saved wherever there are not sufficient young trees of these species to secure a second growth. If these seed trees are retained, with proper care, each succeeding crop of timber will consist of a larger proportion of desirable kinds. The present method of cutting for export leaves practically all the small and immature timber, and where an adequate supply of seed trees is also included, the forest is left in very good condition.

The number of seed trees which should be left to the acre will vary, according to the topography, the stand, and the species. Naturally, seed will scatter farther from a tree

on the top of a ridge than from one in a hollow. Fewer seed trees will be needed where there is plenty of young growth. Trees with light, or winged seed, such as ash, yellow poplar, and sycamore, will scatter their seed farther than the heavy seeded oaks, and hickories, and consequently fewer seed trees per acre will be necessary. Two or three seed trees per acre of poplar or ash are sufficient, while walnut, hickory or white oak will require more. It is not recommended that all the seed trees be of one species but a variety of the best species should be retained in order to maintain the mixed character of the forest.

Old Fields, grown up to loblolly and shortleaf, are a more important part of this type than of any other, owing to its older settlement and larger percentage of cultivated land, though these old fields are a common subtype of forest all over the region. Many areas that were regularly cultivated up to the time of the war, and which have grown up to pine since, are now being cut over for ties.

Where ties are hewn it is often the practice to cut only the larger trees, and so enough smaller ones are left to form a second crop and seed up the openings. This is the best way to cut this second growth pine, and even where a saw mill is employed, the smaller trees can be left with profit, unless the owner means to clear the land and put it in cultivation. In cutting pine, loblolly should be favored at the expense of the shortleaf, because of its more rapid growth.

Many old fields, especially in the western part of the region, grow up to hardwoods only, because there are no seed trees of pine in the neighborhood. The better species are generally scattered, but should be encouraged. Where an occasional loblolly pine occurs, it should be left to grow to help seed up this area. Sometimes black locust comes in on abandoned areas, and it is probably the most profitable tree to grow on old fields where the soil is rich and deep. It grows rapidly and is in great demand for fence posts. After cutting, locust reproduces itself rapidly by means of suckers or sprouts from the roots, which come up for considerable distances around the stump. For this reason,

cutting may begin with advantage just as soon as there are any trees large enough to make posts. Increased cutting tends to increase the density of the stand. Trees should be cut during the winter or early spring, if possible, and never late in the summer or early fall, as frosts will kill the shoots and prevent reproduction. Fire is exceedingly destructive to black locust and should be kept out by all means.

Mississippi Flood Plain.—These lands are too valuable to remain permanently in forest. Much of the level land along the banks of the Mississippi River and formerly occupied by stands of cottonwood has already been cleared and is extremely valuable for agriculture. Movements are on foot to deepen the channels of the streams, clear them of underbrush, and drain large areas of land which will then become productive. Lumber companies are cutting away the cottonwood and other timbers along the Mississippi River and extending dummy lines into the Homochitto swamp region. When the valuable timber is gone, a large per cent of the swamp areas will gradually be transformed into prosperous plantations.

But for a long time to come there will be considerable land on nearly every plantation that cannot be profitably cultivated, because it is too difficult to drain, overflows too easily, or else the owner has all the cleared land he can cultivate with the labor available. This wood land should be managed with as much forethought as any other part of the plantation.

The same methods of cutting should be used as in the hardwood hills type. The retention of the young, immature growth, especially of the valuable species, and the leaving of seed trees where necessary, should form the basis of management in nearly all parts of this type. Ash, oaks, pecan, cypress, and sweet gum should be encouraged wherever conditions are suitable for their growth.

On this type the lighter seeds are usually carried by the overflow waters, so that the leaving of seed trees of cottonwood, willow, or sycamore is quite unnecessary. Oaks, hickories, and ash should be left for seed trees where these

species are desirable. Plenty of young growth should be left to form at least a partial shade, or the weeds and vine are likely to grow so rank and dense after the timber has been removed that they prevent reproduction.

Young stands of pure cottonwood, however seem to demand a different treatment. As far as can be determined, no old stand is ever reseeded to cottonwood, unless from overflow. Seed trees, therefore, are useless. Again, as cottonwood stands are nearly all even-aged, the smaller trees, with scarcely an exception, are badly suppressed and are not worth saving for a future crop. In older stands, however, there is usually a second growth of sycamore, elm, oak and mulberry, which should be protected unless the land is to be cleared for agriculture. Young cottonwood stands, if a market can be found for cordwood, should be thinned by taking out the smaller trees, thus utilizing them before they die, and also giving room for the larger trees to develop rapidly into more merchantable saw-timber.

River and Creek Bottoms.—Much of this type has been cleared and cultivated for many years, and practically all of it will be cleared for agriculture within a few decades, or as soon as the difficulties of drainage have been overcome. In the meantime, however, the forests which are growing on these lands should be cared for and made to yield the greatest possible revenue. Although many years may pass before the land is cleared for farms, it is doubtful economy to grow new forests or consider the present forests permanent. It is desirable to make the most of the growth that is already on the ground.

The selection method of cutting should be followed here as in the other hardwood types, leaving as much young growth as possible on the ground and taking out the mature timber. What is cut should be used to the best advantage, and the woods left in such condition that the remaining trees will make the best timber in the shortest possible time. Care should be taken to protect the young growth, especially that of the more valuable species, and to see that trees are not unnecessarily felled on promising young trees when cutting is being carried on.

*Waste in Logging.**—Waste of timber in logging is attributable to many causes, probably the chief of which are the distances from market, labor conditions and methods of purchase. Much waste is unavoidable under present conditions, but where it can be avoided, every care should be taken to do so.

Waste in logging is of two kinds: (1) the incomplete utilization of the trees cut, and (2) the injury and destruction of reproduction and trees that are left.

(1) The cutting of high stumps is a common and very wasteful practice, and is inexcusable except where trees are badly burnt or rotten at the butt. Stumps in the average pine forest could be cut down to 12 or 15 inches, and should rarely be over 18 inches high.

Much merchantable timber was formerly left in the tops, but owing to better market conditions this waste is becoming less each year. However, young thrifty trees which should be left to grow are being cut down for cross-ties, while knotty logs capable of making excellent ties are left to rot in the woods.

In many small operations, especially where ties are being cut from old field pine, there is considerable waste in the slab. Instead of getting, as in the hardwood regions farther north, an average of 10 board feet of siding per tie, which is usually cut from the best part of the log, all this is often left in the slab and wasted. The absurd conditions of the market, which have placed a ban on 8-foot lumber, are responsible for this waste. There will undoubtedly be a modification in the market requirements within a few years, and timber owners will do well to hold their pine rather than sacrifice it as they are doing now. In selling standard timber, small owners should insist on the least possible amount of waste, not only when they are selling their timber by the thousand board feet, but even when they are selling by the acre or by the boundary.

* See also extract No. 398 from the Yearbook of the U. S. Department of Agriculture for 1905, entitled, "Waste in Logging Southern Yellow Pine," which can be had on application to the Forest Service.

(2) In the average logging operation tremendous injury is done to the trees left standing and to the reproduction already started. Every care should be taken to avoid this as much as possible. Trees should be felled in such a way that the young trees are not broken or crushed, or groups of young growth destroyed. If the breaking of some young trees is unavoidable, those of greatest value should be saved. Inasmuch as immature trees increase in value with age, a group of longleaf thirty years old, for example, should be preserved in preference to one only ten years old. Also, where a choice is necessary, a tree should be felled into a young gum or beech rather than into a thrifty ash or yellow poplar. Trees should be felled so that the tops, though left to lie where felled, will not subsequently be a menace from fire to the remaining stand; that is, they should be as far away from seed trees or groups of young growth as possible. Where a steam skidder is used, it should be placed in such a position that the logs will be pulled over ground which has comparatively little young growth. Guy chains for the skidding cable should be fastened to stumps and not to seed trees or young growth.

*Fire Protection.**—Conservative lumbering counts for little unless the forest lands of the State can be protected from fire. After lumbering in the longleaf pine forests, the ground is partly covered with brush, which soon becomes so dry that fires are easily started and are extinguished with great difficulty. Logging locomotives are largely responsible for the first fire that follows lumbering. Every year following, however, the ground is burned either through malice or through the notion that it encourages a better growth of grass. Pine reproduction is not given a chance, even though much of the stump land region has enough trees remaining to seed up the ground. Scrub oaks, more resistant to fire, form dense stands over the stump lands. The absence of pine reproduction is largely due to this

* NOTE.—The prevalence of forest fires and the destruction caused by them through the longleaf pine region is dealt with in Forest Service Circular 149, "Condition of Cut Over Longleaf Pine Lands in Mississippi."

constant burning of the area, although other factors also enter into the problem.

Reproduction of loblolly pine is so much more prolific and certain than that of longleaf that damage by fire is not felt so seriously with this tree. However, the growth is retarded and the quality of the timber decreased by constant burning of the ground. Hardwood lands suffer in the same way by injury to reproduction, sprouts and young growth where fires are permitted to run.

Protection from fire is necessary at all times, but especially during and immediately following lumbering operations. The large amount of inflammable material, added to the ground cover by the slash, makes the fires much more severe and seriously endangers the seed trees and young growth left on the ground. Brush should be cleared away around all steam skidders and other engines and should not be left near seed trees or other young growth. Logging hands should be cautioned against throwing matches or cigarette stumps around in the dry grass or leaves. It should be generally understood that any man, and all men if necessary, employed on the operations are expected to stop work at any time in order to extinguish fires. After logging, fire can only be kept from the large pine tracts by a system of patrol, or by the aid of a good State law. Probably some patrol would be needed for a while, even though a State fire law were enacted. A fire line around a tract or on each side of a railroad running through the tract is a great aid in preventing or extinguishing fires. Such a fire line is best made in the pure longleaf by plowing two strips 3 or 4 feet wide and 30 feet apart, and then burning off the middle strip of unplowed ground every winter.

It is much easier and cheaper to prevent fires than to extinguish them after they are well started. Patrol during a very dry period or through the dangerous months will practically prevent serious fires and will cost less than extinguishing one big fire. A scheme of co-operation between the large timber owners and the county, if it could be arranged, would prove a cheap and most satisfactory way to handle this important problem.

Injury from fire is not so serious in the hardwood types of this region as in the pine types, though much damage is done every year. There is no sentiment against setting fire to the woods or old fields, and the landowners realize that it is a most difficult and nearly impossible task to prevent it. For the present, undoubtedly the best remedy is to create a good, healthy sentiment against fires.

Protection from Stock.—Fire, although the chief danger, is not the only serious menace to the forest. The ranging of stock, especially of hogs, does great injury in some places.

The question of restricting the right to graze animals in the open woods is usually one that solves itself with the increase in population and the general developemnt of a region. Settled communities demand that animals shall be enclosed.

Throughout the woodland region of Mississippi, however, it does not yet seem necessary for farmers to keep their cattle under fence. It would work a hardship on small owners if their cattle could not graze at large, and no law to prevent them from making use of the splendid growth of grass in the woods is yet needed. Cattle do comparatively little injury to pine reproduction, and throughout the hardwood region they are usually kept within fences.

When hogs range over the woods in large numbers they destroy considerable seed of different species, greatly hindering reproduction. Where pine seed trees are scattered and seed is only produced abundantly once in four to eight years, which is the case with longleaf pine, it is readily seen that hogs, always on the lookout for pine nuts, will soldem give them a chance to germinate. Also, as food becomes scarce late in the winter, hogs dig up and eat the roots of the young pines. No hardship would be inflicted by compelling owners to fence their hogs, but rather a real benefit to the farmer as well as to the timberland owner would result. In some parts of the yellow pine region hogs are not listed for taxes, because they are considered as practically valueless property. Large numbers of them are swept away by disease each year, and it is only in good seed years that there is mast enough to fatten

them. By taking the hogs off the range, infectious diseases would be stamped out in a very short time, and the grade of stock would gradually improve. The State should pass a law compelling the fencing of hogs. If it fails to do so, each longleaf pine county should take advantage of the present local option law, which allows counties and districts to regulate this question, and prevent the promiscuous grazing of hogs through the woods and cutover lands.

Contract for Sale of Timber.—Small private owners, trustees of school lands, and others who sell standing timber for removal, should insist on the adoption of all practicable precautions to insure the future usefulness of the area. In a contract for the sale of timber, the following recommendations and clauses are suggested:

1. Describe the sale area by legal subdivisions; metes and bounds, or by a designated name.

2. Estimate the amount of material, preferably by species, included in the sale.

3. Specify whether full or partial payments will be made.

4. No timber will be cut or removed until it has been paid for.

5. No timber will be removed until it has been scaled, measured or counted.

6. All merchantable timber used in buildings, skidways, bridges, construction of roads, or other improvements will be paid for at the contract price, but no charge will be made for material not merchantable under the terms of this agreement and not reserved for seed.

7. All cutting will be done with a saw when possible.

8. No unnecessary damage will be done to young growth or to trees left standing, and no trees shall be left lodged in the process of felling.

9. No trees shall be turpented unless they are to be cut subsequently.

10. The approximate minimum diameter limit at a point 4½ feet from the ground to which living trees are to be cut is.....but trees above these diam-

(Limits for all species involved)
eters may be reserved for seed or protection. A good diam-

eter limit $4\frac{1}{2}$ feet from the ground is 15 inches, and in no case should it be below 12 inches.

11. Stumps will not be cut higher than.....inches (lower when possible) and will be so cut as to cause the least possible waste.

12. All trees cut will be utilized to a diameter of..... inches in the tops (lower when possible) and the log lengths so varied as to make this possible.

13. All timber will be cut and removed on or before and none later than....., and at least..... (feet, b. m. cords, etc.) will be paid for, cut and removed on or before..... 19....., and at least.....of the remainder of the estimated amount during each year of the remaining period.

14. Timber will be scaled by the.....rule, or counted, or measured as follows:

15. During the time that this agreement remains in force,and all..... employees, (I or we) (my or our) subcontractors, and employees of subcontractors will do all in our power to prevent and suppress fires upon this sale area.

16. A bond for fulfillment of contract should be required in the amount of 10 per cent of the purchase price.

RECOMMENDATIONS.

In Forest Service Circular 149, "Condition of Cutover Longleaf Pine Lands in Mississippi," suggestions are made for a forest and fire law for the State. This circular recommends the appointment of a State fire warden, with local fire wardens in each county to carry out the provisions of the law, and the acquisition and administration of lands by the State forest use. In addition to these recommendations, which were preliminary, it is now strongly recommended that the State or counties extend the operation of the stock law, and that the timbered school lands, which are controlled by the various counties, be managed according to forestry principles.

State Forester.—Undoubtedly all the States whose forests form a large part of their resources, which is the case with Mississippi, should employ technically trained foresters to care for these forests. The work of a State Forester is most effective, where he is absolutely free from political influence, thus making his tenure of office entirely dependent on his fitness for the position and the quality of the results obtained. He should be the State Forest Fire Warden, directing the fire-fighting force of the State, and he should manage and administer any State forest land that may be acquired under the law, and conduct experiments in management and reforestation. He should make examinations of private forest lands, if the owners so desire, and give suggestions for their better care and management. He should carry on an educational campaign throughout the State, giving lectures at farmers' institutes and other public meetings. By such lectures he would be brought into close touch with the people of the State, who should be urged to perpetuate by wise use the forests on all lands not needed for agriculture.

Fire Law.—The fire law as outlined in Circular 149 should be carried out and enforced by the county fire wardens, under the direction of the State Forester and the Board of Forestry. These local officers should be appointed by the County Board of Supervisors with the approval of the State Forester and should be paid out of the county funds. Their remuneration at \$2.00 a day, for all days actually engaged in extinguishing fires or prosecuting offenders, should not exceed \$200.00 per year, and the expenses of extra help to fight fire might vary from \$100.00 to \$200.00 more. The counties themselves depend so largely on the timber lands and timber interests for revenue, that money spent for the protection of the forests will be an excellent investment.

State Forests.—Forest lands, properly managed, are among the most profitable investments carried by many of the European states. In this country several of the states have adopted the policy of acquiring and administering forest land. The chief value of State forests are: (1) to

protect the headwaters and the banks of important streams; (2) to furnish a reserve source of timber or fuel supply for the citizens of the State; (3) to serve as object lessons of practical methods of forest management and forest regeneration. Lands for this purpose may be obtained by purchase or by forfeiture. Some States provide that land reverting to the States for taxes shall, if suitable, be held for forest purposes. It is strongly recommended that this be done in Mississippi. From time to time, land in almost every county reverts to the State for taxes. Such tax land is recorded in the books of the State Land Commissioner at Jackson. After two years it may be sold by the sheriffs of the respective counties. Before being put up for sale a list of the tracts of such land should be submitted to the State Forester, who should, if the location and amount justify, examine them and report to the State Board of Forestry as to their suitability for State forest purposes. If more suitable for agricultural purposes, they should be put up for sale, but if not, they should be retained by the State for forest purposes. Tax land sells for about \$1.25 per acre. Usually the timber has been cut off, and the land is seldom very desirable for agricultural purposes. Under State ownership and protection these lands should constantly increase in value and produce timber crops for the benefit of future generations. They should be forever held by the State and so distributed as not to be a burden upon any one county.

School Lands.—The sixteenth section in each township was originally given by the Federal Government to the State, to be held by it as a source of perpetual revenue for the benefit of the public schools of the county in which the section is situated. These school sections are controlled and administered by the local authorities, and all revenues are devoted to the schools of the township or districts in which the sections lie. They can be divided into two classes: (1) Those that have been disposed of on long term leases, or (2) those that are under the direct control of the county.

During the middle of the last century many of these

sections were leased for ninety-nine years or other long periods. As a rule the leases are now held by lumbermen who have either cut off the timber, or intend to do so. When cutover the land is neglected, and when the leases expire, a large part of the land will come back to the State without any possibility of its yielding an income to the schools for an indefinite time. In the future, therefore, in lumbering the school lands, the State should insist that they be kept in a productive condition, so that the object of the lands, to provide a revenue for the schools is not defeated. This can be accomplished by imposing certain restrictions on the cutting, such as are outlined under the chapter on "Management."

The school sections which have not been leased for long periods are controlled by the township trustees and the County Superintendent of Education. They should either be leased for agricultural purposes at an annual rental, or if timbered, the standing timber should be sold and removed. When a sale of timber is made, a contract should be entered into with the purchaser similar to that previously suggested, in order to prevent the destruction of young growth and preserve the yielding power of the forest.

STATISTICAL SUPPLEMENT

By E. N. LOWE.

The census of 1910 has furnished some statistical matter that was not available when the Forest Bulletins Nos. 5 and 7 were prepared. A brief summary of these will be given in the following pages, and, it is believed, will add value to the publications.

In 1909 the business of lumbering and timber products employed in Mississippi 33,397 wage earners, which was 66.3 per cent of total wage earners engaged in manufacturing industries of the State, as against 22,432, or 58 per cent, in 1904. This increase was largely due to a more complete enumeration of the smaller rural mills in 1909. The value of the products in 1909 was \$42,793,000, or 53.1 per cent of the total values of the products of manufacturing industries of the State during that year.

COMPARATIVE SUMMARY FOR 1899, 1904 AND 1909. LUMBER AND TIMBER PRODUCTS.

EXPRESSED IN THOUSANDS.

	No. of Estab- lishments.	No. of Persons Engaged.	Capital.	Salaries.	Wages.	Cost of Ma- terial.	Value of Pro- ducts.	Value Added by Man- uf'ture.
1899	608	16,241	\$10,800	497	4,558	6,826	16,664	9,838
1904	664	24,415	24,819	1,300	9,242	7,005	26,162	19,157
1909	1647	37,118	39,455	1,818	12,583	14,207	42,793	28,586

Turpentine and rosin, estimated separately from lumber and timber products, in 1909 were valued at \$1,475,000, while in 1904 the valuation was \$2,366,000, showing a decided falling off. Mississippi ranked fourth among the States in rosin and turpentine.

COMPARATIVE SUMMARY FOR 1899, 1904 AND 1909. TURPENTINE AND ROSIN.

EXPRESSED IN THOUSANDS.

	No. of Plants.	No. persons Engaged.	Capital.	Salaries.	Wages.	Cost of Material.	Value Prod.	Value Added by Man'f't.
1899	145	2,633	798	68	530	698	1,772	1,074
1904	124	3,036	598	146	737	394	2,366	1,972
1909	64	2,811	1251	132	582	349	1,475	1,126

From the above it will be seen that, while the number of plants engaged in turpentine and rosin business in the

State has steadily diminished since 1899, the values in 1904 nearly doubled those of the other two years, reaching in that year \$4,338,000, while the valuation for 1909 is somewhat less than for 1899. The turpentine industry in the State has steadily declined since 1909.

The total number of persons engaged in lumber and timber products in 1909 was 37,118, of which 90 per cent were wage earners. The total number engaged in the turpentine and rosin industry in the same year was 2,811, of which 91.5 per cent were wage earners.

In 1909 ownership of the 1,647 establishments in the State engaged in the manufacture of lumber and timber products was as follows:

LUMBER AND TIMBER PRODUCTS.

	No. of Plants.	Average No. Wage Earners.	Value of Products.	Value added by Manufac- ture.
1909.....	1647	33,397	\$42,792,844	\$28,586,246
Individual.....	920	7,803	8,413,371	6,216,909
Firm.....	507	5,612	7,540,553	5,324,757
Corporation.....	220	19,982	26,838,920	17,044,580
Per Cent of Total.....	100.0	100.0	100.0	100.0
Individual.....	55.9	23.4	19.7	21.7
Firm.....	30.8	16.8	17.6	18.6
Corporation.....	13.4	59.8	62.7	59.6

From the above table it will be seen that the 13.4 per cent corporation-owned plants employ nearly 60 per cent of the wage earners engaged in the business, and their products have a valuation of nearly 63 per cent of the whole. It will be noted, too, that the efficiency of labor is somewhat greater in the large plants than in the smaller ones, if the value of crude products is considered.

Turpentine and rosin plants were owned in 1909 as follows:

	No. Plants	Av. No. Wage Earners.	Val. Products.	Value Added by Man'f ture.
Individual.....	15	242	\$ 159,349	\$ 118,976
Firm.....	22	388	251,589	197,364
Corporation.....	27	1943	1,063,691	809,180
Per Cent of Total.....	100.0	100.0	100.0	100.0
Individual.....	23.4	9.4	10.8	10.6
Firm.....	34.4	15.1	17.1	17.5
Corporation.....	42.2	75.5	72.1	71.9

Data with regard to size of the establishments show the following:

LUMBER AND TIMBER PRODUCTS, 1909.

	No. Plants.	Av. No. Wage Earners.	Val. Products.	Value Added by Man'f ture.
Total No. Plants.....	1647	33,397	\$ 42,792,844	\$ 28,586,246
Less than \$5,000.....	805	2,610	1,698,245	1,310,164
\$5,000 and less than \$20,000	455	4,644	4,766,790	3,614,497
\$20,000 and less than 100,000	299	8,460	12,495,579	8,679,012
\$100,000 and less than \$1,000,000.....	88	17,683	23,832,230	14,973,574
Per Cent of Total.....	100.0	100.0	100.0	100.0
Less than \$5,000.....	48.9	7.8	4.0	4.0
\$5,000 and less than \$20,000	27.6	13.9	11.1	12.6
\$20,000 and less than \$100,000.....	18.2	25.3	29.2	30.4
\$100,000 and less than \$1,000,000.....	5.3	52.9	55.7	52.4

TURPENTINE AND ROSIN, 1909.

	No. Plants.	Av. No. Wage Earners.	Val. Products.	Value Added by Manufacture.
Total No. of Plants.....	64	2,573	\$ 1,474,029	\$ 1,125,520
Less than \$5,000.....	13	47	42,164	24,135
\$5,000 and less than \$20,000	32	526	372,174	284,150
\$20,000 and less than \$100,000.....	16	889	552,123	461,729
\$100,000 and less than \$1,000,000.....	3	1111	508,168	355,506
Per Cent of Total.....	100.0	100.0	100.0	100.0
Less than \$5,000.....	20.3	1.8	2.9	2.1
\$5,000 and less than \$20,000	50.0	20.4	25.2	25.2
\$20,000 and less than \$10,000.....	25.0	34.6	37.4	41.0
\$100,000 and less than \$1,000,000.....	4.7	43.2	34.5	31.6

The lumber industry showed an increase from 1,206,265 M. feet board measure in 1899 to 2,572,669 M. feet board measure in 1909. The entire cut for 1909 showed that 82.2 per cent was yellow pine. Other principal varieties sawed, in the order of their importance, were oak, gum, cottonwood, cypress, poplar, hickory, ash, tupelo, and elm.

From the above table it will be seen that more than 43 per cent of the turpentine and rosin in 1909 was produced by a few large plants. This is in large measure due to the habit practiced by the large lumbering plants of boxing their trees for two or three years before cutting. Experience seems to prove that boxing pine timber for two or three seasons immediately before cutting does not injure the quality of the cut, while the amount of turpentine recovered adds very materially to the income of the company.

Note on the Flora of Mississippi *

By E. N. LOWE.

So little attention has been given to the flora of Mississippi in the past, and so little has been published upon the subject, that available data are scant and difficult to get by those seeking information. This fact we deem a sufficient excuse for this brief sketch of our flora. The Geological Survey in the course of several years of field work has accumulated considerable botanical material, together with notes of observations made in the field. These are as yet very imperfect, but will form the basis for the following sketch.

In the foregoing report (Bulletin No. 7) on the Forest Conditions of Mississippi, the area of the State has been divided into eight forest regions. So far as our data now available shows, these forest regions, which are rather closely related to geological structure, correspond in a general way with the floral distribution in the state. Geological structure has such a direct influence on topography and soil, which in turn directly influence the distribution of plant species, that a geological map of the state would for present purposes answer for a floral map of the state. Therefore, the accompanying sketch map, which represents the distribution of the geological formations of the state (differing slightly from that used in Bulletin No. 7), will be used in this study of the flora, the floral regions being represented on the map by the geologic and soil divisions. The correspondence is not exact, but close enough for present purposes.

Consulting the map it will be seen that in the extreme northeast corner of the state a small narrow division is marked off and called the Northeastern or Tennessee River Hills. The area is one of high broken topography—originally a plateau, but now much cut up by erosion into steep hills and ridges. Much of the rock is hard limestone, sandstone and chert of the Carboniferous formation.

*In this paper the botanical nomenclature of Chapman and the earlier editions of Gray has been used rather than that of later botanists, for the reason that I believe it will be more familiar to the majority of the readers of this bulletin, as it is to myself.

I wish to acknowledge here indebtedness to Lloyd and Tracy's *Insular Flora of Mississippi and Louisiana* for discussion of the strand Flora of Mississippi.

This is especially true near the Tennessee River, where the old Appalachian uplift dies away; a few miles south of the river the softer sands of the Cretaceous overlap the older hard rocks. The soil in this region is generally rather sterile, except in the stream bottoms.

The geological structures and topography here representing a transition from the old Appalachian uplift to the Coastal Plain, we would naturally infer a like transitional character in the flora of the region. Such is found to be the case. In the tree growth this is not very evident, though one or two species of more northern distribution reach Mississippi here, and have little if any farther distribution southward. 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 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 shortleaf yellow pine (*Pinus mitis*) and old field pine (*P. taeda*), mostly second growth. Mixed with these are various species of oak, as black jack (*Quercus nigra*), post oak (*Q. stellata*), Spanish oak (*Q. falcata*), scarlet oak (*Q. velutina*), together with dogwood (*Cornus florida*), hickory (*Carya tomentosa* and *C. alba*), chestnut (*Castanea dentata*), crab apple (*Pyrus angustifolius*), 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 deer-berry (*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 (*Rhododendron nudiflora*) adorn the slopes in the spring season. The hazel (*Corylus Americana*) is not uncommon on shaded slopes, the witch hazel (*Hamamelis Virginiana*) occupying similar places.

Numerous interesting herbaceous species occupy the ground beneath the taller growth. Clinging to the limestone ledges are the following:

<i>Saxifraga Virginiensis,</i>	<i>Camptosorus rhizophyllus,</i>
<i>Heuchera Americana,</i>	<i>Asplenium angustifolium,</i>
<i>Heuchera villosa,</i>	<i>Cardamine Pennsylvanica.</i>
<i>Anemonella thalictroides,</i>	

In the dry open woodlands are the following:

<i>Hypoxys erecta,</i>	<i>Ranunculus fascicularis,</i>
<i>Lithospermum hirtum,</i>	<i>Delphinium virescens,</i>
<i>Hieracium scabrum,</i>	<i>Viola pedata,</i>
<i>Viola palmata,</i>	<i>Silene Virginica,</i>
<i>Silene stellata,</i>	<i>Houstonia cerulea,</i>
<i>Fragaria Virginica.</i>	<i>Phlox pilosa,</i>

On the damp slopes and stream banks grow red maple (*Acer rubrum*), red bud (*Cercis Canadensis*), mulberry (*Morus rubrum*), black walnut (*Juglans nigra*), white walnut (*J. cinerea*), yellow poplar (*Liriodendron tupilifera*), and tupelo gum (*Nyssa uniflora*). Beneath these grow oak-leaved hydrangea (*Hydrangæa quercifolia*) (*Hydrangea arborescens*), spice bush (*Lindera benzoin*), and woodbine (*Lonicera sempervirens*). Herbaceous species growing in similar places are the following:

<i>Ranunculus abortivus,</i>	<i>Asplenium ebeneum,</i>
<i>Ranunculus recurvatus,</i>	<i>Epigaea repens,</i>
<i>Adiantum pedatum,</i>	<i>Uvularia perfoliata,</i>
<i>Phegopteris hexagonoptera,</i>	<i>Boehmeria cylindrica,</i>
<i>Asarum Canadense,</i>	<i>Hepatica triloba,</i>
<i>Smilax herbacea,</i>	<i>Hepatica acutiloba,</i>
<i>Dioscorea villosa,</i>	<i>Podophyllum peltatum,</i>
<i>Viola pubescens,</i>	<i>Arisaema triphyllum,</i>
<i>Oakesia sessilifolia,</i>	<i>Laportea Canadensis,</i>
<i>Viola cucullata,</i>	<i>Smilacina racemosa,</i>
<i>Trillium sessile,</i>	<i>Solidago caesia,</i>
<i>Chimaphila maculata,</i>	<i>Ruellia strepens,</i>
<i>Iris cristata,</i>	<i>Dentaria multifida.</i>

Along low, wet spring branches thickets of alder (*Alnus serrulata*) and willow (*Salix nigra*) grow in dense masses.

The bottoms of the Tennessee, Tombigbee and Tusculumbia rivers and their larger branches, support remnants of what was once a heavy growth of white, willow and water oaks (*Quercus alba*, *Q. phellos*, *Q. aquaticus*), basket oak (*Q. Michauxii*), sycamore (*Platanus occidentalis*), beech (*Fagus ferruginea*), river maple (*Acer dasycarpum*), black gum (*Nyssa multiflora*), 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 (*Celtis Mississippensis*), ash (*Fraxinus Americanus*), sassafras (*sassafras officinale*), box elder (*Negundo aceroides*), red bud (*Cercis Canadensis*), and hop horn-bean (*Ostrya Virginica*). Not infrequently among these will be found growing the great-leaved magnolia (*Magnolia macrophylla*), which is common in the state south of the Vicksburg and Meridian railroad, but rare in the northern parts of the state. The paw paw (*Asimina triloba*) and silver bell (*Halesia tetraptera*) are rather common shrubs on the river bottom lands.

Eleven species of this region have not yet been found elsewhere in Mississippi. These are as follows:

<i>Pinus inops</i> ,	<i>Heuchera villosa</i> ,
<i>Epigaea repens</i> ,	<i>Dentaria multifida</i> ,
<i>Chimaphila maculata</i> ,	<i>Cardamine Pennsylvanica</i> ,
<i>Viola pubescens</i> ,	<i>Iris cristata</i> ,
<i>Hepatica triloba</i> ,	<i>Houstonia coerulea</i> .
<i>Hepatica acutiloba</i> ,	

Species that have been found on Pontotoc Ridge and one or two adjoining counties to the west, as well as in the region under consideration, are the following:

<i>Camptosorus rhizophyllus</i> ,	<i>Corylus Americana</i> ,
<i>Asplenium angustifolium</i> ,	<i>Juglans cinerea</i> ,
<i>Saxifraga Virginiensis</i> ,	<i>Heuchera Americana</i> .
<i>Anemonella thalictroides</i> ,	

Northeastern Prairie Belt.---The boundaries of this region, and its relationship to other divisions can best be had by reference to the sketch map inserted above.

The region has a gently rolling surface, and was originally prairies, having only here and there scattered patches of trees, except on the stream bottoms, where heavy timber grew. The region is now largely in cultivation, but some timber still remains in the bottoms.

The characteristic soil of the prairies which is residual from Cretaceous limestone, is a heavy, tenaceous, calcareous loamy clay, black when wet, dark gray when dry. In much of the region a yellowish brown loam soil prevails, which probably represents remnants of a very late geological formation, the Columbian, or Brown Loam. Occasionally an isolated eminence will show a capping of the Brown Loam overlying a considerable thickness of red sands. The vegetation shows variation with these soil differences. The growth on the bottoms is very similar to bottom land growth throughout the north half of the state.

As already stated, the black soils were originally prairies devoid of tree growth except scattered clumps of crab apple (*Pyrus angustifolius*), honey locust (*Gleditsia triacanthos*), and along ledges, where the limestone comes to the surface, red cedar (*Juniperus Virginiana*). On the bluffs of streams are found very commonly hackberry (*Celtis Mississippensis*), red bud (*Cercis Canadensis*), rock maple (*Acer saccharinum*), chestnut (*Castanea vesca*), mulberry (*Morus rubra*). Common shrubs and creepers in the same localities are:

<i>Aesculus pavia</i> ,	<i>Rhus Toxicodendron</i> ,
<i>Amorpha fruticosa</i> ,	<i>Cissus bipinnata</i> ,
<i>Wistaria fruticosa</i> ,	<i>Berchemia volubilis</i> ,
<i>Ampelopsis quinque-fovia</i> ,	<i>Rhus copallina</i> .

In the edges of the fields are such familiar species as *Apogon humilis*, *Granium carolinianum*, *Valerianella radiata*, *Anthemis cotula*, *Oralis stricta*, *Dichondra repens*, *Rubus*

trivialis, *Ranunculus multifidus*, *Ambrosia artemisiaefolia*
Ambrosia trifida, *Salvia lyrata*, *Rubus villosus*.

On the open prairie lands occur:

<i>Coreopsis lanceolata</i> ,	<i>Polygala Boykinii</i> ,
<i>Brunella vulgaris</i> ,	<i>Sisyrinchium sp.</i>
<i>Allium mutabile</i> ,	<i>Thaspium aureum</i> ,
<i>Scutellaria parvula</i> ,	<i>Coreopsis grandiflora</i> ,
<i>Ranunculus abortivus</i> ,	<i>Silene Virginica</i> .

More typically prairie species are the following, which are characteristic:

<i>Silphium laciniatum</i> ,	<i>Cacalia tuberosa</i> ,
<i>Silphium terebinthinaceum</i> ,	<i>Hartmannia speciosa</i> ,
<i>Asclepias</i> (several species),	<i>Petalostemon candidus</i> ,
<i>Asclepiodora viridis</i> ,	<i>Oenothera triloba</i> .

On the higher red loam soils an entirely different assemblage occurs. This soil is not so rich in plant food as the black soils, lime especially being much less. These areas support a rather dwarfish growth of trees of a few species, chiefly oaks. The commonest are:

<i>Quercus stellata</i> ,	<i>Carya alba</i> ,
<i>Quercus nigra</i> ,	<i>Diospyros Virginiana</i> ,
<i>Quercus falcata</i> ,	<i>Pinus mitis</i> ,
<i>Quercus vilutina</i> ,	<i>Prunus serotina</i> .

Characteristic herbaceous species associated with these are:

<i>Rosa humilis</i> ,	<i>Spigelia Marilandica</i> ,
<i>Baptisia leucantha</i> ,	<i>Plantago aristata</i> ,
<i>Phlox pilosa</i> ,	<i>Verbascum Blattaria</i> ,
<i>Tradescantia Virginica</i> ,	<i>Verbena hastata</i> ,
<i>Psoralea melilotoides</i> ,	<i>Oenothera sinuata</i> ,
<i>Tephrosia Virginiana</i> ,	<i>Apocynum cannabinum</i> .

The red sandy hills found occasionally in the prairie region present still another assemblage of plants, the group as a whole resembling very closely the flora of the sandy loam regions of the State in the vicinity of Oxford and

Holly Springs. The tree and shrub growth is identical with that of Lafayette County east of Oxford. For example, the commonest tree is pine (*Pinus taeda* and *P. mitis*), with which occur the following:

<i>Liquidambar Styraciflua</i> ,	<i>Rhus typhina</i> ,
<i>Diospyros Virginiana</i> ,	<i>Rhus glabra</i> ,
<i>Sassafras officinale</i> ,	<i>Quercus nigra</i> ,
<i>Ulmus alata</i> ,	<i>Vitis rotundifolia</i> ,
<i>Tecoma radicans</i> ,	<i>Vaccinium arboreum</i> .

Hardly less characteristic is the herbaceous growth:

<i>Ceanothus Americanus</i> ,	<i>Cerastium viscosum</i> ,
<i>Pentstemon laevigatus</i> ,	<i>Trifolium procumbens</i> ,
<i>Lonicera japonica</i> ,	<i>Krigia Virginica</i> ,
<i>Specularia perfoliata</i> ,	<i>Plantago aristata</i> ,
<i>Phlox pilosa</i> ,	<i>Gnaphalium purpureum</i> ,
<i>Opuntia</i> ,	<i>Shrankia uncinata</i>
<i>Aster paludosus</i> ,	<i>Stylosanthes elatior</i> .
<i>Physalis viscosa</i> ,	

The soils on the stream bottoms are generally heavy and rich, but showing considerable differences. The flora also show some variation, but these will be omitted here, and the general character presented.

The commoner tree growth consists of the following:

<i>Quercus velutina</i> ,	<i>Negundo aceroides</i> ,
<i>Quercus alba</i> ,	<i>Catalpa bignonioides</i> ,
<i>Quercus phellos</i> ,	<i>Salix nigra</i> ,
<i>Quercus aquaticus</i> ,	<i>Populus deltoides</i> ,
<i>Quercus Michauxii</i> ,	<i>Fraxinus Americanus</i> ,
<i>Carya alba</i> ,	<i>Acer saccharinum</i> ,
<i>Gleditschia triacanthos</i> ,	<i>Ulmus Americanus</i> ,
<i>Robinia Pseudacacia</i> ,	<i>Acer dasycarpum</i> ,
<i>Platanus occidentalis</i> ,	<i>Cornus asperifolia</i> ,
<i>Liriodendron Tulipifera</i> ,	<i>Cercis Canadensis</i> ,
<i>Morus rubra</i> ,	<i>Ulmus fulva</i> ,
<i>Tilia Americana</i> ,	<i>Viburnum prunifolium</i> .
<i>Betula nigra</i> ,	

Characteristic shrubs of the lowland forests are:

<i>Asimina triloba</i> ,	<i>Cissus bipinata</i> ,
<i>Aesculus glabra</i> ,	<i>Arundinaria</i> ,
<i>Berchemia volubilis</i> ,	<i>Lonicera sempervirens</i> ,
<i>Cephalanthus occidentalis</i> ,	<i>Azalea nudiflora</i> (rare).
<i>Tecoma radicans</i> ,	

So far no great diversity has been noted in the herbaceous flora of the river bottoms. In the open wet forests the following are frequent:

<i>Clematis crispa</i> ,	<i>Polymnia Uvedalia</i> ,
<i>Viola cucullata</i> ,	<i>Saururus cernuus</i> ,
<i>Arisaema quinatum</i> ,	<i>Osmunda cinnamomea</i> ,
<i>Dioscorea villosa</i> ,	<i>Allium cernuum</i> ,
<i>Ranunculus nitida</i> ,	<i>Pentstemon laevigatus</i> ,
<i>Phlox divaricata</i> ,	<i>Ranunculus pusillus</i> ,
<i>Thaspium barbinode</i> ,	<i>Ilysanthes gratiolooides</i> .
<i>Smilax Pseudo-China</i> ,	

On open lowland fields a very characteristic form is *Oenothera triloba*. Its tufted rosette of leaves and its large lemon-yellow flowers make it very conspicuous.

Pontotoc Ridge.---The next topographic and soil division to be recognized consists of a series of high ridges running north and south, and having the distribution shown in the map. The soils are red sandy loams derived from weathering of the Ripley marls of Cretaceous age. These red soils are much richer in plant food than their appearance would indicate, and the plants of the Pontotoc Ridge present decided differences from the prairies lying to the east and the Flatwoods on the west. The northern part of the Ridge is much broken into hills about the headwaters of the Hatchie River, the soil is sandy and rather sterile, so that the growth partakes largely of the character of the red sand hills of the prairie belt. Pines (*Pinus mitis* and *P. taeda*) are the principal tree growth, but with a considerable admixture of oaks (*Quercus stellata*, *Q. nigra*, *Q. falcata*) and chestnut (*Castanea vesca*). In the more typical soil of this region found from New Albany south-

ward, the tree growth presents besides the forms above enumerated (pines are rare), the following trees:

<i>Quercus rubra,</i>	<i>Liquidambar styraciflua,</i>
<i>Quercus alba,</i>	<i>Quercus phellos,</i>
<i>Carya tomentosa,</i>	<i>Quercus aquatica,</i>
<i>Carya alba,</i>	<i>Acer rubrum,</i>
<i>Juglans nigra,</i>	<i>Acer dasycarpum,</i>
<i>Juglans cinerea</i> (near Ripley),	<i>Betula nigra,</i>
<i>Liriodendron tulipifera,</i>	<i>Fagus ferruginea,</i>
<i>Robinia pseudacacia,</i>	<i>Gleditschia triacanthos.</i>
<i>Magnolia macrophylla,</i>	

Common shrubs on the upland slopes are:

<i>Corylus Americanus,</i>	<i>Hydrangea quercifolia,</i>
<i>Lonicera japonica,</i>	<i>Hydrangea arborescens.</i>
<i>Lindera benzoin,</i>	

On lowlands bordering streams are the following:

<i>Alnus serrulata,</i>	<i>Salix nigra.</i>
<i>Arundinaria tecta</i>	

Characteristic early spring herbaceous forms are given below. The herbaceous flora of summer and autumn has not yet been investigated. Herbs of the open wooded hill slopes are:

<i>Potentilla Canadensis,</i>	<i>Euonymus Americanus,</i>
<i>Houstonia patens,</i>	<i>Asplenium ebeneum,</i>
<i>Viola cucullata,</i>	<i>Claytonia Virginica,</i>
<i>Ranunculus fascicularis,</i>	<i>Erigenia bulbosa,</i>
<i>Ranunculus abortivus,</i>	<i>Corallorhiza odontorhiza,</i>
<i>Trillium sessile,</i>	<i>Sanguinaria Canadensis,</i>
<i>Aspidium acrostichoides,</i>	<i>Podophyllum peltatum.</i>
<i>Dioscorea villosa,</i>	

Clinging to limestone bluffs were the following species:

<i>Saxifraga Virginiensis,</i>	<i>Camptosorus rhizophyllus,</i>
<i>Dentaria laciniata,</i>	<i>Woodsia obtusa.</i>

Flatwoods Region.---This region, as the name implies, presents a low-lying flat topography on the whole, though

at times the surface becomes rolling and even hilly. The characteristic feature, however, is its flatness, which has caused it to be likened to a broad river valley. The flatwoods extend as a north and south belt three to fifteen miles wide bordering the west side of Pontotoc Ridge and the limestone prairies. (See map.)

The soil is prevailingly a heavy tenaceous dark gray clay with a subsoil of gray joint clay. The drainage is usually not good, so that the soil, except in dry years, is wet and cold. The streams are sluggish and overflow readily after heavy rains.

The flora of this region has received little attention so far, but from a general impression received (no notes having been taken by the Geological Survey) the flora corresponds rather closely with that of the Plateau region lying west of it. There seems to be a much closer similarity between this flora and that of the upland flora to the west than between this and the flora of Pontotoc Ridge. The tree growth of the higher lands of the Flatwoods consists of post oak (*Quercus stellata*), black jack (*Q. nigra*), Spanish oak (*Q. falcata*), pine (*Pinus taeda* and *P. mitis*), an occasional black gum (*Nyssa sylvatica*) and hickory (*Carya tomentosa*). Shrubs are not very plentiful, but haws (*Crataegus apiifolia*, *C. Crus-galli* and other species) are rather common. *Vaccinium arboreum* and *Prunus Americana* are occasional.

On the bottoms the growth is Spanish oak (*Quercus falcata*), larger and taller than on the higher lands, abundant hickory of several species, the shell-bark (*Carya alba*) being plentiful, yellow poplar (*Liriodendron tulipifera*), black gum (*Nyssa sylvatica*), sweet gum (*Liquidambar styraciflua*), willow and water oak (*Quercus phellos* and *Q. aquaticus*), and beech (*Fagus ferruginea*).

The herbaceous species have not been noted with sufficient care to justify listing, but almost certainly correspond rather closely with the herbaceous flora of the region lying to the west, which will be next described.

North-Central Plateau.---This region is much larger than any of those so far considered. It occupies all that

region of the northern half of the State lying west of the Flatwoods and east of a belt ten to fifteen miles wide bordering the Yazoo-Mississippi Delta. The boundaries may be traced on the sketch map.

The surface of this region is that of a maturely eroded 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. Many streams trench the surface, the larger having broad flats 75 to 100 feet lower than the plateau surface. Often one or more terraces fringe the stream valleys. On account of the mature erosion the original plateau has been cut into hills and ridges, the surface being more broken and intricately dissected near the larger streams, while in the wider stretches between streams the original plateau presents a gently rolling surface.

The upland soils of the region are yellowish brown silt loams and reddish sandy loams, with occasional stretches of sticky red clay soils. The silt loams are derived from the Columbian or Brown Loam which caps the plateau surface from five to fifteen feet deep, the sandy loams and red clay soils being derived by the exposure and weathering of the Eocene sands and clays that underly the Brown Loam throughout this region. Plant food is fairly abundant in the silt loam, the sandy and red clay soils being more sterile. The bottom land soils are sandy loams, though some are heavier where the streams receive washings from the Flatwoods.

The tree growth of this region is very largely pine of two species (*Pinus mitis* and *P. taeda*). The forests, however, are not usually pure pine forests, as occur so extensively in the southern part of the State, but have a considerable admixture of oaks of several species and other hardwood trees. The hardwood species prevail where the silt loam soil is the prevailing type, the pines being dominant in the other parts, especially in the sandy hills and ridges, which are most common in the eastern parts of the region. The oaks most abundantly mixed with the pines are black

jack (*Quercus nigra*), post oak (*Q. stellata*), and Spanish oak (*Q. falcata*).

Fairly representative of the growth in the western parts of the region where the silt loam is the prevailing type of soil, are the following:

<i>Quercus rubra</i> ,	<i>Quercus nigra</i> (not common),
<i>Quercus velutina</i> ,	<i>Nyssa sylvatica</i> (occasional),
<i>Quercus alba</i> ,	<i>Prunus Americanus</i> ,
<i>Carya tomentosa</i> ,	<i>Cornus florida</i> ,
<i>Carya alba</i> ,	<i>Pinus mitis</i> (occasional),
<i>Ulmus Americanus</i> ,	<i>Pinus taeda</i> (occasional),
<i>Quercus falcata</i> ,	<i>Prunus serotina</i> .
<i>Quercus stellata</i> ,	

Where the land has been cleared, farmed, and finally thrown out to grow up again the trees that take possession are chiefly:

<i>Pinus taeda</i> ,	<i>Liquidambar styraciflua</i> ,
<i>Diospyros Virginiana</i> ,	<i>Sassafras officinale</i> .

Later, black jack (*Quercus nigra*) enters, and a struggle for the mastery begins between the pines and oak, the oak finally getting the upperhand, when other oaks and hardwoods gradually crowd in and finally supersede the black jack in the supremacy.

The typical upland forest of the more sandy eastern parts of the region are the following:

<i>Pinus mitis</i> ,	<i>Prunus Americanus</i> ,
<i>Pinus taeda</i> ,	<i>Rhus glabra</i> ,
<i>Quercus nigra</i> ,	<i>Ulmus alata</i> ,
<i>Quercus stellata</i> ,	<i>Sassafras officinale</i> ,
<i>Quercus falcata</i> ,	<i>Cornus florida</i> ,
<i>Quercus velutina</i> ,	<i>Crataegus Crus-galli</i> ,
<i>Carya tomentosa</i> ,	<i>Liquidambar styraciflua</i> ,
<i>Carya alba</i> ,	<i>Quercus prinus</i> .
<i>Castanea vesca</i> ,	

The shrubby undergrowth of the region is somewhat typical, showing a decided xerophytic character, as seen from the following list:

<i>Vitis rotundifolia</i> ,	<i>Vaccinium arboreum</i> ,
<i>Bignonia capreolata</i> ,	<i>Aesculus Pavia</i> ,
<i>Ceanothus Americana</i> ,	<i>Hamamelis Virginiana</i> ,
<i>Hydrangea quercifolia</i> ,	<i>Rubus villosus</i> ,
<i>Hydrangea arborescens</i> ,	<i>Rubus Canadensis</i> ,
<i>Rhus copallina</i> ,	<i>Corylus Americanus</i> ,
<i>Vaccinium stamineum</i> ,	<i>Rhus Toxicodendron</i> .

The upland herbaceous forms of the region are open land or wooded land forms. Those especially characteristic of open lands are:

<i>Plantago aristata</i> ,	<i>Pentstemon pubescens</i> ,
<i>Stellaria media</i> ,	<i>Specularia perfoliata</i> ,
<i>Ranunculus fascicularis</i> ,	<i>Krigia Virginica</i> ,
<i>Houstonia patens</i> ,	<i>Krigia dandelion</i> ,
<i>Claytonia Virginica</i> ,	<i>Apogon humilis</i> ,
<i>Rudbeckia hirta</i> ,	<i>Erigeron bellidifolius</i> ,
<i>Centrosema Virginiana</i> ,	<i>Myosurus minimus</i> ,
<i>Aster patens</i> ,	<i>Salvia lyrata</i> ,
<i>Aster paludosus</i> ,	<i>Cerastium viscosum</i> ,
<i>Cassia Chamaecrista</i> ,	<i>Sagina decumbens</i> ,
<i>Asclepias tuberosa</i> ,	<i>Draba brachycarpa</i> ,
<i>Asclepias verticillata</i> ,	<i>Stylosanthes elatior</i> ,
<i>Commelina Virginica</i> ,	<i>Polygala incarnata</i> ,
<i>Asyrium Crux-Andreeae</i> ,	<i>Eupatorium album</i> ,
<i>Anemone Caroliniana</i> ,	<i>Nothoscordon striatum</i> ,
<i>Diodia teres</i> ,	<i>Geranium Carolinianum</i> ,
<i>Diodia Virginica</i> ,	<i>Coreopsis lanceolata</i> ,
<i>Rudbeckia amplexicaulis</i> ,	<i>Coreopsis tripteris</i> ,
<i>Linum Virginianum</i> ,	<i>Lobelia spicata</i> ,
<i>Oenothera frusticosa</i> ,	<i>Draba verna</i> (rare),
<i>Daucus pusilla</i> ,	<i>Houstonia longifolia</i> .
<i>Pentstemon laevigatus</i> ,	<i>Ionactis linariifolius</i>

Herbs that grow beneath open woods are the following:

<i>Tephrosia Virginica</i> ,	<i>Anemonella thalictroides</i> (not
<i>Antennaria plantaginifolia</i> ,	common),
<i>Ruellia ciliosa</i> ,	<i>Smilax herbacea</i> ,
<i>Viola palmata</i> ,	<i>Thaspium aureum</i> ,

<i>Viola cucullata,</i>	<i>Gonolobus macrophyllus,</i>
<i>Viola villosa,</i>	<i>Adiantum pedatum,</i>
<i>Agave Virginica,</i>	<i>Onoclea sensibilis,</i>
<i>Steironema ciliata,</i>	<i>Aspidium achrostichoides,</i>
<i>Cnicus Virginiana,</i>	<i>Phegopteris hexagonoptera,</i>
<i>Echinacea purpurea,</i>	<i>Arisaema Dracontium,</i>
<i>Solidago caesia,</i>	<i>Dasystema pectinata,</i>
<i>Mitchella repens,</i>	<i>Smilacina racemosa,</i>
<i>Onosmodium Virginianum,</i>	<i>Sanicula Marilandica,</i>
<i>Cypripedium pubescens,</i>	<i>Sanicula Canadensis,</i>
<i>Spiranthes gracilis,</i>	<i>Spigelia Marilandica,</i>
<i>Smilax Walteri,</i>	<i>Dioscorea villosa,</i>
<i>Galium pilosum,</i>	<i>Dentaria laciniata (rare),</i>
<i>Galium circaezans,</i>	<i>Heuchera Americana,</i>
<i>Rosa humilis,</i>	<i>Saxifraga Virginiensis (rare),</i>
<i>Potentilla Canadensis,</i>	<i>Pedicularis Canadensis,</i>
<i>Asclepias obtusifolius,</i>	<i>Geranium maculatum,</i>
<i>Asclepias variegata,</i>	<i>Dodecatheon media,</i>
<i>Shrankia uncinata,</i>	<i>Polemonium reptans,</i>
<i>Psoralea melilotoides,</i>	<i>Polygonatum biflorum,</i>
<i>Tradescantia Virginica,</i>	<i>Chamaelirium Carolinianum,</i>
<i>Houstonia purpurea,</i>	<i>Pteris aquilina,</i>
<i>Houstonia angustifolia,</i>	<i>Asplenium Flix-foemina,</i>
<i>Podophyllum peltatum,</i>	<i>Osmunda regalis,</i>
<i>Allium mutabile,</i>	<i>Osmunda cinnamomea,</i>
<i>Hypoxis erecta,</i>	<i>Hexalectris aphyllus,</i>
<i>Lithospermum hirta,</i>	<i>Lobelia inflata.</i>

The trees of the bottom lands in this region do not differ materially from those of lowlands throughout the State. In the southern part of the region the larger stream bottoms present some characteristics derived from the Mississippi Delta. For example, the gray moss (*Tillandsia usneoides*), the eared magnolia (*Magnolia Fraseri*), and notably the dwarf palmetto (*Sabal minor*) are found here, but have not been noted further north in this region, or in any of the regions lying to the east. Characteristic lowland trees are:

<i>Quercus alba,</i>	<i>Liquidambar styraciflua,</i>
<i>Quercus Michauxii,</i>	<i>Fraxinus Americana,</i>

<i>Quercus rubra</i> ,	<i>Fagus ferruginea</i> ,
<i>Quercus aquatica</i> ,	<i>Acer rubrum</i> ,
<i>Quercus phellos</i> ,	<i>Acer saccharinum</i> ,
<i>Quercus lyrata</i> ,	<i>Ilex opaca</i> ,
<i>Quercus prinus</i> ,	<i>Cercis Canadensis</i> ,
<i>Carpinus Carolinianus</i> ,	<i>Carya alba</i> ,
<i>Ulmus Americana</i> ,	<i>Carya amara</i> ,
<i>Ulmus fulva</i> ,	<i>Juglans nigra</i> ,
<i>Ulmus alata</i> ,	<i>Populus deltoides</i> (not com-
<i>Betula nigra</i> ,	mon),
<i>Taxodium distichum</i> ,	<i>Salix nigra</i> ,
<i>Liriodendron tulipifera</i> ,	<i>Platanus occidentalis</i> .

Shrubs and creepers of the lowlands are the following:

<i>Ampelopsis quinque-folia</i> ,	<i>Staphylea trifolia</i> ,
<i>Cephalanthus occidentalis</i> ,	<i>Asimina triloba</i> ,
<i>Brunnichia cirrhosa</i> ,	<i>Alnus serrulata</i> ,
<i>Aralia spinosa</i> ,	<i>Tecoma radicans</i> ,
<i>Euonymus Americanus</i> ,	<i>Lonicera sempervirens</i> ,
<i>Smilax rotundifolia</i> ,	<i>Cissus bipinnata</i> ,
<i>Vitis rotundifolia</i> ,	<i>Pyrus arbutifolia</i> ,
<i>Rosa Carolina</i> ,	<i>Pyrus melanocarpa</i> ,
<i>Cornus stricta</i> ,	<i>Crataegus apiifolia</i> ,
<i>Ilex decidua</i> ,	<i>Asimina parviflora</i> ,
<i>Vaccinium corymbosum</i> ,	<i>Aralia spinosa</i> .
<i>Vitis riparia</i> ,	

Herbaceous forms of the wooded lowlands are not particularly abundant, but the following species are representative:

<i>Phlox divaricata</i> ,	<i>Trillium sessile</i> ,
<i>Commelyna hirtella</i> ,	<i>Ranunculus recurvatus</i> ,
<i>Arisaema triphyllum</i> ,	<i>Boehmeria cylindrica</i> ,
<i>Arisaema dracontium</i> ,	<i>Osmunda regalis</i> ,
<i>Uvularia perfoliata</i> ,	<i>Adiantum pedatum</i> ,
<i>Uvularia sessile</i> ,	<i>Osmunda cinnamomea</i> ,
<i>Lobelia cardinalis</i> ,	<i>Habenaria ciliaris</i> ,
<i>Smilax rotundifolia</i> ,	<i>Spiranthes praecox</i> ,
<i>Smilax tamnoides</i> ,	<i>Platanthera bracteata</i> ,

<i>Medeola Virginica,</i>	<i>Platanthera psychodes,</i>
<i>Lilium superbum,</i>	<i>Microstylis ophioglossoides,</i>
<i>Polymnia Uvedalia,</i>	<i>Polygonum Virginianum,</i>
<i>Thalictrum purpurascens,</i>	<i>Dioclea Boykinii,</i>
<i>Elodes campanulata,</i>	<i>Penthorum sedoides,</i>
<i>Galium trifidum,</i>	<i>Mikania scandens,</i>
<i>Actinomeris squarrosa,</i>	<i>Mimulus alatus,</i>
<i>Ilysanthes gratioloides,</i>	<i>Impatiens fulva,</i>
<i>Viola cucullata,</i>	<i>Saururus cernuus.</i>

In open marshy places and bordering or growing in the waters of ponds and sluggish streams the following species are representative:

<i>Sambucus Canadensis,</i>	<i>Zygadenus glaberrimus,</i>
<i>Eupatorium perfoliata,</i>	<i>Samolus floribundus,</i>
<i>Eupatorium rotundifolium,</i>	<i>Ranunculus pusillus,</i>
<i>Senecio lobatus,</i>	<i>Linaria Canadensis,</i>
<i>Physostegia Virginiana,</i>	<i>Gratiola sphaerocarpa,</i>
<i>Sabbatia angularis,</i>	<i>Typha latifolia,</i>
<i>Dulichium spathaceum,</i>	<i>Rhexia Mariana,</i>
<i>Sagittaria variabilis,</i>	<i>Rhexia Virginica,</i>
<i>Orontium aquaticum,</i>	<i>Polygonum sagittatum,</i>
<i>Brasenia peltata,</i>	<i>Ludwigia alternifolia,</i>
<i>Aletris aurea,</i>	<i>Ludwigia palustris,</i>
<i>Fuirena scirpoidea,</i>	<i>Jussiaea decurrens,</i>
<i>Scirpus lacustris,</i>	<i>Sparganium simplex,</i>
<i>Peltandra undulata,</i>	<i>Acorus Calamus,</i>
<i>Ipomoea pandurata,</i>	<i>Hibiscus Moscheutos.</i>

Bluff Hills.---This region embraces a narrow strip 10 to 15 miles wide bordering the Delta lowlands on the east from the northern boundaries of the State to the line of Louisiana on the south. From Vicksburg south the bluffs lie close in towards the river, and are more pronounced than farther north. The bluff hills lie very little above the general level of the plateau, if at all, the hills being remnants of the ragged edge of the interior plateau produced by the deep cutting of streams in passing from the plateau level to that of the Delta lowlands.

The marked broken and intricate character of the

topography, however, is due to a peculiarity of the material eroded. For 10 to 20 miles back from the Delta edge a thick deposit of loess silt overlies the surface 30 to 75 feet thick, and forms the basis for the soil and for the peculiar character of erosion into vertical faces. This loess is a fine yellowish calcareous silt containing numerous snail shells, thickest next the river, and thinning rapidly to an edge at the eastern margin of the region.

On account of the lime content the soil derived from this material is more fertile than that of the plateau farther back, and supports a vegetation somewhat different. In this region the hill flora of the plateau and the lowland flora of the Delta come into competition, with the result that the flora, while of hill type, has some distinct characters derived from the Delta.

The extent of the region from north to south is such that, while the distinctive features of the flora persist, some species appear in the southern part that are not found farther north.

The tree flora of the Loess hills is almost entirely of hardwoods. Pines are not at all a common feature, except as a second growth in old thrown-out fields or other openings. Red cedars (*Juniperus Virginiana*) are not uncommon on the steep slopes, but was probably not part of the original flora. The gray moss (*Tillandsia usneoides*) drapes the trees, being especially abundant in the more southern parts, and gradually disappearing before the northern boundary of the State is reached. *Myrica cerifera* and *Pteris Cretica* have been observed toward the southern end of the region, but so far not farther north. Other herbaceous species that have been found in the region not north of Natchez are the following:

Heterotheca Lamarckii, *Parthenium Hysterophorus*.
Croton Texensis,

The beautiful white Cherokee rose (*Rosa Cherokee*) is very common and striking in the southern half of this region, but is also found on the loam soils east of the Bluff region in the same latitudes.

The tree growth of the Loess hills is rich, both in variety and in quantity. In its original state the forest was heavy and gloomy on account of the luxuriant growth of the gray moss (*Tillandsia usneoides*), which festooned all the trees, and because of abundance of lianas and creepers that matted the forests. Prominent in these loess forests are the following trees:

<i>Quercus alba,</i>	<i>Morus rubra,</i>
<i>Quercus velutina,</i>	<i>Carpinus Carolinina,</i>
<i>Quercus prinus,</i>	<i>Ostrya Virginica,</i>
<i>Quercus rubra,</i>	<i>Carya tomentosa,</i>
<i>Quercus aquatica,</i>	<i>Carya amara,</i>
<i>Quercus Michauxii,</i>	<i>Gleditschia triacanthos,</i>
<i>Magnolia grandiflora,</i>	<i>Cercis Canadensis,</i>
<i>Magnolia cordata,</i>	<i>Pyrus angustifolium,</i>
<i>Magnolia macrophylla,</i>	<i>Acer rubrum,</i>
<i>Liriodendron tupilifera,</i>	<i>Cornus Florida</i>
<i>Juglans nigra,</i>	<i>Castanea Vesca</i>
<i>Ulmus Americana,</i>	<i>Castanea pumila,</i>
<i>Ulmus fulva,</i>	<i>Celtis Mississippiensis,</i>
<i>Fagus ferruginea,</i>	<i>Prunus Americana,</i>
<i>Tilia pubescens,</i>	<i>Robinia Pseudacacia.</i>

The pines (*Pinus taeda* and *P. mitis*), as before stated, are rare in this region as representing part of the primitive flora, while toward the northern limit of the region the butter-nut (*Juglans cinerea*) is occasionally found.

The climbers and shrubs of the region are represented by the following list:

<i>Ampelopsis quinquefolia,</i>	<i>Calycocarpum Lyoni,</i>
<i>Bignonia capreolata,</i>	<i>Hydrangea quercifolia,</i>
<i>Tecoma radicans,</i>	<i>Arundinaria,</i>
<i>Berchemia volubilis,</i>	<i>Cornus stolonifera,</i>
<i>Rhus Toxicodendron,</i>	<i>Hydrangea arborescens,</i>
<i>Cissus bipinnata,</i>	<i>Euonymus Americanus,</i>
<i>Cissus Ampelopsis,</i>	<i>Asimina triloba,</i>
<i>Vitis rotundifolia,</i>	<i>Hamamelis Virginica,</i>
<i>Vitis riparia,</i>	<i>Aralia spinosa,</i>
<i>Vitis Labrusca,</i>	<i>Callicarpa Americana,</i>

<i>Vitis cordifolia</i> ,	<i>Crataegus spathulata</i> ,
<i>Rosa Cherokee</i> ,	<i>Lindera benzoin</i> ,
<i>Gelsemium sempervirens</i> ,	<i>Rhus copallina</i> ,
<i>Lonicera sempervirens</i> ,	<i>Crataegus apiifolia</i> ,
<i>Myrica cerifera</i> (south).	

Common herbaceous forms growing on the uplands and Loess slopes are the following:

<i>Rubus villosus</i> ,	<i>Parthenium Hysterophorus</i> ,
<i>Rubus trilialis</i> ,	<i>Croton Texensis</i> (south),
<i>Elephantopus Carolinianus</i> ,	<i>Aspidium acrostichoides</i> ,
<i>Equisetum robustum</i> ,	<i>Aspidium patens</i> ,
<i>Heterotheca Lamarckii</i> ,	<i>Asplenium ebeneum</i> ,
<i>Arisaema Dracontium</i> ,	<i>Pteris Cretica</i> (Natchez
<i>Ascyrum Crux-andrae</i> ,	bluffs),
<i>Galium pilosum</i> ,	<i>Diodia teres</i> ,
<i>Viola cucullata</i> ,	<i>Diodia Virginica</i> ,
<i>Viola villosa</i> ,	<i>Adiantum pedatum</i> ,
<i>Ascyrum hypericoides</i> ,	<i>Mitchella repens</i> ,
<i>Ruellia ciliosa</i> ,	<i>Eryngium prostratum</i> ,
<i>Hydrocotyle interrupta</i> ,	<i>Amphicarpaea monoica</i> ,
<i>Dichondra repens</i> ,	<i>Geum album</i> ,
<i>Epiphegus Virginiana</i> ,	<i>Spigelia Marilandica</i> ,
<i>Podophyllum peltatum</i> ,	<i>Desmodium rotundifolium</i> .
<i>Sanicula Canadensis</i> ,	

The lowlands of this region present only slight differences from the flora of the adjacent Delta lowlands as seen by the brief list given below:

<i>Quercus alba</i> ,	<i>Fraxinus quadrangulata</i> ,
<i>Quercus prinus</i> ,	<i>Fagus ferruginea</i> ,
<i>Quercus Michauxii</i> ,	<i>Ilex opaca</i> ,
<i>Quercus lyrata</i> ,	<i>Ilex Dahoon</i> ,
<i>Magnolia grandiflora</i> ,	<i>Platanus occidentalis</i> ,
<i>Magnolia cordata</i> ,	<i>Carya olivæformis</i> ,
<i>Taxodium distichum</i> ,	<i>Carya aquatica</i> ,
<i>Liquidambar styraciflua</i> ,	<i>Salix nigra</i> ,
<i>Nyssa sylvatica</i> ,	<i>.....detoides</i> ,
<i>Nyssa uniflora</i> ,	<i>Acc. aasyrcarpum</i> ,

<i>Symplocos tinctoria</i> ,	<i>Acer saccharinum</i>
<i>Liriodendron tulipifera</i> ,	<i>Crataegus arborescens</i> ,
<i>Schizandra coccinea</i> ,	<i>Magnolia Frazeri</i> ,
<i>Smilax rotundifolia</i> ,	<i>Brunnichia cirrhosa</i> ,
<i>Ostrya Virginica</i> ,	<i>Ilex decidua</i> ,
<i>Sabal minor</i> ,	<i>Carpinus Carolinianus</i> ,
<i>Cornus stricta</i> ,	<i>Arundinaria macrosperma</i> ,
<i>Fraxinus Americana</i> ,	<i>Cephalanthus occidentalis</i> .

A few of the commoner herbaceous forms are given below :

<i>Polygonum Virginianum</i> ,	<i>Arisaema Dracontium</i> ,
<i>Polygonum acre</i> ,	<i>Tillandsia usneoides</i> ,
<i>Diodia Virginica</i> ,	<i>Epidendrum conopseum</i> ,
<i>Eclipta alba</i> ,	<i>Cassia Chamaecrista</i> ,
<i>Mikania scandens</i> ,	<i>Viola cucullata</i> ,
<i>Sanicula Canadensis</i> ,	<i>Boehmeria cylindrica</i> ,
<i>Solidago caesia</i> ,	<i>Uvularia perfoliata</i> ,
<i>Galium trifidum</i> ,	<i>Ludwigia alternifolia</i> ,
<i>Galium circaezans</i> ,	<i>Jussiaea decurrens</i> ,
<i>Hypericum mutilum</i> ,	<i>Mimulus alatus</i> ,
<i>Penthorum sedoides</i> ,	<i>Dioscorea villosa</i> ,
<i>Impatiens fulva</i> ,	<i>Lobelia cardinalis</i> ,
<i>Phryma leptostachya</i> ,	<i>Phegopteris hexagonoptera</i> ,
<i>Pilea pumila</i> ,	<i>Aspidium Thelypteris</i> .
<i>Euonymus Americanus</i> ,	

The Yazoo Delta.---The delta region comprises all the lowlands of alluvial origin bordering the Mississippi River. It is a narrow strip from one to a few miles wide in South Mississippi, but north of Vicksburg widens to a broad nearly level plain 60 miles wide at its widest part and about 200 miles long. The region lies so nearly level that the drainage is poor, and occasionally practically the whole region overflows. The soil is very rich, but presents two well-marked general divisions. Along the streams and for a few miles back the soil is a fine sandy loam which lies a little higher and is better drained than the lower lands in the inter-stream areas, where, owing to the relative lowness and the heavier clay soils, much of the surface is permanently occupied by bays, lakes and swamps.

These Delta plains were originally covered with heavy hardwood forests, much of which still stands. The trees are prevailingly of the moisture and water-loving kinds as would be expected, and differ from the tree flora of the alluvial soils of the last region quantitatively rather than qualitatively. While the region perhaps presents no new species, the bulk of the forest growth runs much more largely to a few abundant species, such as represented below:

<i>Quercus alba,</i>	<i>Nyssa uniflora,</i>
<i>Quercus lyrata,</i>	<i>Platanus occidentalis,</i>
<i>Quercus phellos,</i>	<i>Fagus ferruginea,</i>
<i>Quercus aquaticus,</i>	<i>Acer dasycarpum,</i>
<i>Quercus Michauxii,</i>	<i>Carya olivaeformis,</i>
<i>Fraxinus Americana,</i>	<i>Carya aquaticus,</i>
<i>Taxodium distichum,</i>	<i>Celtis Mississippiensis,</i>
<i>Magnolia grandiflora,</i>	<i>Salix nigra,</i>
<i>Liquidambar styraciflua,</i>	<i>Populus deltoides,</i>
<i>Nyssa sylvatica,</i>	<i>Tilia pubescens.</i>

These are but a few of the species growing here but are representative, embracing by far the greater part of the tree growth. The shrubs of the region are not numerous in species, and differ little, except in relative abundance of different species, from those of the last region having similar habitat.

The herbaceous flora of the Delta is not very varied. The shade of the forests is such that few species thrive in the dense half light of the virgin forest.

A few that have not been mentioned as occurring in the last region, together with a few others most commonly found in the lowlands are given here:

<i>Polygonum Virginianum,</i>	<i>Spermacoce glabra,</i>
<i>Saururus cernuus,</i>	<i>Asclepias perennis,</i>
<i>Commelyna hirtella,</i>	<i>Ammannia coccinea,</i>
<i>Echium vulgare</i> (fields),	<i>Conobea multifida,</i>
<i>Lippia lanceolata,</i>	<i>Hymenocallis lacera.</i>
<i>Penthorum sedoides,</i>	

Jackson Prairie Region.---This region of small prairies extends in a belt varying from 10 to 30 miles wide, in a direction slightly northwest and southeast across the State (boundaries may be seen on the sketch map). Its greatest breadth is in the extreme western part from the longitude of Jackson to the Bluff hills; eastward it narrows to the line of Alabama. The region is one of rolling topography, in places very gently so, in others quite hilly. The more hilly parts usually exhibit a red sandy loam soil due to weathering of remnants of the Lafayette formation. In the broad western part the soil is the Columbian or Brown Loam modified somewhat by the underlying calcareous Jackson clays. The typical prairie soils are rather heavy dark gray clay loams produced by weathering of the Jackson clays and marls. This character of soil is usually not found in continuity over wide areas, but is patchy, the patches surrounded by one of the other two types. As would be expected, the flora of this region presents three rather well marked phases. The typical soil, that of the true prairie type, supports a characteristic prairie flora, the western loam part supports the flora of the Brown Loam region, modified by invasions from the prairie flora, and the sandy loam parts toward the east support the flora of the southern long-leaf pine hills (to be noticed next) modified by additions from the prairie flora.

In this brief sketch it will be necessary to notice only the flora of the typical prairie, our discussion of the region lying to the north giving a fairly adequate impression of the part of this region overlaid by the Brown Loam, and the sketch of the flora of the southern pine belt, which will follow, will give, we hope, a sufficient view of the flora of the more sandy portions.

Most of the surface of even the prairie soil is or has been occupied by a somewhat stunted tree growth, in places quite open, in others rather dense. The trees that make up almost entirely these dwarfed forests are a very few. Perhaps 98 per cent is made up of the following species:

<i>Quercus stellata</i> ,	<i>Carya tomentosa</i> ,
<i>Quercus nigra</i> ,	<i>Diospyros Virginiana</i> ,
<i>Quercus falcata</i> ,	<i>Pinus taeda</i> (in old fields).

Of course on low grounds along streams a richer tree growth prevails, but is not characteristic of this region, and presents no characteristics different from the lowlands of adjoining regions already discussed.

The subjoined list of mostly herbaceous species is fairly representative of the upland growth on this soil:

<i>Lepidium Virginicum</i> ,	<i>Rudbeckia hirta</i> ,
<i>Viola cucullata</i> ,	<i>Coreopsis lanceolata</i> ,
<i>Oxalis violacea</i> ,	<i>Coreopsis grandiflora</i> ,
<i>Oxalis stricta</i> ,	<i>Coreopsis tripteris</i> ,
<i>Rhus copallina</i> ,	<i>Buchnera elongata</i> ,
<i>Rhus Toxicodendron</i> ,	<i>Asclepias variegata</i> ,
<i>Tephrosia spicata</i> ,	<i>Asclepias tuberosa</i> ,
<i>Rhynchosia tomentosa</i> ,	<i>Acerates paniculata</i> ,
<i>Erythrina herbacea</i> ,	<i>Desmanthus brachylobus</i> ,
<i>Delphinium azureum</i> ,	<i>Desmanthus luteus</i> ,
<i>Linum Virginianum</i> ,	<i>Oenothera linifolia</i> ,
<i>Geranium maculatum</i> ,	<i>Hydrangea quercifolia</i> ,
<i>Ceanothus Americanus</i> ,	<i>Viburnum prunifolium</i> ,
<i>Aesculus pavia</i> ,	<i>Prunus Americana</i> ,
<i>Polygala Boykinii</i> ,	<i>Helenium angustifolium</i> ,
<i>Petalostemon candidus</i> ,	<i>Helianthus lactiflorus</i> ,
<i>Petalostemon violaceus</i> ,	<i>Cacalia tuberosa</i> ,
<i>Clitoria mariana</i> ,	<i>Pentstemon pubescens</i> ,
<i>Baptisia alba</i> ,	<i>Pentstemon laevigatus</i> ,
<i>Silphium integrifolium</i> ,	<i>Verbena Bonariensis</i> ,
<i>Gaura filipes</i> ,	<i>Collinsonia scabriuscula</i> ,
<i>Spigelia Marylandica</i> ,	<i>Houstonia patens</i> ,
<i>Liatris spicata</i> ,	<i>Claytonia Virginica</i> .
<i>Aster virgatus</i> ,	<i>Solidago rugosa</i>
<i>Rudbeckia laciniata</i>	

Some of the lowland forms of this region are:

<i>Aristolochia tomentosa</i> ,	<i>Aralia spinosa</i> ,
<i>Brunnichia cirrhosa</i> ,	<i>Halesia tetraptera</i> ,

<i>Euonymus Americanus,</i>	<i>Symplocos tinctoria,</i>
<i>Pedicularis Canadensis,</i>	<i>Vicia micrantha,</i>
<i>Podophyllum peltatum,</i>	<i>Sisyrinchium album,</i>
<i>Uvularia perfoliata,</i>	<i>Polymnia Uvedalia,</i>
<i>Aesculus pavia,</i>	<i>Phegopteris hexagonoptera,</i>
<i>Arisaema Dracontium,</i>	<i>Polygonatum giganteum,</i>
<i>Smilacina racemosa,</i>	<i>Thaspium aureum,</i>
<i>Trillium sessile,</i>	<i>Commelyna hirtella,</i>
<i>Hydrolea affinis,</i>	<i>Herpestis rotundifolia,</i>
<i>Asclepias perennis,</i>	<i>Coreopsis trichosperma.</i>

Longleaf Pine Region.---This region constitutes the whole southern half of the State south of the Jackson prairies. In fact, the floral characteristics of this region are noticed in the eastern part of the State as far north as Meridian, thus lapping over that end of the Jackson prairie region as shown on the map. This is due to the fact that, while limited areas of the prairie soil with its flora are to be found in the eastern part of the State, they are completely surrounded by the red sandy formations that furnish the soil of the southern pine region flora, and hence that flora has followed the soil northward.

The soil of this region, as just stated, is a reddish brown sandy loam, and is on the whole a more sterile soil than any of those already discussed. It is generally poor in all the elements of plant food, and when high above drainage is a dry soil. In the low flat coastal belt, however, the surface lies so low that over the whole region considerable areas lie at about the level of ground water, and are permanently wet and sobby. The water-logged condition induces an acidity of the soil, so that altogether the condition of a northern bog is simulated, with the result that these places support a flora very suggestive of bog flora.

This region might be conveniently described under two floral facies, that of the low, wet coastal flats, and that of the upland pine region proper. These distinctions will only be hinted at in this paper, though the floral differences between, for example, Lincoln and Harrison counties are so striking as to be at once noticed.

The upland forests of this region are almost pure long-leaf pine (*Pinus australis*), with a very sparse sprinkling of other trees, though near the northern boundary and in the western part of the region the forests are mixed with hardwoods and other pines.

Remembering that over the greater part of the region the long-leaf pine constitutes fully 90 per cent of the tree growth, we append a list of trees growing on the uplands of this region:

<i>Pinus australis</i> ,	<i>Rhus typhina</i> ,
<i>Pinus mitis</i> ,	<i>Prunus Americanus</i> ,
<i>Pinus taeda</i> ,	<i>Carya tomentosa</i> ,
<i>Pinus Cubensis</i> (near coast),	<i>Magnolia macrophylla</i> ,
<i>Quercus stellata</i> ,	<i>Diospyros Virginiana</i> ,
<i>Quercus nigra</i> ,	<i>Sassafras officinale</i> ,
<i>Quercus falcata</i> ,	<i>Liquidambar styraciflua</i> ,
<i>Quercus Catesbaei</i> (south),	<i>Rhus copallina</i> ,
<i>Quercus rubra</i> ,	<i>Castanea pumila</i> ,
<i>Quercus laurifolia</i> (south),	<i>Nyssa sylvatica</i> ,
<i>Quercus virens</i> (near coast),	<i>Pyrus angustifolia</i> ,
<i>Cornus florida</i> ,	<i>Viburnum dentatum</i> .

The following is a partial list of species, mostly herbaceous, found growing beneath the upland forests and in the open uplands:

<i>Stylosanthes elatior</i> ,	<i>Jatropha stimulosa</i> ,
<i>Ruellia ciliosa</i> ,	<i>Stillingia sylvatica</i> ,
<i>Houstonia purpurea</i> ,	<i>Verbena stricta</i> ,
<i>Eryngium yuccaefolium</i> ,	<i>Monarda punctata</i> ,
<i>Aster adnatus</i> ,	<i>Cassia nictitans</i> ,
<i>Phaseolus pauciflorus</i> ,	<i>Cassia Chamaecrista</i> ,
<i>Eryngium virgatum</i> ,	<i>Centrosema Virginiana</i> ,
<i>Lobelia brevifolia</i> ,	<i>Rhynchosia reniformis</i> ,
<i>Hypericum pilosum</i> ,	<i>Gerardia aphylla</i> ,
<i>Helianthus angustifolius</i> ,	<i>Ascyrum stans</i> ,
<i>Polygala grandiflora</i> ,	<i>Ascyrum Cru x-Andreae</i> ,
<i>Polygala nana</i> ,	<i>Liatris spicata</i> ,
<i>Polygala lutea</i> ,	<i>Dasytoma pectinata</i> ,
	<i>Chrysopsis graminifolia</i> ,

<i>Polygala polygama</i> ,	<i>Liatrix squarrosa</i> ,
<i>Polygala cruciata</i> ,	<i>Brickellia cordifolia</i> ,
<i>Drosera rotundifolia</i> ,	<i>Aster patens</i> ,
<i>Drosera filifolia</i> (near coast),	<i>Aster paludosus</i> ,
<i>Erythrina herbacea</i> ,	<i>Viola villosa</i> ,
<i>Selaginella apus</i> ,	<i>Mitchella repens</i> .
<i>Houstonia rotundifolia</i> (in dry sand flats),	

The following species have their chief distribution in the low pine barrens within a few miles of the coast, in soil permanently marshy:

<i>Ilex glabra</i> (in dense copses),	<i>Pinguicula lutea</i> ,
<i>Gaylussacia dumosa</i> ,	<i>Polygala lutea</i> ,
<i>Drosera rotundifolia</i> ,	<i>Polygala polygama</i> ,
<i>Drosera filifolia</i> ,	<i>Hypoxis juncea</i> ,
<i>Serenoa serrulata</i> ,	<i>Utricularia setacea</i> ,
<i>Eriocaulon septangulare</i> ,	<i>Erigeron nudiculis</i> ,
<i>Eriocaulon gnaphalodes</i> ,	<i>Dichromena latifolia</i> ,
<i>Viola primulaefolia</i> ,	<i>Baldwinia uniflora</i> ,
<i>Zygadenus glaberrimus</i> ,	<i>Sarracenia flava</i> ,
<i>Andromeda nitida</i> ,	<i>Osmunda cinnamomea</i> ,
<i>Hydrocotyle repanda</i> ,	<i>Lycopodium alopecuroides</i> ,
<i>Sabal minor</i> ,	<i>Eupatorium rotundifolium</i>

Very characteristic shrubs that for the most part form dense copses on the low grounds, especially along the margins of streams are the following:

<i>Azalea nudiflora</i> ,	<i>Myrica cerifera</i> ,
<i>Kalmia latifolia</i> ,	<i>Cyrilla racemiflora</i> ,
<i>Illicium Floridanum</i> ,	<i>Halesia diptera</i> ,
<i>Ilex glabra</i> ,	<i>Cephalanthus occidentalis</i> ,
<i>Ilex Cassine</i> ,	<i>Alnus serrulata</i> ,

Gelsemium sempervirens (climbing abundantly over other shrubs and trees),

Trees of the low grounds and stream bottoms are:

<i>Quercus phellos</i> ,	<i>Acer dasycarpum</i> ,
<i>Quercus aquaticus</i> ,	<i>Negundo aceroides</i> ,

<i>Quercus alba,</i>	<i>Salix nigra,</i>
<i>Pinus taeda,</i>	<i>Symplocos tinctoria,</i>
<i>Pinus glabra,</i>	<i>Quercus laurifolia,</i>
<i>Taxodium distichum,</i>	<i>Quercus prinus,</i>
<i>Acer dasycarpum,</i>	<i>Ilex Dahoon,</i>
<i>Magnolia grandiflora,</i>	<i>Prunus Caroliniana,</i>
<i>Magnolia glauca,</i>	<i>Ostrya Virginica,</i>
<i>Carpinus Carolinianus,</i>	<i>Xanthoxylum Clava-Herculis,</i>
<i>Tilia pubescens,</i>	<i>Liquidambar styraciflua,</i>
<i>Fagus ferruginea,</i>	<i>Nyssa sylvatica,</i>
<i>Betula nigra,</i>	<i>Nyssa uniflora,</i>
<i>Platanus occidentalis,</i>	<i>Cornus alternifolia,</i>
<i>Quercus lyrata,</i>	<i>Chionanthus Virginica.</i>

Common herbaceous species inhabiting the borders and alluvial flats of streams are given below:

<i>Commelyna hirtella,</i>	<i>Cassia nictitans,</i>
<i>Dioclea Boykinii,</i>	<i>Botrychium ternatum,</i>
<i>Eupatorium album,</i>	<i>Botrychium Virginicum,</i>
<i>Eupatorium semiserratum,</i>	<i>Arisaema triphyllum,</i>
<i>Ilysanthes gratioides,</i>	<i>Arisaema quinatum,</i>
<i>Pycnanthemum albescens,</i>	<i>Mikania scandens,</i>
<i>Penthorum sedoides,</i>	<i>Rhexia stricta,</i>
<i>Hydrocotyle umbellata,</i>	<i>Elodes campanulata,</i>
<i>Jussiaea pilosa,</i>	<i>Lycopus Virginicus,</i>
<i>Monotropa uniflora,</i>	<i>Lobelia cardinalis,</i>
<i>Mimulus alatus,</i>	<i>Amorpha fruticosa,</i>
<i>Melothria pendula,</i>	<i>Aralia spinosa.</i>
<i>Asarum arifolium,</i>	

The gulf border of the State furnishes a strand flora quite distinct from the flora of the rest of the State, and showing considerable diversity of forms. Immediately on the beach sands are the following:

<i>Cakile fusiformis,</i>	<i>Salsola Kali,</i>
<i>Dondia linearis,</i>	<i>Cenchrus megacephalus,</i>
<i>Sesuvium portulacastrum.</i>	

Forming an inner zone of the beach are the following characteristic forms:

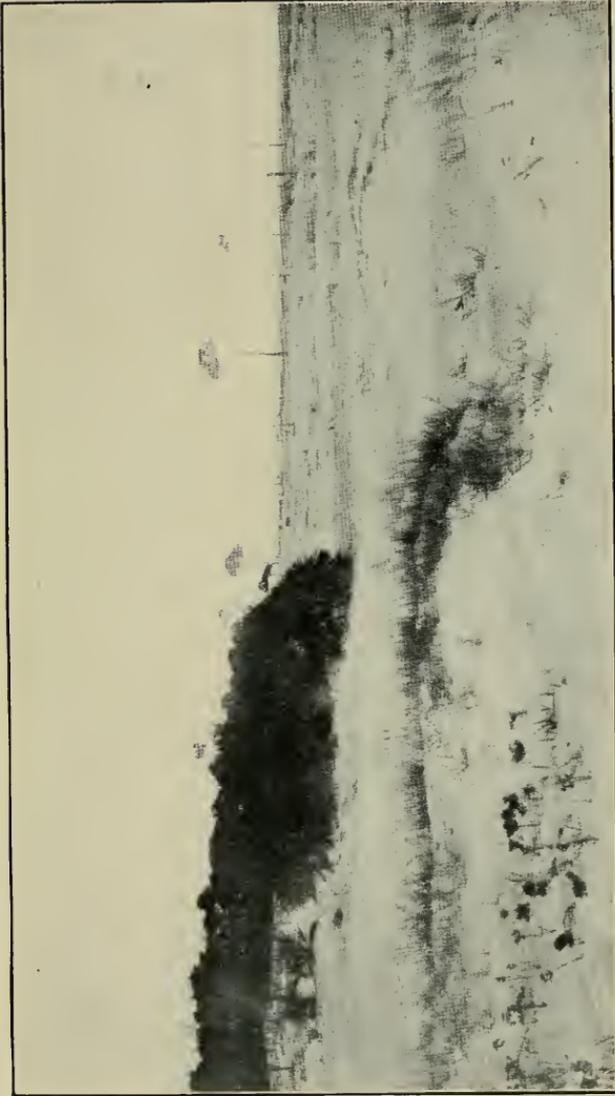


FIG. 6.—Mississippi Coast. Sand spit plain. *Serenoa serrulata* dunes. In the middle foreground a *Panicum repens* dune. Left foreground *Cyperus cylindricus*, *Pinus Taeda* in the background; pine graveyard on the right.—From Lloyd and Tracy's Insular Flora of Mississippi and Louisiana.



<i>Ipomoea Pes-Caprae</i> ,	<i>Strophostyles helvola</i> ,
<i>Ipomoea acetosaeifolia</i> ,	<i>Panicum amarum</i> ,
<i>Panicum halophilum</i> ,	<i>Uniola paniculata</i> ,
<i>Iva imbricata</i> ,	<i>Daubentonia longifolia</i> .

Upon the higher sand ridges and dunes a little back from the beach are found the following:

<i>Pinus taeda</i> ,	<i>Sabal minor</i> ,
<i>Pinus australis</i> ,	<i>Serenoa serrulata</i> ,
<i>Quercus geminata</i> ,	<i>Ilex vomitoria</i> ,
<i>Quercus Virginiana</i> ,	<i>Myrica cerifera</i> .
<i>Cladonia rangiferina</i> ,	

In and bordering salt marshes are the following species:

<i>Batis maritima</i> ,	<i>Dondia maritima</i> ,
<i>Salicornia biglovii</i> ,	<i>Limonium Nashii</i> ,
<i>Avicennia nitida</i> ,	<i>Leptilon Canadense</i> ,
<i>Euphorbia polygonifolia</i> ,	<i>Crantzia lineata</i> ,
<i>Lippia nodiflora</i> ,	<i>Atriplex cristata</i> ,
<i>Xyris serotina</i> ,	<i>Hydrocotyle repanda</i> ,
<i>Utricularia subulata</i> ,	<i>Hydrocotyle interrupta</i> .
<i>Lithophila vermiculata</i> ,	

A few observations may be briefly noted from the foregoing discussion. Two widely separated regions of the State, wide apart both in topography and physical aspects and in distinctive floral features, are the northeastern hills in the immediate vicinity of the Tennessee River and the flat coastal pine barrens. These two regions have each a comparatively large number of species peculiar to the region, in the one case, species characteristic of rich shaded northern hills, in the other, of wet barren sand flats, that are southern in distribution. The nearest approach to the pine barrens flora of the south (which includes the pine barrens flora of New Jersey) is the bog floras of the northern glaciated regions. Just what is the significance of this parallelism has not yet been satisfactorily explained. General similarity of soil conditions may be sufficient to explain the persistence of these peculiar floras in those particular situations, but doubtfully accounts for their origin in such widely separated areas.

It is to be noticed that at least one northern tree, the butternut (*Juglans cinerea*) found in this region, is only found, so far as at present known, along streams tributary to the Tennessee. The fruit of this tree is heavy and could only be transported by water or by animals. Their occurrence along the streams might be explained by the action of back water in time of high water, reinforced by the activity of squirrels in disseminating the seed. The only other region of the State where this tree has been noted is in the northwest part of the State near the Mississippi River, where its occurrence might be similarly explained.

The general characteristics of the southern pine region extend considerably farther north toward the eastern line of the State than farther west, which may be accounted for in the manner already suggested.

The azalea (*Rhododendron nudiflora*) and mountain laurel (*Kalmia latifolia*), shrubs of distinctive northern distribution, are found equally abundant in the Tennessee River hills and along streams of the southern pine region, but are not particularly common in the intervening regions. In the western half of the State, particularly that part north of the A. & V. Railroad, and west of the I. C. Railroad, these two species are very rare, so far as our investigations have discovered.

The magnolias of all species, except the sweet bay (*Magnolia glauca*), have their chief distribution in the Loess silt region, and are more abundant in the southern half of the region. The distribution of the gray moss (*Tillandsia usneoides*) corresponds quite closely with this, including, however, the swamps of cypress and gum. In the overflow regions, and bordering swamps of the Delta and large tributary streams, the fan palmetto (*Sabal minor*) finds its northern distribution a little north of latitude 33°.

Lippia nodiflora and *Daubentonia longifolia*, which are very common on the sands of the Gulf coast, seem not to be common elsewhere in the State except in the sandy soils bordering the Mississippi River as far north as Vicksburg. Doubtless other strand species will be found to have a similar distribution.

