EXAMINATION OF FERRY (CADDO) LAKE

Volume II

Reports by Lionel Janes

U.S. Department of the Interior
1914

Compiled for the Shreveport to Daingerfield Study

INTRODUCTORY NOTES

By: Jacques D. Bagur

This is the second volume of a three-volume set of materials on the U.S. Department of the Interior's 1914 investigation of Caddo Lake. The present volume contains the reports of the ecologist, Lionel Janes, including his summary report, main report, and description of wood specimens. All of these reports were obtained from the National Archives.

Volume III of this set contains Janes' folio of photographs. Janes also prepared six maps of his ecologic survey plots, which are housed separately. With the exception of the wood specimens themselves (which are not included for obvious reasons and may not be available), these are all of the materials produced by Janes for his ecologic survey of Caddo Lake.

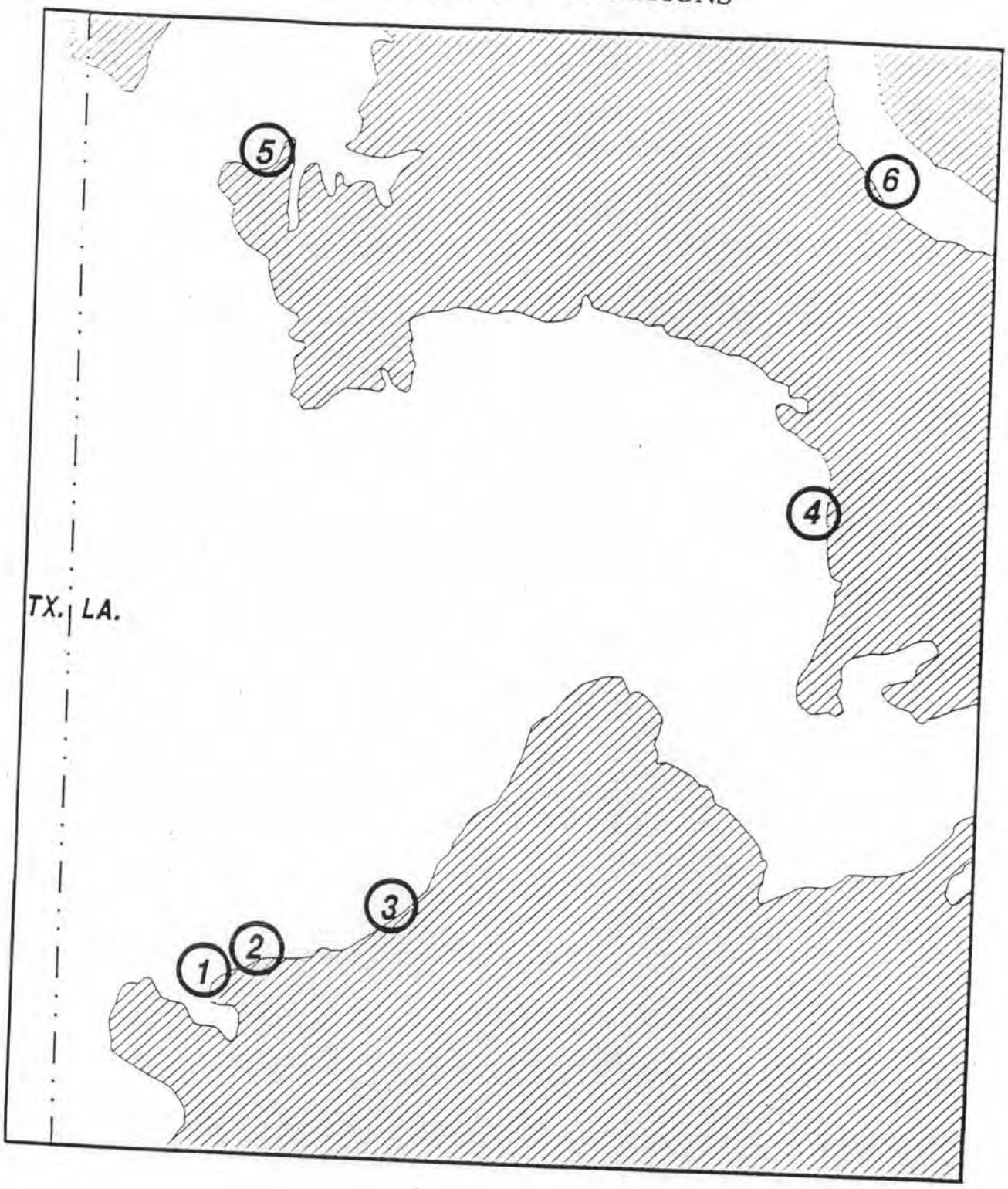
Throughout these reports, Janes refers to tree numbers and sample plots. Some of the trees are described and pictured in the photographic folio, and the location of all numbered trees is shown on the sample plot maps. The location of the sample plots is shown on the "Hydrographic and Topographic Map," which is in two parts.

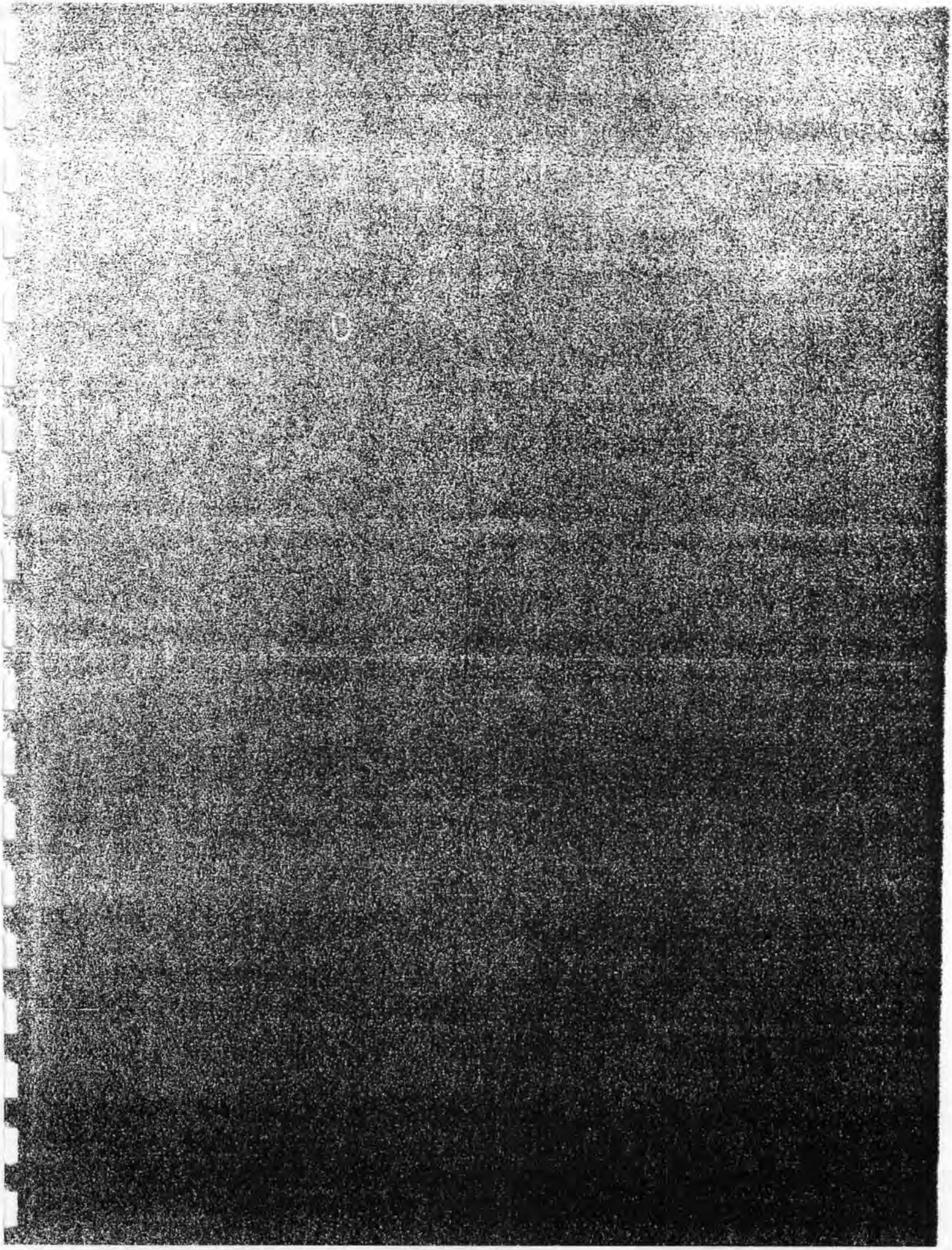
Janes' reports are distinguished for their impeccable research and stylistic elegance. On the basis of his age analysis of trees on the Big Terrace and Lower Terrace, Janes reached the conclusion that Caddo Lake came into existence in 1777.

Caution should be exercised in reviewing Janes' dating of cypress trees, since he was working at a time before the problem of false rings became known. His dating of some overcup oaks is incompatible with historic evidence for the origins of Caddo Lake in 1800, particularly in light of his observations on number of years required for germination and number of years required to reach stump height.

The following page provides a ready reference map of the sample plot locations.

SAMPLE PLOT LOCATIONS





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EXAMINATION OF FERRY LAKE, CADDO PARISH, LOUISIANA,

Township 20 North, Range 16 West, Louisiana Meridian.

AN ECOLOGIC SURVEY

In Pursuance of Instructions of the Commissioner of the

General Land Office

Under date of September 27, 1913,

by

Lionel L. Janes, Ecologist,

General Land Office.

SUMMARY REPORT.

July 14, 1914.

Submitted through
Arthur D. Kidder,
Supervisor of Surveys,
General Land Office.

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INTRODUCTION.

The ecologic survey of Ferry Lake was undertaken in pursuance of a provision contained in: THE SPECIAL INSTRUCTIONS of the Commissioner of the General Land Office dated September 27, 1913, concerning the "Reexamination and Surveys in Twn. 20 N., R. 16 W., L. M., Ferry Lake, Louisiana," to Mr. Arthur D. Kidder, Supervisor of Surveys, General Land Office.

The report covering the results of the ecologic investigation consists of five parts as follows:

(1) A detailed technical discussion.

(2) A photographic folio illustrating various ecologic features bearing on the questions at issue.

(3) A set of six Plats of six different Sample Plots selected at various places on the shores of Ferry and Clear Lakes.

(4) A number of Samples of wood taken from hardwood stumps in the water of Ferry Lake.

(5) A brief summary report dealing with the conclusions reached.

The discussion under the various headings in the Summary Report is, in most cases, only a brief extract of what appears under the same headings in the detailed discussion. Many subjects and details not mentioned in the

Summary are discussed at length in the detailed technical Report, which see.

FERRY LAKE EXAMINATION, CADDO PARISH, LOUISIANA.

Schedule of joint field work under the Commissioner's instructions "E" dated September 27, 1913, and "FS" dated November 22, 1913.

Ecology,
Lionel L. Janes, Ecologist, General Land Office,
Surveying and Mapping,
Arthur D. Kidder, Supervisor of Surveys, G. L. O.

1. Topographical survey and map of six sample plots bordering Ferry Lake, James Bayou and Clear Lake, in T. 20 N., R. 16 W., to show position and elevation of forest trees for ecological discussion.

2. Accurate projection of contour at mean high water mark of the years 1812 and 1839 (173.09 M.G.L.) marking mean margin of the overcup oak and cypress timber belts surrounding Ferry Lake, James Bayou and Clear Lake in T. 20 N., R. 16 W.

3. Accurate location and elevation of isolated forest trees furnishing special data.

4. Hydrographic survey and map showing contours in the bed of Ferry Lake, James Bayou and Clear Lake, including pre-raft drainage.

5. Maps to bring out three successive stages in the history of the Ferry Lake basin:

a. Wooded valley and stream stage.
b. Raft stage of lake, 173.09 ft., M.G.L.
c. Present lake stage, 167.00 " "

6. Topographical and ecological survey of upland areas omitted from the early official surveys.

ACKNOWLEDGMENTS.

I am under very great obligations to Mr. Arthur D. Kidder, Supervisor of Surveys, General Land Office, for the fullest possible cooperation in this work. It was necessary in collecting the proofs supporting the conclusions reached by the Ecologic investigation that many surveying operations involving the running of numerous lines of levels, the mapping of numerous Sample Plots, the location and absolute elevation of various forest trees on the shores and the stumps in the water, etc., be executed. All necessary surveys were promptly executed with accuracy and precision. Absolute proofs of the Ecologic conclusions reached could not be established without such surveys.

I am also under great obligations to Mr. Walter W. Ross, Computer and Draftsman, General Land Office. Mr. Ross acted as Plane Table Operator and Draftsman. In mapping the Ecologic data appearing upon the Plats of the six Sample Plots selected by me, his work was exceedingly painstaking and accurate, and a large part of the value of the Plats is due to his careful work.

DEFINITION OF ECOLOGY.

Ecology considers organisms in relation to their environment, and is that phase of biology that endeavors to explain the origin, variation, and role of plant and animal structures, and the origin and variation of plant and animal associations.

Plant ecology, in one aspect, known as morphological and physiological ecology, or the ecology of plant structure and behavior, considers the individual organism and its component parts as related to environment. In another aspect, plant ecology, known as physiographic ecology, considers plants en masse, as related to soil and climate. Ecology relates both the structure and behavior of plants to external conditions, paying attention chiefly to the cause and significance of environmental variations.

Forest ecology considers forest trees and forests in relation to their environment and in the main, is a science of the field, treating forest trees as they grow in nature.

DATE OF EXAMINATION.

The field work covering the Ecologic Survey of Ferry Lake commenced November 5, 1913, and continued with several intermissions until April 12, 1914.

OBJECT OF STUDY.

(1) To determine if possible by a study of the dead vegetable remains in the water, of the living vegetation on the shores of the lake, or in any other manner, the true history of Ferry Lake in Township 20 North, Range 16 West, Louisiana Meridian, extending into the past as far as is practicable.

(2) To determine if possible by a study of the living vegetation on its shores, the elevation of the mean high water surface of Ferry Lake, in Township 20 North, Range 16 West, Louisiana Meridian, in 1812 and 1839.

(3) To assemble the proofs of the conclusions reached.

METHOD OF STUDY.

A. Field Work.

(1) A preliminary examination of the territory involved.

(2) A detailed study of James Bayou, Clear, and Ferry Lakes, in Twn. 20 N., R. 16 W., L. M., their shores and the adjacent locality.

(3) The location of the mean high water mark of 1812 and 1839, on the shores of James Bayou, Clear and Ferry Lakes.

(4) A detailed ecologic study of upland areas omitted from the early official surveys in Twn 20 N., R. 16 W., L.M.

(5) Detailed study and mapping of six Sample Plots selected at different places on the shores of James Bayou, Clear and Ferry Lakes.

(6) A detailed study of numerous cross-sections taken from stumps in the water and from trees cut on the shores of James Bayou, Clear and Ferry Lakes, and in the adjacent upland forest for the purpose of obtaining growth and ecologic data.

(7) The taking of numerous photographs illustrating the ecologic conditions prevailing, etc.

B. Office Work.

(1) Microscopic studies.

(2) The preparation of the report.

LOCATION.

The portions of Ferry Lake under consideration are situated in T. 20 N., R. 16 W., L. M., Caddo Parish, Louisiana.

THE TOPOGRAPHY OF THE BASIN OF FERRY LAKE, ITS SHORES AND ADJACENT LOCALITY.

(1) Area covered by water.

Ferry Lake in T. 20 N., R. 16 W., L. M., is a shallow body of water fluctuating in depth at different seasons of

the year, occupying an old stream valley which forms a basin for the lake. It is, in fact, simply a submerged stream valley. Cypress Bayou coming in from the west, the channel of which is rather deeply cut in to the bed of the lake, meandered for many centuries through the wooded valley before the lake came into existence. James Bayou, coming down from the north, joined its waters with those of Cypress Bayou which thereafter flowed southeastward, ultimately reaching the Red River. See Photographs Nos. 1 to 8, inclusive, and Sheet No. 7, Topographic Map of Ferry Lake.

(2) Shores of the lake.

The shores of the lake are diversified, being narrow and abrupt in many places and bordered by rather steep bluffs. In other places the slope of the shore is gentle to moderate, the gradient being comparatively uniform for a considerable distance back away from the lake. See Photographs Nos. 13, 20, 24 to 37, inclusive, and Sheet No.7.

(3) The upland adjacent to Ferry Lake.

The surface of the upland adjacent to Ferry Lake is uneven, frequently irregular and usually comparatively high. It is commonly carved by lines of drainage and is occasionally covered on the more level areas with numerous natural mounds. Where it has not been cleared for farming or other purposes, it is covered with a virgin upland forest of pines, hickories, oaks, etc. See photographs Nos. 68, 69, and 70.

(4) Tributary drainage systems.

There are several small tributaries flowing into Ferry Lake draining the adjacent upland. Along the water courses of these in numerous places a forest growth characteristic of overflow lands is found. See Sheet No. 7, Topographic map of Ferry Lake.

TERRACES ON THE SHORE OF FERRY LAKE.

There are in numerous places on the shores of Ferry Lake several well defined Terraces which for convenience of discussion I have classified as follows:

(1) The Upland or highest terrace, usually not well defined but occasionally clearly demarked with a Terrace floor and prominent escarpment on the upper side. There is no evidence that it was ever owerflowed by the waters of the present Ferry Lake. Where it has not been cleared for farming purposes it is covered with a forest composed of trees characteristic of Upland Forests, such as post oak, upland hickories, etc., some of which are centuries old.

(2) The Big, higher, or upper Terrace, contiguous to and immediately below the Upland Terrace, occasionally 100 feet or more in width, in exposed situations usually marked on the lower side by a more or less ill defined escarpment approximately at 173.09 foot contour, and also,

in exposed situations usually marked by a well defined escarpment on the upper side, which is occasionally coincident with the bluffs bordering the lake. In non-exposed situations it is covered with a hardwood forest, consisting of overcup oak, willow oak, etc.

(3) The Lower, or Middle Terrace, varying in width with the shore gradient, in exposed situations commonly marked on the upper side by a more or less ill-defined escarpment approximately at the 173.09 foot contour.

In non-exposed situations this terrace is occupied by a scattered stand of cypress trees in most cases with their root systems considerably exposed by soil erosion at their bases.

(4) The Recent, or lowest Terrace, below the Lower Terrace usually not clearly defined at its upper borders except in a few places. This Terrace is relatively unimportant and will not be again referred to in this Summary.

BELTED ARRANGEMENT OF THE TIMBER ON THE SHORES AND IN THE WATER OF FERRY LAKE.

There are six such more or less parallel belts of timber as follows:

(1) A belt of cypress stumps which marks the submerged banks of the channel of Cypress Bayou through the Bed of Ferry

Lake.

In many places this belt is still well defined by stumps of cypress trees. Before being killed the trees were numerous, large, tall, straight, apparently sound, with comparatively little taper, and many of them extremely old. See Photographs Nos. 1 and 7.

(2) A belt of hardwood stumps between the submerged banks of the channel of Cypress Bayou and the shores of Ferry Lake.

Between the channel of Cypress Bayou and the shores of Ferry Lake there is a belt of numerous hardwood stumps of various species characteristic of overflow lands. These are now very much decayed, dilapidated, jagged, and worn. Many have completely rotted away, and numerous others have been broken to pieces by the waves. The stumps remaining are only remnants of the stump portions of the trees killed by the submergence which produced Ferry Lake. The top portions of thousands of these stumps can be seen projecting above the surface in times of ordinary low water, while numerous others beneath the surface do not appear at all. In many places on the lake bottom there are numerous trunks of hardwood trees which lie wholly or partially buried in the soft mud which has been deposited on the bottom since the lake came into existence. See photographs Nos. 2 to 9, inclusive, 16 and 21.

(3) A belt of young timber consisting of cypress, water locust, planer tree, button bush, willow, etc., which germinated on the beach above low water mark at low water stages in comparatively recent years.

This belt is comparatively speaking the youngest belt of timber occurring on the shores of Ferry Lake. Its character and significance is discussed on page 18 of this Summary. See photographs Nos. 9 and 40, and Plats of Sample Plots Nos. 1 to 3, inclusive.

(4) A belt now consisting chiefly of cypress timber, below the 173.09 foot contour but above the mean low water mark of the Raft Period.

This belt occupies the Lower Terrace. It formerly consisted principally of cypress, water locust, planer tree, button bush, and black willow, species ordinarily found only on areas inundated during a considerable portion of the year.

Wave action at the base of the trees, continued during a long period of years, especially in exposed situations, has bared the root systems and killed many of the trees. In some places the forest growth is now only scattering. In other situations it has been practically completely destroyed. Most of the killed cypress trees have long since fallen and been subsequently washed to higher levels. See photographs

Nos. 32, 42, and Plats of Sample Plots Nos. 2 and 3.

(5) A belt of hardwood timber, characteristic of lands regularly overflowed, situated between the 173.09 foot contour and the adjacent upland forest.

This belt occupies the Big Terrace. It consists of overcup oak, willow oak, persimmon, water hickory, cottonwood, red gum, crataegus, swamp holly, etc. These species germinated on the beach after the lake came into existence and after the hardwood forest characteristic of upland areas which formerly occupied this terrace had been killed. On many places the stand is dense and heavy, but in others, especially in exposed situations, it is thin or entirely wanting, due to severe wave action in times of high water during the Raft Period. See photographs Nos. 24, 54, 55, 58, and Plats of Sample Plots Nos. 1 to 6, inclusive.

(6) The Upland Forest.

This belt of timber is situated above the belt discussed under heading No. (5), and covers the Upland Terrace and upland adjacent to Ferry Lake. It consists of trees which are characteristic of upland areas in this locality, such as post oak, black jack oak, upland hickories, loblolly pine, shortleaf pine, white oak, Spanish oak, etc. Where it has not been cleared for farming or other purposes, the

stand is in many places dense and heavy. The forest trees occupying the Upland Terrace are descendants of other forest trees of the same species which formerly occupied this situation for centuries. See photographs Nos. 68 to 71, inclusive.

FOREST GROWTH ON THE UPLAND TERRACE AND ADJACENT UPLANDS.

The Upland forest on the Upland Terrace and adjacent upland areas is typical of the Upland Forest, occurring on Upland areas in this latitude in the lower Mississippi valley. At all elevations on the Upland Terrace the upland forest is of the same character as that on the adjacent Upland areas. That is to say, the forest on the Upland Terrace is typically an Upland forest.

Characteristics of the forest on the Upland Terrace.

The forest on the Upland Terrace possesses numerous characteristics, a few of which are here mentioned:

(1) It contains the following species:

Post oak, black jack oak, Spanish oak, white oak, upland hickory, wing elm, sassafras, pine, persimmon, red haw, swamp holly, etc.

(2) It contains numerous trees, especially oaks and hickories which are large and old.

(3) It has occupied its present position for centuries. That is to say, the forest trees now occurring are descendants of other forest trees of the same species which formerly

occupied this site.

(4) It is not now nor has it been for several centuries at least, temporarily overflowed by the waters of any Lake occupying the valley of Cypress Bayou, except possibly at the lowest levels on the Upland Terrace during the Raft Period of the present Ferry Lake, very rarely and temporarily at times of excessively high water therein, during unusual flood periods which occasionally occurred at intervals of many years.

(5) Growth analysis studies made on the stump cross-sections of a number of larger post oaks occurring indicate that the larger trees vary in age from 150 to 250 years of age, or older, etc. See Photographs Nos. 68 to 71, inclusive, and Plats of Sample Plots Nos. 3 and 6.

Significance of the forest growth on the Upland Terrace.

The particular features of the forest growth occurring on the Upland Terrace of great significance are the following:

(1) Species of trees.

(2) Size and age of the trees.

These features are of great significance because they are absolute proof that the Upland Terrace has not been regularly overflowed by the overflow waters of any permanent body of water for many centuries.

FOREST GROWTH ON THE BIG TERRACE.

Species occurring on the Big Terrace are in general

those ordinarily found on lands subject to regular inundation in this latitude in the lower Mississippi valley.

Characteristics of the forest on the Big Terrace.

The forest on the Big Terrace possesses numerous characteristics, a few of which are here mentioned:

(1) It contains the following species: Overcup oak, willow oak, water hickory, red gum, green haw, swamp holly, persimmon, etc.

(2) It consists of but relatively few species of hardwoods together with cypress and young pine.

(3) It contains numerous overcup and willow oaks which, though large, are comparatively young.

(4) It occupies the site of the hardwood forest characteristic of Upland areas which formerly occupied this Terrace, and, with the exception of the large living post oaks still standing on the upper part of the Big Terrace, the left overs of the former upland forest, it has germinated since Ferry Lake came into existence.

(5) The forest on the Big Terrace does not contain either large living cypress trees or the remains of large dead cypress trees, standing or down, which are several centuries old, or which germinated on the Big Terrace at any time before Ferry Lake came into existence.

(6) It contains at lower levels, above the 173.09 foot contour scattering cypress trees which are normally comparatively tall, relatively of small diameter, with com-

The age of the older trees is of especial significance because they germinated after Ferry Lake came into existence.

FOREST GROWTH ON THE LOWER TERRACE.

The species of trees occurring on the Lower Terrace are, in general, those ordinarily found on lands subject to inundation during a considerable portion of the year in this latitude in the lower Mississippi Valley.

Characteristics of the forest on the Lower Terrace.

(1) It contains the following species:

Bald cypress, water locust, planer tree, swamp privet, button bush, and black willow.

(2) It contains numerous large cypress trees which are comparatively short, apparently stunted, greatly enlarged at base, exhibit considerable taper, commonly dead topped, usually hollow butted, decrepit, etc. That is to say, the form and condition of the stems indicate that the trees have grown under unfavorable site conditions.

(3) It contains numerous standing cypress trees, many of which are now dead and dying, with their root systems almost or entirely exposed by soil erosion at their bases, due to wave action during the Raft Period and since.

(4) It is situated on the site of a hardwood forest which occupied this territory before Ferry Lake came into

existence.

(5) It is comparatively young, the oldest trees having germinated since Ferry Lake came into existence.

(6) Growth analysis studies made on the stump cross-sections of a number of larger and older trees indicate in general that the older trees vary from 90 to 120 years of age or a few years older, etc. See photographs Nos. 11, 17, 21, 29, 30, 32, 42, and Plats of Sample Plots Nos. 2 and 3.

Significance of the older forest growth now found on the Lower Terrace.

Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Ferry Lake, the older forest growth now found on the Lower Terrace germinated after Ferry Lake came into existence. The age of the older trees is, therefore, of great significance.

BELT OF YOUNG TIMBER ON THE LOWER LEVELS OF THE LOWER TERRACE ABOVE THE MEAN LOW WATER MARK OF RECENT YEARS.

Characteristics of this belt of young timber.

(1) It contains the following species:

Bald cypress, water locust, planer tree, swamp privet, black willow, and button bush. That is to say, it consists of cypress and a few hardwoods.

(2) It is situated on the site of the hardwood forest

which formerly occupied this Terrace before Ferry Lake came into existence.

(3) It is, comparatively speaking, the youngest belt of timber occurring on the shores of Ferry Lake, having germinated thereon since drainage conditions became better on the Lower Terrace during the last half century.

(4) The young trees occurring average between 20 and 40 years of age, etc.

See photographs 9, 15 to 21, inclusive, and 40, and Plats of Sample Plots Nos. 1 to 3, inclusive, and 6.

Significance of the belt of young timber on the lower levels of the lower terrace above low water mark of recent years.

The stand of young timber on the lower levels of the Lower Terrace is typical in many ways of the stand of young timber which germinated on the Lower Terrace soon after Ferry Lake came into existence when it was as old as the stand under consideration. Exclusive of the territory in the valleys of the tributaries flowing into Ferry Lake, however, the trees ordinarily have made less diameter and height growth in the same number of years, because, while water conditions were suitable, soil conditions were generally unfavorable, in that the trees germinated and grew usually in a hard clay soil containing little humus unsuitable to rapid diameter and height growth.

The final complete removal of the Great Raft in the Red River a little less than half a century ago caused better drainage conditions to prevail and the belt of timber under consideration soon germinated thereon, water conditions being suitable and tree seed of species characteristic of lands inundated for a considerable portion of the year being present.

The average age of the older young timber in this belt is, therefore, of great significance.

BELT OF HARDWOOD STUMPS BETWEEN THE SUBMERGED BANKS OF THE CHANNEL OF CYPRESS BAYOU AND THE SHORES OF FERRY LAKE.

This belt of hardwood stumps is absolutely unique and presents a most remarkable spectacle. It extends from the submerged banks of Cypress Bayou to the shores of Ferry Lake. The stumps are the remains of a magnificent mixed hardwood forest which covered the valley of Cypress Bayou before Ferry Lake came into existence. The stump portions of the trees are smaller than they were at the time the trees were killed because portions have decayed and have been broken off by the waves. Stumps and snags of the more durable species are now most commonly met with. The stumps of species less durable have practically disappeared. Indeed,

very many stumps everywhere have either completely rotted, or have been broken to pieces by the waves and totally destroyed. See photographs Nos. 2 to 6, inclusive.

ORIGIN AND SUBSEQUENT HISTORY OF THE BELT OF OLD STUMPS BETWEEN THE SUBMERGED BANKS OF CYPRESS BAYOU AND THE SHORES OF FERRY LAKE.

The old stumps in this belt are only the remains of a magnificent virgin, mixed, hardwood forest, which formerly occupied the valley of Cypress Bayou, now the bed of Ferry Lake. When the valley was submerged the forest trees were alive and the stump portions were covered with bark and were larger than they now are. The dead trees were formerly very numerous. The several stages in the origin of the old stumps, snags, and stems now found in the water may be stated as follows:

(1) Dense Living Forest of Mixed Hardwood Trees and Cypress before submergence.

The forest before submergence is discussed under the heading, "The Forest Occupying the Valley of Cypress Bayou, now the Bed of Ferry Lake, When the Lake Came into Existence."

(2) Living Forest Trees in the Water After Submergence.

The hardwood trees remained alive one or two years after the submergence, the valley of Cypress Bayou during

this time being simply a flocded forest of living trees. The trees finally all died, however, being in reality actually drowned to death. A number of cypress trees, however, were not killed by the submergence, some of them surviving even to the present time.

(3) Dead Standing Trees in the Water, Which Remained Standing a Few Years Before Decay was Noticeable.

For a few years after the trees were killed they stood with their bases in the water, leafless and bare, before they commenced to materially decay. The valley of Cypress Bayou during this time was in reality simply a flooded forest of standing dead trees.

(4) State of Progressive Decay and Deterioration Continuing to the Present Time.

A few years after the trees were killed, spores of saprophytic fungi borne by the wind soon germinated in the tissues of the dead wood and since then, the killed timber has been in a state of progressive decay. As the years passed wood rotting fungi have been constantly at work in the dead tree stems projecting out of the water, and the waves have been constantly at work wearing away and breaking to pieces the tissues of the wood, until at the present time many stumps and stems have completely rotted, and others have been broken to pieces by the waves. The stems

remaining are only scattered remnants of the stump and stem portions of the trees killed by submergence.

For many years after the floor of the wooded valley of Cypress Bayou was submerged, the valley itself, except in Cypress Bayou proper, was simply a flooded woods differing from the valley before submergence only in the following particulars.

(1) The standing hardwood trees were dead.

(2) The bases of the trees were submerged in water which fluctuated in depth during different seasons of the year.

CHARACTERISTICS OF THE BELT OF STUMPS BETWEEN THE SUBMERGED BANKS OF CYPRESS BAYOU AND THE SHORES OF FERRY LAKE.

This belt of stumps possesses numerous characteristics, among which are the following:

(1) It consists of scattered cypress and numerous hardwood stumps of species characteristic of lands regularly overflowed; overcup oak, willow oak, red gum, water hickory, persimmon, cottonwood, hackberry, elm, mulberry, ash, etc.

(2) The stumps vary in size from small to large.

(3) The stumps are ordinarily jagged, dilapidated, decayed, and worn down in many instances to low water level.

(4) In many places the hardwood stumps are still very numerous, indicating the density of the hardwood forest formerly occupying the site.

(5) Normally, only the upper portions of the stumps project above the water surface. In times of occasionally temporary excessively high water practically all the hardwood stumps are covered. In times of low water the tops of thousands of hardwood stumps may be seen projecting from one to three feet or more above the water surface.

(6) There are thousands of stumps beneath the surface, which normally do not project above the water.

(7) There are numerous prostrate trees and snags which lie partly or wholly buried in the soft mud, which covers the bottom of the lake. See photograph No. 9.

(8) The stumps are in a state of progressive decay and this, together with wave action, will ultimately result in their complete destruction.

(9) The stumps are only remnants of the stump and stem portions of the hardwood trees killed by submergence.

(10) An examination of the wood tissues of many old stumps indicate that the rate of growth more especially at higher levels was comparatively slow during the life time of the trees.

(11) Since the time when navigation on Ferry Lake has

been possible, the stumps and prostrate portions of trees in the water have always been a dangerous menace and in times of low water have practically prevented navigation, except for small light draft boats elsewhere than in the channel of Cypress Bayou.

See photographs Nos. 2 to 9, inclusive.

THE BELT OF CYPRESS STUMPS WHICH MARKS THE CHANNEL OF CYPRESS BAYOU THROUGH FERRY LAKE.

This belt of stumps, also discussed on page 13 of the detailed technical discussion, represents only remnants of the dead trees which were killed by submergence. Before submergence the living cypress Forest covering the Banks of Cypress Bayou consisted of large trees of comparatively great age.

Site conditions were good for the growth of the species and they therefore grew to be large, tall, and old. The trees stood close together, not only along the banks but also in a narrow belt on the sides of the channel below the Banks, down to an elevation of 154 feet or lower.

Most of the cypress trees growing along the channel were killed by submergence, or enduring the unfavorable site conditions for a few years finally succumbed. A few trees have, however, survived even to the present time. Growth

analysis studies made upon the stump cross-sections of several of the old dead cypress trees in the water show that the older trees varied from 150 to 400 years of age or over, when killed. These older trees germinated on the ground during the long wooded valley period preceding the existence of Ferry Lake.

THE LIVING FOREST OCCUPYING THE VALLEY OF CYPRESS BAYOU, NOW THE BED OF FERRY LAKE, WHEN THE LAKE CAME INTO EXISTENCE.

The living forest occupying the valley of Cypress Bayou at the time Ferry Lake came into existence was at lower levels adjacent to the bayou and elsewhere, composed of species characteristic of lands inundated for a considerable portion of the year. At higher levels, mostly above the 158 foot contour, it was composed of species characteristic of lands regularly overflowed, such as are now found on the Big Terrace. In fact, the forest now found on the forested portions of the Big Terrace as on Sample Plot Nos. 2, 3, and 6, is typical and representative in many ways of the forest growth as it existed over the greater part of the valley of Cypress Bayou before submergence.

CHARACTERISTICS OF THE LIVING FOREST OCCUPYING THE VALLEY OF CYPRESS BAYOU WHEN FERRY LAKE CAME INTO EXISTENCE.

The living forest occupying the valley of Cypress Bayou when Ferry Lake came into existence possessed numerous characteristics among which were the following:

(1) At lower levels mostly below the 158 foot contour and between this contour and the banks of Cypress Bayou a forest characteristic of lands inundated for a considerable portion of the year, consisting of cypress, planer tree, water locust, willow, and button bush was found.

Above the 158 foot contour and at higher levels a forest characteristic of lands regularly overflowed consisting of overcup oak, willow oak, red gum, water hickory, persimmon, cottonwood, hackberry, white elm, mulberry, white ash, crataegus, swamp holly, etc., was found.

At still higher levels species characteristic of the Upland Forest, such as loblolly pine, post oak, etc., was found.

That is to say, the forest consisted of numerous species and was, therefore, complex in character.

(2) The hardwood forest consisted of a dense stand of trees of various sizes from small trees up to trees which were from 24 to 30 inches in diameter or larger.

(3) The hardwood trees were of various ages ranging from young seedlings up to 240 years of age or older.

(4) The individual trees of this hardwood forest were the descendants of species of trees occupying this valley before the forest under consideration germinated.

(5) At lower and intermediate levels it was more or

paratively little swell at base, of slow growth, ordinarily not over 120 years of age, and which germinated after Ferry Lake came into existence.

(7) Growth analysis studies made on the stump cross-sections of a number of larger and older trees occurring on the Big Terrace indicate in general that the older hardwood trees vary from 90 to 120 years of age or a few years older. See photographs Nos. 24, 54, 55, 57, 58, and Plats of Sample Plots Nos. 1 to 6, inclusive.

Significance of the forest growth now found on the Big Terrace.

Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Ferry Lake, the forest characteristic of lands regularly overflowed now found on the Big Terrace is very similar to that which occupied the valley of Cypress Bayou before Ferry Lake came into existence.

The following features of the forest characteristic of lands regularly overflowed on the Big Terrace are of great significance:

(1) Species of trees.

(2) Size of trees.

(3) Density of stand.

(4) Age of trees.

less regularly overflowed by the overflow waters of Cypress Bayou.

(6) It was a magnificent, virgin, primaeval forest up to the time of the submergence which produced its death.

(7) It had occupied its position for many centuries before Ferry Lake came into existence.

AGE OF THE OLDER LIVING HARDWOOD TREES OCCUPYING THE VALLEY OF CYPRESS BAYOU, NOW THE BED OF THE LAKE, WHEN THE LAKE CAME INTO EXISTENCE.

The age of the older hardwood trees above referred to is obtained by growth analysis studies of the old stumps now found in the water.

Growth analysis studies were made of cross-sections and remnants of cross-sections of many of the old hardwood stumps in the water. The rate of growth varies with the species, elevation of ground surface, degree of crowding in the forest, etc. The age varies with the rate of growth, the size of the tree, etc.

The hardwood stump representing the oldest tree found by me exhibited approximately 240 annual rings of growth at a stump height of 6.5 feet. This was an oak stump, 24 inches in diameter, elevation of hard ground surface at base of tree 167.5 feet. Doubtless there are many larger hardwood

stumps in the lake which represent older trees.

Many of the larger hardwood trees killed by submergence were from 150 to 240 years of age or older when killed. Many stumps are now in such an advanced stage of decay that accurate growth analysis thereof is impossible.

CONDITION OF FERRY LAKE IN 1812.

In 1812 Ferry Lake had been in existence approximately a little more than 30 years.

At this time the submerged valley of Cypress Bayou presented a most remarkable spectacle. There was presented to view a standing forest of great extent consisting of dead trees in a progressive state of decay, with their bases submerged in water. These standing dead trees may be classified as follows:

(1) Large standing dead cypress trees marking the submerged Banks of the channels of Cypress Bayou and its tributaries through the bed of Ferry Lake.

(2) A number of living cypress trees in various parts of the Lake especially along the banks of the submerged channels of the tributaries flowing into Cypress Bayou, and in some instances extending for considerable distances back away from the tributary channels. Many cypress trees were not killed outright by the submergence which produced Ferry

Lake, but continued to live on a number of years before finally succumbing to the unfavorable environment.

(3) A dense forest of dead standing hardwood trees, considerably decayed, from which most of the branches had fallen.

In most cases the entire tree trunks of both cypress and hardwoods, especially of larger trees of the more durable species, were standing in 1812, although many of them were in an advanced state of decay.

When the wooded valley traversed by Cypress Bayou became flooded the drowned forest was given the name of Ferry Lake.

DATE OF THE SUBMERGENCE WHICH PRODUCED FERRY LAKE.

The date of the origin of Ferry Lake may be stated approximately as being in the decade between 1770 and 1780, with the probability that its origin dates between 1775 and 1780. See the detailed technical discussion page 115 for proofs.

The approximate age of the lake may also be ascertained by tradition and by historical and geological evidence, all of which are fully discussed in the report of Mr. Leverett, the Geologist assigned to the case.

ELEVATION OF THE MEAN HIGH WATER SURFACE OF FERRY LAKE IN 1839.

The "Manual of Instructions for the Survey of Public Lands of the United States" issued January 1, 1902, reads as follows: Page 62, Section 154, "Lands bounded by waters are to be meandered at mean high water mark. This term has been defined in a state decision (47 Iowa, 370), in substance as follows:

"High water mark in the Mississippi River is to be determined from the river bed and that only is river bed which the river occupies long enough to wrest it from vegetation."

Again, at page 64, Section 168, "Meander lines will not be established at the segregation line between dry and swamp or overflowed land, but at the ordinary high water mark of the actual margin of the river, or lakes, on which such swamp or overflowed lands border."

The elevation of the mean high water surface of Ferry Lake in 1839 was approximately at the 173.09 foot contour, mean Gulf level at Biloxi, Mississippi. For proofs see the detailed technical discussion page 117. See photographs Nos. 24, 25, and 27 to 38, inclusive, and Sheet No. 7, Topographic Map of Ferry Lake, and discussion of this subject by Mr. Kidder.

The elevation of the mean high water surface of Ferry Lake in 1812 was also at the 173.09 foot contour.

UPLAND AREAS OMITTED FROM THE EARLY OFFICIAL SURVEYS.

The upland areas omitted from the early official surveys are, in general, similar to the surveyed upland areas adjacent to Ferry Lake.

The unsurveyed areas may be classified as follows:

(1) Portions of the Big Terrace above the 173.09 foot contour. The Big Terrace above the 173.09 foot contour was, during the Taft Period, above the mean high water mark of the water of Ferry Lake. Its upland character has been fully discussed on pages 20 to 23 inclusive, and pages 38 to 60 inclusive of the detailed technical report. In 1839, in non-exposed places, it was covered with a young hardwood forest of overcup oak, willow oak, water hickory, red gum, etc. See photographs Nos. 24 to 27, 29 to 34, 37, 38, 45, 47 to 51, and 56 to 67.

(2) Upland areas above the Big Terrace, including portions of the Upland Terrace and adjacent uplands.

The unsurveyed upland areas are shown on sheet No. 7, Topographic Map of Ferry Lake. Where they have not been cleared for farming or other purposes, they are covered with a heavy forest, consisting of trees of numerous species

common to upland areas, such as post oak, black jack oak, Spanish oak, upland hickories, pine, etc. The forest growth on these areas differs in no essential way from the forest growth on other upland areas adjacent to Ferry Lake. See discussion of the upland forest on pages 23 to 25 inclusive and pages 27 to 38 inclusive of the detailed technical report.

Many of the larger and older hardwood trees on the unsurveyed upland areas above the Big Terrace are from 150 to 250 years of age or older. The trees occurring are descendants of other hardwood trees of the same species which formerly occupied this site. There is every indication ecologically that these upland areas have not been covered by a permanent body of water for many centuries.

See the discussion of the above areas by Mr. Kidder.

SAMPLE PLOTS.

Six Sample Plots were selected by the present writer on the shores of Ferry and Clear Lakes, in Twn. 20 N., R. 16 W., L. M. These Sample Plots were accurately mapped and the topographic and ecologic features of interest occurring graphically represented on the large sized Plats.

The Plats of the Sample Plots exhibit the parallel belting of the timber on the shores of Ferry Lake, the relative position and elevation of the parallel belts and individual trees composing them, etc. In connection with the photo-descriptive section of the Report, and the detailed technical discussion, the Plats are of great value in interpreting the topographic and ecologic features occurring on the shores and in the water of Ferry Lake.

Much time and effort was expended in making the Plats complete and accurate in every detail, which it was desired to illustrate. The numbers in connection with the symbols representing the different species of trees on the Sample Plots are used for convenience of reference only. The data of ecologic interest in connection with each tree occurring may be found in the discussion opposite the various tree numbers on pages 151 to 174, inclusive, of the detailed technical report.

See Plats of Sample Plots No. 1 to 6, inclusive.

PLATS OF THE SAMPLE PLOTS.

The Plats of the Sample Plots exhibit, among other things:

1. Unsurveyed land on the shores of Ferry Lake.
2. The general character of shore.
3. Elevation and gradient of the shore terraces where the Sample Plots were taken.
4. Escarpment on the lower and upper sides of the Big Terrace.
5. The position of the mean high water marks of 1812, 1839, and 1913.
6. Species of trees growing on the shore terraces.
7. Plant associations on the shore terraces and contiguous uplands.
8. Position and elevation of the individual trees of the various species on the Sample Plots.
9. Overlapping of the overcup oak and cypress belts at the 173.09 foot contour, which marks the mean high water position of 1839 and 1812.
10. Drift cypress trees at various levels on the Big Terrace.
11. Position and elevation of old stumps in the water on the lower portions of the Sample Plots.
12. The absence of overcup oak, cypress, etc., species characteristic of lands regularly overflowed or inundated for a considerable portion of the year on the Upland Terrace, and in the Upland Forest.
13. The absence of bald cypress, a species characteristic of lands inundated for a considerable portion of the year, on the upper part of the Big Terrace.
14. The absence of large hardwood trees of species common to lands regularly overflowed on the upper part of the Lower Terrace.

15. Position of lines of drift material on the Big Terrace which indicate temporary high water marks.

16. Parallel belting of the timber on the shores and in the water.

17. Example of high grade and unusually excellent graphic representation.

18. An original graphic representation of Ecologic data.

See Plats of Sample Plots Nos. 1 to 6, inclusive.

THE CAUSE OF THE SUBMERGENCE WHICH PRODUCED FERRY LAKE.

Mr. Leverett, the Geologist assigned to this case, has determined that the submergence which produced Ferry Lake was caused by what is known as the Great Raft in the Red River. See the report of Mr. Leverett.

DURATION OF THE GREAT RAFT IN THE RED RIVER.

For the discussion of this topic, see the detailed Report page 149.

THE LONG WOODED-VALLEY PERIOD OF CYPRESS BAYOU ANTEDATING FERRY LAKE.

The long wooded-valley period antedating Ferry Lake lasted many centuries. The proof of this proposition is as follows:

(1) The larger living hardwood trees which were killed by the submergence which produced Ferry Lake, varied in age up to 240 years or older, and were the descendants of other hardwood forest trees which formerly occupied the same situations. These hardwood trees germinated on the ground and grew to maturity during the wooded-valley period. None of the hardwood trees growing in the valley of Cypress Bayou before the submergence which produced the lake, can germinate, grow, and develop into trees in a permanent body of water.

(2) The larger cypress trees along the channel of Cypress Bayou, which were killed by the submergence which produced the lake, varied in age up to 400 years or older. These trees germinated on the ground during the long wooded-valley period antedating Ferry Lake.

(3) The channel of Cypress Bayou is rather deeply cut into the bed of the lake and in some places has developed ox-bow loops and cut-offs. To develop this channel system has required a very long period of time, many centuries at least. See sheet No. 7, Topographic Map of Ferry Lake.

(4) Under the heading "UNTENABLE THEORIES," page 121, of the detailed technical report, it is shown that no permanent body of water, antedating the present Ferry Lake has occupied the valley of Cypress Bayou for many centuries.

Respectfully submitted

Lionel L. James,

Ecologist,

General Land Office.

MAIN REPORT

EXAMINATION OF FERRY LAKE, CADDO PARISH, LOUISIANA,

Township 20 North, Range 16 West, Louisiana Meridian.

AN ECOLOGIC SURVEY

In Pursuance of Instructions of the Commissioner of the

General Land Office

under date of September 27, 1913,

by

Lionel L. Janes, Ecologist,

General Land Office,

July 14, 1914.

Submitted through
Arthur D. Kidder,
Supervisor of Surveys,
General Land Office.

INTRODUCTION.

THE SPECIAL INSTRUCTIONS of the Commissioner of the General Land Office, dated September 27, 1913, concerning the "Reexamination and Surveys in Twn. 20 N., R. 16 W., Louisiana Meridian, Ferry Lake, Louisiana," to Mr. Arthur D. Kidder, Supervisor of Surveys, General Land Office, provide among other things, for "An exhaustive investigation of such evidence as may now exist bearing upon the locus of the lake in 1812 and 1839, and carefully consider and report upon all evidence of geological, topographical, or hydrographical character, physical conditions respecting timber growth, past and present, within and without the surveyed meander line, including the testimony of persons long acquainted with the locality, to the end that every ascertainable fact may be reported to the Secretary of the Interior upon which may be based his answers to the questions:

(1) Did Ferry Lake exist as a navigable body of water in the year 1812, when Louisiana was admitted into the Union?

(2) Did Warren's survey correctly meander Ferry Lake as it existed at the date of the admission of Louisiana into the Union?"

The Ecologic Survey of Ferry Lake was undertaken in pursuance of instructions contained in the above letter.

The report covering the results of the Ecologic investigation consists of five parts as follows:

(1) A complete detailed technical discussion.

(2) Photographic folio illustrating various Ecologic features bearing upon the questions at issue.

(3) A set of six Plats of six different Sample Plots selected at various places on the shores of Ferry and Clear Lakes.

(4) A number of samples of wood taken from hardwood stumps in the water of Ferry Lake.

(5) A brief summary report dealing with the conclusions reached.

FERRY LAKE EXAMINATION, CADDO PARISH, LOUISIANA.

Schedule of joint field work under the Commissioner's instructions "E" dated Sept. 27, 1913, and "FS" dated Nov. 22, 1913.

Ecology,
Lionel L. Janes, Ecologist, General Land Office,
Surveying and Mapping,
Arthur D. Kidder, Supervisor of Surveys, G. L. O.

1. Topographical survey and map of six sample plots bordering Ferry Lake, James Bayou and Clear Lake, in T. 20 N., R. 16 W., to show position and elevation of forest trees for ecological discussion.

2. Accurate projection of contour at mean high water mark of the years 1812 and 1839 (173.09 M.G.L.) marking mean margin of the overcup oak and cypress timber belts surrounding Ferry Lake, James Bayou and Clear Lake in T. 20 N., R. 16 W.

3. Accurate location and elevation of isolated forest trees furnishing special data.

4. Hydrographic survey and map showing contours in the bed of Ferry Lake, James Bayou and Clear Lake, including pre-raft drainage.

5. Maps to bring out three successive stages in the history of the Ferry Lake basin:

a. Wooded valley and stream stage.
b. Raft stage of lake, 173.09 ft., M.G.L.
c. Present lake stage, 167.00 " "

6. Topographical and ecological survey of upland areas omitted from the early official surveys.

ACKNOWLEDGMENTS.

I am under very great obligations to Mr. Arthur D. Kidder, Supervisor of Surveys, General Land Office, for the fullest possible cooperation in this work. It was necessary in collecting the proofs supporting the conclusions reached by the Ecologic investigation that many surveying operations involving the running of numerous lines of levels, the mapping of numerous Sample Plots, the location and absolute elevation of various forest trees on the shores and the stumps in the water, etc., be executed. All necessary surveys were promptly executed with accuracy and precision. Absolute proofs of the Ecologic conclusions reached could not be established without such surveys.

I am also under great obligations to Mr. Walter N. Ross, Computer and Draftsman, General Land Office. Mr. Ross acted as Plane Table Operator and Draftsman. In mapping the Ecologic data appearing upon the Plats of the six Sample Plots selected by me, his work was exceedingly painstaking and accurate, and a large part of the value of the Plats is due to his careful work.

DEFINITION OF ECOLOGY.

Ecology considers organisms in relation to their environment, and is that phase of biology that endeavors to explain the origin, variation, and role of plant and animal structures, and the origin and variation of plant and animal associations.

Plant ecology, in one aspect, known as morphological and physiological ecology, or the ecology of plant structure and behavior, considers the individual organism and its component parts as related to environment. In another aspect, plant ecology, known as physiographic ecology, considers plants en masse, as related to soil and climate. Ecology relates both the structure and behavior of plants to external conditions, paying attention chiefly to the cause and significance of environmental variations.

Forest ecology considers forest trees and forests in relation to their environment and in the main, is a science of the field, treating forest trees as they grow in nature.

DATE OF EXAMINATION.

The field work covering the Ecologic Survey of Ferry Lake commenced November 5, 1913, and continued with several intermissions until April 12, 1914.

OBJECT OF STUDY.

(1) To determine if possible by a study of the dead vegetable remains in the water, of the living vegetation on the shores of the lake, or in any other manner, the true history of Ferry Lake in Township 20 North, Range 16 West, Louisiana Meridian, extending into the past as far as is practicable.

(2) To determine if possible by a study of the living vegetation on its shores, the elevation of the mean high water surface of Ferry Lake, in Township 20 North, Range 16 West, Louisiana Meridian, in 1812 and 1839.

(3) To assemble the proofs of the conclusions reached.

METHOD OF STUDY.

A. Field Work.

(1) A preliminary reconnaissance of James Bayou, Clear, and Ferry Lakes, in Township 20 North, Range 16 West, Louisiana Meridian, their shores, and the adjacent locality.

(2) A detailed study of James Bayou, Clear, and Ferry Lakes, in Township 20 North, Range 16 West, Louisiana Meridian, their shores, the adjacent upland locality, the forest growth thereon, the stumps in the water, etc.

(3) The location of the mean high-water mark of 1812 and 1839 on the shores of James Bayou, Clear, and Ferry Lakes, in Township 20 North, Range 16 West, Louisiana Meridian, and the collection of data to establish position of same.

(4) Detailed ecologic studies of upland areas omitted from the early official surveys in Township 20 North, Range 16 West, Louisiana Meridian.

(5) A detailed study and mapping of six Sample Plots. selected at different places on the shores of James Bayou, Clear, and Ferry Lakes, in Township 20 North, Range 16 West, Louisiana Meridian, for the purpose of obtaining ecologic data.

(6) The cutting of living cypress trees in the water, of numerous trees of various species on the Sample Plots, elsewhere on the shores of James Bayou, Clear, and Ferry Lakes, and on the adjacent upland, for the purpose of obtaining growth and ecologic data.

(7) A detailed examination and study of cypress stumps on the submerged banks of Cypress Bayou, of numerous hardwood and cypress stumps elsewhere in the bed of the lake, the taking of numerous soundings at the base of the stumps to obtain depth data, etc.

(8) The detailed study of numerous cross-sections taken from stumps in the water, and of trees cut on

the shores of James Bayou, Clear, and Ferry Lakes, and in the adjacent upland forest, for the purpose of obtaining growth and ecologic data.

(9) The taking of numerous photographs illustrating the ecologic conditions prevailing in the water, on the Sample Plots, elsewhere on the shores of the bodies of water previously mentioned, and on the adjacent upland.

B. Office work.

(1) Microscopic studies.

(2) The preparation of the report.

LOCATION.

The portions of Ferry Lake and James Bayou under consideration are situated in sections 4, 5, 8, 9, sections 10 to 17 inclusive, and sections 20 to 32 inclusive, Township 20 North, Range 16 West, Louisiana Meridian, Caddo Parish, Louisiana, and cover approximately acres.

A considerable portion of Ferry Lake is situated in the State of Texas and a considerable area located in Township 20 North, Range 15 West, Louisiana Meridian, was officially surveyed years ago under the authority of the General Land Office of the Federal Department of the Interior and the title thereto subsequently alienated from the United States Government.

THE TOPOGRAPHY OF THE BASIN OF PERRY LAKE, ITS SHORES, AND ADJACENT LOCALITY.

(1) Area Covered by Water.

Perry Lake in Township 20 North, Range 16 West, Louisiana Meridian, is a shallow body of water fluctuating in depth at different seasons of the year, occupying an old stream valley which forms a basin for the lake. It is, in fact, simply a submerged stream valley. Cypress Bayou coming in from the west, the channel of which is rather deeply cut into the bed of the lake, meandered for many centuries through the valley, before the lake came into existence. James Bayou, coming down from the north, joined its waters with those of Cypress Bayou which thereafter flowed southeastward, ultimately reaching the Red River.

The floor of the valley, now the bed of the lake, has in most places a slope which is comparatively even, regular and uniform. The regularity of this slope is broken by remains of old channels of Cypress and James Bayou, channels of small tributaries which formerly flowed into these Bayous and by small deltas built at the present mouths of these tributaries. These small deltas doubtless cover alluvial deposits laid down before the submergence which produced the lake. See

sheet No. 7, Topographic Map of Ferry Lake in Twn. 20 N., R. 16 W., L. M.

(2) Shores of the Lake.

The shores of the lake are diversified, being narrow and abrupt in many places and bordered by rather steep bluffs. In other places the slope of the shore is gentle to moderate, the gradient being comparatively uniform for a considerable distance back away from the lake. See sheet No. 7, Plats of Sample Plots Nos. 1 to 6 inclusive, and Photographs Nos. 11, 15, 20, 23, to 40, inclusive, 42, and 43.

(3) Upland Adjacent to Ferry Lake.

The surface of the upland adjacent to Ferry Lake is uneven, frequently irregular, and usually comparatively high. It is commonly carved by lines of drainage and is occasionally covered on the more level areas with numerous natural mounds. Where it has not been cleared for farming or other purposes it is covered with a virgin upland forest of pines, hickories, oaks, etc. See Plats of Sample Plots Nos. 3 to 6 and Photographs Nos. 33, 68, 69, and 70.

(4) Tributary Drainage Systems.

There are several small tributaries flowing into Ferry Lake, draining the adjacent upland. Along the water courses of these, in numerous places, forest

growth characteristic of overflow lands is found. See sheet No. 7, Topographic Map of Ferry Lake, in Twn. 20 N., R. 16 W., L. M.

TERRACES ON THE SHORE OF FERRY LAKE.

There are in numerous places on the shores of Ferry Lake, several well defined terraces which, for convenience of discussion, I have classified as follows:

(1) The UPLAND or Highest Terrace, hereafter in this discussion designated the Upland Terrace, usually not well defined but occasionally clearly demarked with a terrace floor and prominent escarpment on the upper side. This terrace is prehistoric and is, comparatively speaking, extremely old. There is no evidence that it was ever overflowed by the waters of the present Ferry Lake. Where it has not been cleared for farming purposes, it is covered with an upland forest composed of trees characteristic of upland areas, some of which are centuries old.

(2) The BIG, Higher, or Upper Terrace, hereafter in this discussion designated the Big Terrace, occasionally one hundred feet or more in width, ordinarily but not everywhere marked on the lower side by an escarpment approximately at the 173.09 foot contour, and also

usually but not everywhere marked by a well defined escarpment on the upper side ... which in exposed situations is occasionally coincident with the bluffs bordering the lake. This terrace was regularly overflowed at times of high water during the Raft Period and, where not deforested by a wave action, supports in general a growth of hardwood forest trees characteristic of overflow lands. See Plats of Sample Plots Nos. 1 to 6 inclusive, and photographs Nos. 53 to 57, etc.

(3) The LOWER or Middle Terrace, hereafter in this discussion designated the Lower Terrace, varying in width with the shore gradient, usually but not everywhere marked on the upper side by an escarpment approximately at the 173.09 foot contour, but usually not clearly demarked by an escarpment at its lower edge. This terrace was formerly covered principally with cypress trees, which germinated at low water stages during the Raft Period, and, where not deforested by wave action, still supports such growth. This cypress originally formed a belt of timber surrounding the lake, occupying a position above the low water mark during the Raft Period, and below the 173.09 foot contour. The removal of obstructions in the Red River, approximately a half century ago brought about a recession of the waters of Ferry Lake and caused

better drainage conditions to prevail on this terrace. For this reason a few hardwood species characteristic of lands regularly overflowed are commencing to appear at higher levels. See Plats of Sample Plots 1 to 6 inclusive, and photographs Nos. 32, 42, 43, etc.

(4) The RECENT or Lowest Terrace, below the Lower Terrace, usually not clearly defined at its upper borders except in a few places. Cypress and planer tree seedlings are coming in between the low water mark of recent years and the upper border of this terrace. This terrace is comparatively speaking of little importance and will not be again referred to in this discussion.

BELTED ARRANGEMENT OF THE TIMBER ON THE SHORES AND IN THE WATER OF FERRY LAKE.

There are six such more or less parallel belts of timber as follows:

(1) A belt of cypress stumps which marks the submerged banks of the channel of Cypress Bayou through the bed of Ferry Lake.

This belt is clearly defined by stumps of cypress trees. Before being killed these were numerous, large, tall, straight, apparently sound, with comparatively

little taper, and, many of them, extremely old. The stumps exhibit every indication of having grown under favorable site conditions. The Bayou was appropriately named, its shores being covered with an unusually dense stand of large cypress timber. At lower levels and in depressions in the bed of the lake other areas of large cypress stumps may still be seen. Occasionally cypress stumps occur as isolated individuals among groups of hardwood stumps. This is what should be expected on overflow areas, covered with species characteristic of overflow lands. Many cypress stumps formerly found along the channel of Cypress Bayou and elsewhere have completely decayed and disappeared. Many had been cut off and others completely removed in years past in order to vacilitate navigation. The stumps remaining are only remnants of the magnificent forest growth which formerly covered the banks of the bayou, and which was killed by the submergence which produced Perry Lake. See photograph No.

(2) A Belt of hardwood stumps between the submerged banks of the channel of Cypress Bayou and the shores of Perry Lake.

Between the channel of Cypress Bayou and the shores of Perry Lake, there is a belt of numerous hardwood

stumps, of various species characteristic of overflow lands. These are now very much decayed, dilapidated, jagged, and worn. Many have completely rotted away and numerous others have been broken to pieces by the waves. The stumps remaining are only remnants of the stems and stump portions of the trees killed by the submergence which produced Ferry Lake.

The top portions of thousands of these stumps can be seen projecting above the surface in times of ordinary low water, while numerous others beneath the surface do not appear at all. In many places in the lake bottom there are numerous stems of hardwood trees lying wholly or partially buried in the soft mud which has been deposited on the bottom since the lake came into existence.

The belt of hardwood stumps extends to the lower edge of the belt of cypress timber, which germinated on the beach at low water stages during the Raft Period, discussed under heading No. (4). The belt of living timber now represented only by stumps formerly extended from the channel of Cypress Bayou shoreward to the lower limit of the upland forest discussed under heading No. (6). Its upper portion was composed of species characteristic of the upland forest.

This belt of living timber formerly covering the valley of Cypress Bayou was a magnificent mixed forest of great extent, composed chiefly of a dense stand of beautiful hardwood trees of various species. The trees were of varying sizes ranging from small seedlings up to large trees 30 to 40 inches in diameter. Many of the larger trees were over 200 years of age. The forest was in a flourishing condition when suddenly overtaken by a great catastrophe, the submergence which produced Ferry Lake. The presence of so many stumps in the water has always been exceedingly detrimental to navigation in times of low water. See photographs Nos.

(3) A belt of young timber consisting of cypress, water locust, planer tree, button bush, willow, etc., which germinated on the beach above low water mark at low water stages in comparatively recent years.

This belt occupies a portion of the site of the hardwood forest discussed under heading No. (2), and is situated between the present mean low water mark and the lower levels of the Lower Terrace, being best developed below the mean low water mark of the Raft Period. In some places the stand is very dense. In others, where the ground surface of the shore is steeper, it is poorly developed, or practically absent.

as of 1914

It is comparatively young, being ordinarily less than 40 years old. Normally, however, it is 20 to 30 years of age, or less. established after 1876 or so

The diameter and height of the individual trees composing this belt varies with the age, density of the stand, species, and quality of the site. In favorable localities, cypress has attained a diameter at breast height of [illegible] inches and a total height of 30 feet. In other places it is much smaller. Planer tree, ordinarily low and bushy, has hardly passed the shrub stage. Water locust is usually less than 20 feet high. Willow, normally a very rapid growing tree, occasionally reaches a diameter at breast height of 18 inches and a total height of 40 feet. Button bush is merely a shrub.

A similar belt of timber, germinating after Ferry Lake came into existence, occupied the territory between 173.09 foot contour and mean low water mark of the Raft Period, and ultimately developed into the belt of timber discussed under heading No. (4). See photograph No. 9, 17, and 40.

(4) A belt now consisting chiefly of cypress timber, below 173.09 foot contour and above the mean low water mark of the Raft Period.

This belt occupies the Lower Terrace and is situated on the site of the hardwood forest discussed under heading No. (2). It formerly consisted principally of cypress, water locust, planer tree, button bush, and black willow, species ordinarily found only on areas inundated during a considerable portion of the year. These species germinated on the beach at low water stages of the lake after it came into existence and after the hardwood forest, formerly occupying this territory, had been killed.

Wave action at the bases of the trees, continued during a long period of years, especially in exposed situations, has bared the root systems and killed many of the trees. In some places the forest growth is now only scattered; in other situations it has been completely destroyed. Most of the dead trees have long since fallen and been subsequently washed to higher levels. Much of the drift cypress on the beach has already rotted away, but in many places numerous trees may still be seen in various stages of decay. Planer tree and cypress are the chief species remaining alive. See photographs Nos. 11, 20, 32, and 42.

After Perry Lake came into existence a few years elapsed before species characteristic of lands inundated

for a considerable portion of the year germinated on this Terrace. It was necessary first, that soil and humus conditions become suitable and tree seed become available, etc. Since the stand became well established, trees have germinated more or less every year. There is on this Terrace, therefore, an uneven-aged, mixed, hardwood and cypress forest, consisting of trees of various ages and sizes up to large mature trees. Of the trees germinating soon after Ferry Lake came into existence, cypress is the only species remaining. The form of the stems of the older cypress trees indicate that they grew under unfavorable site conditions. That is to say, the trees are comparatively short, apparently stunted, possess greatly enlarged bases, exhibit considerable taper, are commonly dead topped, and invariably hollow butted. See photographs Nos. 39 and 40.

Not necessarily so!

Cypress? probably cohort regeneration

Unfavorable site conditions, due largely to the presence of a superabundance of overflow waters, caused poor soil aeration, and wave action at the bases of the trees gradually brought about root exposure and ultimately the death of the trees.

The larger cypress varies in size up to 40 inches in diameter or larger and is 130 years of age or older. Most of it is, however, smaller and younger.

→ Establishment in about 1784 or earlier

Since the removal of the Great Raft in the Red River a little less than half a century ago, drainage conditions have gradually become better on this Terrace and species of hard wood trees less water enduring have come in. On the upper portion of the Lower Terrace in some places, hardwood species characteristic of lands regularly overflowed, such as willow oak, overcup oak, etc., are coming in. Being new comers, these species are still scattering and young, but willow oak has reached an age of 15 years and overcup oak in rare cases an age of 25 years. See photographs Nos. 28,35&36, and Plats of Sample Plots Nos. 1 to 6, inclusive.

(5) A belt of hardwood timber, characteristic of lands regularly overflowed, situated between the 173.09 foot contour, and the adjacent upland forest.

This belt occupies the Big Terrace, and is situated on the site of the hardwood forest discussed under heading No. (2). It consists of overcup oak, willow oak, persimmon, water hickory, cotton wood, red gum, crataegus, swamp holly, etc. These species germinated on the beach after the lake came into existence and after the hard wood forest formerly occupying this territory had been killed.

In many places the stand is very dense and heavy, but in others, especially in exposed situations, it is thin or entirely wanting, due to severe wave action in times of high water during the Raft Period.

After Ferry Lake came into existence a number of years elapsed before the hardwood species characteristic of lands regularly overflowed germinated on this Terrace. After soil and humus conditions became suitable and seed became available, the species gradually came in, and, later, after the stand became well established, trees have germinated more or less every year since. The stand is, therefore, an uneven-aged, mixed, hardwood forest, consisting of trees of various sizes and ages up to large mature trees.

During the Raft Period at times of high water in Ferry Lake, cypress seed was cast upon the beach by the waves above the 173.09 foot contour, where it germinated and developed into trees. There is, therefore, above the mean high water mark of the Raft Period, a narrow strip occupied by both hardwood and cypress.

The cypress in this situation is markedly different in form and appearance from the cypress below the 173.09 foot contour, in that the trees are usually tall, of slow growth, of small diameter, with little taper, and, ordinarily, with comparatively little swell at the base.

Wave action in times of high water during the Raft Period, more especially in exposed situations, produced soil erosion at the bases of the trees on the Big Terrace, in some cases only baring the root crowns, and in others completely exposing the root systems.

Since the removal of the Great Raft, in the Red River, a little less than half a century ago, drainage conditions have become better on the Big Terrace, and on adjacent contiguous areas below the 173.09 foot contour. For this reason, some of the species growing in this belt have in recent years extended their range slightly below the mean high water mark of the Raft Period. Better drainage conditions, due to causes mentioned above, have enabled a few species normally characteristic of the upland forest, to obtain a foothold in certain situations on the Big Terrace. These are principally loblolly pine, red cedar, etc. See photographs Nos. 31, 47, 48, etc.

On the upper portion of the Big Terrace, living trees characteristic of the upland forest, consisting principally of large post oaks, which germinated in many cases before Ferry Lake came into existence, are occasionally found. The overflow waters of the lake never covered their root systems a sufficient length

of time to kill them. Wave action continued intermittently for a long period of years, has produced considerable soil erosion at their bases and also a recession of the escarpment in this situation. See photographs Nos. 60 and 61.

The large hardwoods on the Big Terrace, characteristic of lands regularly overflowed, which germinated after Ferry Lake came into existence, vary in size up to 30 inches in diameter, or larger, and from 75 to 100 years of age, or older. See Plats of Sample Plots Nos. 1 to 6 inclusive and Photographs Nos. 24 to 38, etc.

(6) The Upland Forest. This belt of timber is situated beyond the belt discussed under heading No. (5), and covers the Upland Terrace and upland adjacent to Ferry Lake. It consists of trees which are characteristic of the upland areas in this locality, such as post oak, black jack oak, black hickory, loblolly pine, shortleaf pine, white oak, Spanish oak, etc. Where it has not been cleared for farming purposes, the stand is in many places dense and heavy.

The trees composing the upland forest are descendants of other forest trees of the same species, which formerly occupied this situation for centuries.

Before Ferry Lake came into existence, the upland forest extended considerably lower than its present

Essentially all Big Terrace trees should be flood tolerant (willow oak, overcup oak, planer tree, etc.) that are less than 194 to 217 years old (as of 1994)

position. That is to say, the Big Terrace, which is now covered with a belt of hardwood timber peculiar to land regularly overflowed, was formerly covered with species peculiar to the upland forest.

Since the removal of the Great Raft in the Red River, less than a half century ago, drainage conditions have become better on the upper portions of the Big Terrace and a few species peculiar to the upland forest, such as red cedar, loblolly pine, etc., have slightly extended their range to lower elevations. Loblolly pine, in the upland forest, is found only in situations where the soil is sandy. Likewise, on the Big Terrace, it is found only where sufficient sand has been washed from the adjacent upland to enable the pine to get a start. See photographs Nos. 31, 51, 62, etc.

These trees should be no older than 100 years old (as of 1994)

Much of the timber on the Upland Terrace is large and old, as it is on all the uncleared areas in the upland forest. That is to say, trees are commonly met with which are 24 to 30 inches in diameter or over, and which are 200 years of age or older. See photographs Nos. 68 to 71, inclusive.

Cypress trees, normally found on areas inundated for considerable portion of the year, and overcup oak, normally found on areas regularly overflowed, are not components of the upland forest. There is absolutely

no evidence whatever that overcup oak and cypress have occupied the Upland Terrace for many centuries. There is, however, absolute evidence that post oak and other trees peculiar to the upland forest have occupied the Upland Terrace for many hundreds of years. See Plats of Sample Plots Nos. 3 to 6, and photographs Nos. 68 to 71, inclusive.

LIVING CYPRESS TREES IN THE WATER OF FERRY LAKE.

There are numerous living cypress trees in the water of Ferry Lake, which are in many cases of large size. Along James Bayou, near the junction of James Bayou with Ferry Lake, near the mouths of tributaries flowing into Ferry Lake, and occasionally in other places, there are belts and isolated trees of living cypress. These may be classified as follows:

(1) Cypress trees which have germinated on the beach at low water stages of the lake.

(2) Cypress trees now in the deeper water, which germinated before Ferry Lake came into existence, and which are still living, having survived the catastrophe of the submergence.

(3) Cypress trees which have germinated on old stumps.

Cypress commonly germinates on old stumps in the water. The cones of cypress containing seed are light and readily float upon the water. If a seed lodges in a crack or crevice of a decaying stump, it may germinate, in which event the root system develops downward. As the stump continues to rot the resulting decayed material is absorbed by the finer rootlets until the entire stump has been consumed. When the roots reach the ground, they penetrate it, and thereafter continue to absorb food materials therefrom. If the water remains con-

tinuously about the basis, the conditions for growth and development are very unfavorable.

Individual cypress trees sometimes exhibit great ability to maintain an existence with their bases continuously submerged in water, occasionally living for very many years. In such cases, however, the trees commonly exhibit evidences of unfavorable site conditions, such as enlarged bases, short stems, rapid taper, dead tops, hollow buts, etc.

Great numbers of cypress trees were killed by the submergence which produced Ferry Lake, but some were not, due to the great ability of cypress to withstand unfavorable water conditions. The presence of flowing waters along James Bayou, in fact, all over Ferry Lake, has doubtless enabled the root systems in the ground to obtain a small amount of oxygen necessary to maintain life, and probably prevented toxic properties to form in the ground in sufficient quantities to kill the roots.

FOREST GROWTH ON THE FLOOD PLAINS AND LOWER SLOPES OF THE VALLEYS OF THE TRIBUTARIES FLOWING INTO FERRY LAKE.

In many places around Ferry Lake, tributaries flow into it, which, in times of heavy rains, or soon thereafter, carry considerable water. The flood plains of these tributaries in some places, therefore, are covered with forest growth peculiar

to areas inundated for a considerable portion of the year, such as cypress, water locust, planer tree, etc. Other portions of the flood plains at higher levels and of the lower slopes of the valleys are covered with forest growth peculiar to areas regularly overflowed, such as overcup oak, water hickory, etc., which extends up the valley slopes, to the lower borders of the upland forest. The more or less concentric parallel belts of timber on the shores of Ferry Lake are interrupted, therefore, by the parallel belts of timber along the tributaries flowing into Ferry Lake, and which occasionally extend back into the territory adjacent to the lake, a considerable distance from the shore.

FOREST GROWTH ON THE UPLAND TERRACE AND ADJACENT UPLANDS.

The Upland Forest on the Upland Terrace and adjacent upland areas is typical of the upland forest, occurring on upland areas in this latitude in the lower Mississippi Valley. At all elevations on the Upland Terrace, the upland forest is of the same character as that on the adjacent upland areas. That is to say, the forest on the Upland Terrace is typically an upland forest, and possesses all of the characteristics of an upland forest.

SPECIES OF TREES GROWING ON THE UPLAND TERRACE AND ADJACENT UPLANDS.

The species of trees found on the Upland Terrace and on the adjacent uplands are those ordinarily found on upland areas in the lower Mississippi Valley region. The principle species commonly occurring are as follows:

COMMON NAME	SCIENTIFIC NAME.
Post oak	Quercus minor (Marsh.) Sargent.
Black Jack oak	Quercus marilandica (Muenchh.)
Spanish oak	Quercus digitata (Marsh.) Sudworth.
White oak	Quercus alba (Linn.)
Mocker nut (hickory)	Hicoria alba (Linn.) Britton.
Pig nut (hickory)	Hickory glabra (Mill.) Britton.
Shagbark (hickory)	Hicoria ovata (Mill.) Britton.
Wing elm	Ulmus alata (Michx.)
Sassafras	Sassafras Sassafras (Linn.) Karst.
Loblolly pine	Pinus taeda (Linn.)
Shortleaf pine	Pinus echinata (Mill.)
Persimmon	Diospyros virginiana (Linn.)
Red haw	Crataegus (Species)
Deciduous holly	Ilex decidua (Walt.)

The principal species occasionally occurring on the

Upland Terrace and adjacent uplands are as follows:

COMMON NAME	SCIENTIFIC NAME.
Black gum	Nyssa sylvatica (Marsh.)
Red cedar	Juniperus virginiana. Linn.
Willow oak	Quercus phellos. Linn.
Water oak	Quercus nigra. Linn.
White ash	Fraxinus Americana. Linn.
White elm	Ulmus Americana. Linn.
Honey locust	Gleditsia triacanthos. Linn.
Yellow buckeye	AEsculus octandra. Marsh.

CHARACTERISTICS OF THE FOREST ON THE UPLAND TERRACE.

Where it has not been cleared for farming purposes and exclusive of the territory in the valleys of the tributaries flowing into Ferry Lake, the forest on the Upland Terrace possesses numerous characteristics, among which are the following:

(1) The forest consists of numerous species of hardwoods and two species of pine. That is to say, it is complex in character.

(2) It consists of a stand which is ordinarily dense and heavy, comprising trees of various sizes and ages.

(3) The trees composing it have grown at a relatively slow rate.

(4) It contains numerous trees, especially oaks and hickories, which are large and old. See Photograph No. 70.

(5) It requires good drainage conditions and relatively dry site.

(6) It has occupied its present position for centuries. That is to say, the forest trees now occurring are descendants of other forest trees of the same species, which formerly occupied this site.

(7) It is not now nor has it been for several centuries at least, temporarily overflowed by the waters of any Lake occupying the valley of Cypress Bayou, except possibly at the lowest levels on the Upland Terrace during the Raft Period of the present Ferry Lake, very rarely and temporarily at times of excessively high water therein, during unusual flood periods which occasionally occurred at intervals of many years.

(8) It does not contain species of trees which are entirely characteristic of lands inundated for a considerable portion of the year, such as cypress, water locust, willow, etc. See Plats of Sample Plots Nos. 3 and 6 and photographs Nos.68to 78.

(9) It does not contain species of trees which are entirely characteristic of lands regularly overflowed, such as overcup oak, etc. See Plats of Sample Plots Nos. 3 and 6 and photographs Nos. 66, 68, 69, and 70.

THE RANGE OF THE UPLAND FOREST PREVIOUS TO THE EXISTENCE OF FERRY LAKE.

Exclusive of the valleys of the tributaries flowing into Ferry Lake, the upland forest, previous to the existence of Ferry Lake, extended to lower elevations and occupied what is now the Big Terrace. The evidence of this fact appears in various forms, among which are the following:

(1) Remains of post oak stumps, roots, etc., not yet completely decayed.

(2) Post oak trees dead and down upon the ground for many years, much decayed, still lying where they fell. See photographs Nos. 62 and 63.

(3) Post oak stumps, large, old, much decayed and dilapidated, with their root systems entirely or almost completely exposed, still standing where they grew. See photograph No. 59.

(4) Live post oak trees on the upper portion of the Big Terrace commonly with their root crowns and the upper part of their root systems exposed by soil erosion at their bases, more or less enlarged at base, decrepit and defective. See photographs Nos. 60 and 61.

NOTES ON VARIOUS SPECIES OCCURRING ON THE UPLAND TERRACE.

POST OAK is never found on lands inundated for a considerable portion of the year, nor normally, on lands regularly overflowed. That is to say, it is typically an upland tree. Its occurrence on the Big Terrace is explained above. After obtaining a foothold, however, it is tenacious of life and may withstand an occasional temporary overflow and even considerable soil erosion at the base. Under such circumstances, however, the reaction of the growing tissues to the unfavorable site conditions is ordinarily manifested in an enlarged base, decay in the butt portion, in an unhealthy and decrepit appearance, etc.

Post oak is the most common oak occurring and is very frequently met with. It is, as stated above, typically an upland species and is a very common tree on the Upland Terrace and adjacent uplands. It normally grows to large size, and reaches comparatively great age. Its size, rate of growth, age, frequency of occurrence, associates in the forest, etc., on the Upland Terrace, are typical of upland areas in general in the adjacent locality. See Plats of Sample Plot Nos. 3 and 6 and Photographs Nos. 70 and 71.

The rate of growth for post oak is comparatively slow. Growth analysis studies were made on the stump cross-sections of two post oak trees on the lower part of the Upland Terrace, adjacent to Sample Plat No. 4, with the following results:

SPECIES	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES.	AGE IN YEARS
Post oak	2.3	26	194
Post oak	2.5	20	197

Growth studies were made on the stump cross-sections of three post oaks on the south shores of Ferry Lake on the upper part of the Big Terrace, Sec. 27, Twn. 20 N., R. 16 W., L.M., with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES.	AGE IN YEARS.	ELEVATION OF GROUND SURFACE AT BASE OF STUMP FEET.
26	2.5	24.4	156	179.1
23	2.2	20.8	164	179.4
24	2.8	22.6	173	179.58

Growth analysis studies were made on the stump cross-section of a representative post oak tree growing on the upland in Sec. 33, Twn. 20 N., R. 16 W., L. M., which gave the following results:

SPECIES	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE IN YEARS.
Post oak	2.8	22.6	167

Growth analysis studies made on two post oaks on Sample Plot No. 3 gave the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES.	AGE IN YEARS.	ELEVATION OF GROUND SURFACE AT BASE OF STUMP FEET.
131	1.3	25.0	112	179.0
132	12.5	24.0	120	179.0

Post oak No. 132 was hollow and defective at base. At 1.6 feet from the ground the stump diameter was 42.5 inches. The first sound cross-section was obtained at 12.5 feet from the ground. The total age of this tree is undoubtedly much greater than 120 years. See photograph No. 68.

BLACK JACK OAK is a common tree found on the Upland Terrace and in the upland forest. It is a tree of medium size, and comparatively slow growth. It is a common associate of post oak everywhere. Live trees of this species are never found on lands inundated for a considerable portion of the year, nor on lands regularly overflowed.

SPANISH OAK is a rather common tree in the upland forest. It occasionally reaches comparatively large size.

WHITE OAK occurs rather rarely on the better sites in the upland forest in this locality. It normally reaches large size and usually grows rather slowly. It grows alike on rich uplands and bottom lands where not too moist.

Upland HICKORY is characteristic of and very commonly occurs on the Upland Terrace and on the adjacent uplands. It is commonly an associate of post oak, black jack oak, and other

upland species. It reaches large size but grows slowly, normally more slowly even than post oak. A number of the larger trees occurring were measured and found to be from 16 to 24 inches in diameter or over at breast height.

None of the upland species of hickory occur on lands inundated for a considerable portion of the year, nor on lands regularly overflowed. Although better drainage conditions have existed on the upper portions of Big Terrace for something less than half a century, none of the upland species of hickory have as yet germinated thereon.

LOBLOLLY PINE is a common tree on sandy soils on the Upland Terrace, and in the upland forest. It possesses considerable ability to grow under a wide range of conditions and is frequently found along the borders of swamps and lowlands. It grows best on a sandy soil and where a little sand has been washed upon the Big Terrace by heavy rains in recent years, young loblolly pine has come in thereon. It ordinarily has a comparatively rapid growth and occasionally reaches a diameter at breast height of 36 inches. Young loblolly pine on the Big Terrace has grown at a very rapid rate. See photographs Nos. 48, 51, etc.

A growth analysis study was made on the stump cross-section of a loblolly pine stump, found on Sample Plot No. 6, along the shore of Clear Lake, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES.	AGE IN YEARS.	ELEVATION OF GROUND SURFACE AT BASE OF STUMP FEET
31	2.0	29.0	77	182.07

SHORTLEAF PINE occurs less frequently and in this locality grows more slowly and is a smaller tree than loblolly pine. It is characteristic of upland areas.

PERSIMMON is found scattered through the forest on the Upland Terrace and adjacent uplands. It is a common tree on areas which are high, dry, and well drained. Numerous young trees of this species are found also on the Big Terrace. It possesses great ability to grow under a wide variety of conditions, and very rarely germinates on old stumps in the water. See photograph No.

RED HAW, crataegus, is a low bushy tree, frequently met with on the Upland Terrace and adjacent uplands. It very commonly occurs on the Big Terrace, and also at higher levels on the Lower Terrace. Its seed is commonly scattered by birds and the species possesses a wide distribution.

DECIDUOUS HOLLY is a low bushy tree, frequently only a shrub, very common on the Big Terrace and other lands regularly overflowed. It is comparatively uncommon in the upland forest.

SIGNIFICANCE OF THE FOREST GROWTH ON THE UPLAND TERRACE.

The particular features of the forest growth occurring on the Upland Terrace of great significance are the following:

(1) Species of trees.

(2) Size and age of the trees.

SPECIES OF FOREST TREES NOW GROWING ON THE BIG TERRACE.

The species growing on the Big Terrace are in general those ordinarily found on lands subject to regular inundation in this latitude in the lower Mississippi Valley.

The principal species commonly occurring are as follows:

COMMON NAME.	SCIENTIFIC NAME.
Overcup oak	Quercus lyrata (Walt.)
Willow oak	Quercus phellos (Linn.)
Water hickory, (or Bitter pecan)	Hicoria aquatica (Britton)
Red (or Sweet gum)	Liquidamber styraciflua (Linn.)
Green haw	Crataegus (Species).
Deciduous holly	Ilex decidua (Walt.)
Persimmon	Diospyros virginiana (Linn.)

The following species occur scatteringly:

COMMON NAME.	SCIENTIFIC NAME.
Bald cypress	Taxodium distichum (Linn.)
(Common) Cottonwood	Populus deltoides (Marsh.)

COMMON NAME.	SCIENTIFIC NAME.
Red Mulberry	Morus rubra (Linn.)
White ash	Fraxinus Americana (Linn.)
Loblolly pine	Pinus taeda (Linn.)
Prickly ash	Xanthoxylum Clava-herculis (Linn.)
Mississippi hackberry (Sugar-berry)	Celtis Mississippiensis (Bosc.)
Red cedar	Juniperus Virginiana (Linn.)

CHARACTERISTICS OF THE FOREST NOW FOUND ON THE BIG TERRACE.

Exclusive of the valleys of the tributaries flowing into Ferry Lake, the forest on the Big Terrace possesses numerous characteristics, among which are the following:

(1) It consists of but relatively few species of hardwoods, together with cypress and young pine. That is to say, it is simple in character.

(2) With the exception of the large living post oaks still standing upon the upper part of the Big Terrace, the trees composing it have grown at a relatively rapid rate.

(3) It contains numerous overcup and willow oaks which, though large, are comparatively young. See photographs Nos.

(4) It occupies a site of a hardwood forest characteristic of upland areas and, with the exception of the large living post oaks still standing on the upper part of the Big Terrace, it has germinated since Ferry Lake came into existence.

(6) After the original hardwood forest on the Big Terrace characteristic of upland areas had been destroyed by the overflow water of Perry Lake, the hardwood trees characteristic of lands regularly overflowed, which first came in thereon, germinated from seed deposited by the overflow waters of the lake. The seed grew on mother or seed trees, in many cases several miles from the place where the seed subsequently germinated.

(6) It was regularly overflowed by the overflow waters from Perry Lake during the Raft Period, and has been occasionally overflowed since.

(7) During the Raft Period, with the exception of a few living post oaks on the upper part of the Big Terrace, the leftovers of the characteristic upland forest, which formerly occupied this site, the forest on the Big Terrace did not contain species characteristic of an upland forest. A few pines and a few species of hardwoods characteristic of upland areas have recently germinated on the Terrace, drainage conditions having become better thereon during the last half century.

(8) The forest on the Big Terrace does not contain either large living cypress trees, or the remains of large dead cypress trees, standing or down, which are several centuries old, or which germinated on the Big Terrace at any time before Perry Lake came into existence.

(9) It contains at lower elevations, above the 173.09

foot contour, scattering cypress trees, which are normally comparatively tall, relatively of small diameter, with comparatively little swell at base, of slow growth, ordinarily not over 120 years of age, and which germinated after Ferry Lake came into existence.

THE CONDITION OF THE BIG TERRACE FOR A NUMBER OF YEARS AFTER FERRY LAKE CAME INTO EXISTENCE.

Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Ferry Lake, the forest growth now found on the Big Terrace occupies the site of a hardwood forest of upland species which was killed by the overflow waters of Ferry Lake. After the lake came into existence, its overflow waters destroyed the native herbs, grasses, and shrubs and killed the trees at lower levels by submerging their bases. Erosion of the soft surface soil, exposing the root systems, was also an active agent of destruction. As soon as the trees were killed the wood was subject to the destructive agencies of fire, wind, insects, fungi, etc., all of which working together, soon accomplished the complete destruction of the trees.

The mean high water mark at that time and later during the Raft Period was approximately at 173.09 foot contour, so that, during the low water stages of the lake the ground surface of

the Big Terrace was comparatively dry. Wood destroying fungi were thus enabled to work unhampered, as were also the wood destroying larvae of forest insects. Severe winds at various times undoubtedly overturned many of the standing dead trees after their hold upon the soil had been loosened by decay and soil erosion at their bases. Occasionally during dry seasons, forest fires undoubtedly burned fiercely in the dry and decaying, standing and down, dead timber upon the beach.

The overflow waters in times of high water were active in cutting into the shore surface both in a horizontal and vertical direction and soon commenced to cut an escarpment in exposed situations along the upper limit of the overflow waters That is to say, exclusive of the work of wave action since the removal of the Great Raft in the Red River a little less than half a century ago, the escarpment on the upper side of the Big Terrace in many places has been produced in large part by overflow waters at times of high water in Ferry Lake during the Raft Period. It is not maintained, in this connection, that the Big Terrace, at some prehistoric time many centuries ago, was not covered with water for a greater or less period, but simply that, during the Raft Period, it was regularly overflowed in times of high water by the waters of Ferry Lake.

ORIGIN OF THE FOREST GROWTH NOW FOUND ON THE BIG TERRACE.

Except in and adjacent to the valleys of the tributaries flowing into Ferry Lake, the hardwoods occurring on the Big Terrace characteristic of lands regularly overflowed, have germinated since Ferry Lake came into existence. They are, therefore, less than the age of the lake. The age of the oldest trees of overcup oak, etc., is less than the age of the lake by the number of years in the interval between the formation of the lake and the time when the oldest hardwood trees germinated.

The interval varied with the different older trees, but was approximately 12 to 15 years or more. Except in and adjacent to the valleys of the tributaries flowing into Ferry Lake, it was necessary that an interval of time elapse before the new hardwood species could come in on the Big Terrace for many reasons, among which are the following:

(1) Species of trees characteristic of upland forests, killed by overflow waters, occupied the lower portions of this terrace. These later fell over and either rotted or burned up.

(2) The ground surface of the beach, when denuded of its upland herbs, grasses, shrubs, and trees, became, in many places, raw and exposed. Soil humus became limited, but this was soon supplied by decaying wood washed upon the shores by the waves. I doubt that rotting wood would provide a very uniform layer of humus.

(3) It was necessary that a period of adjustment of soil conditions should intervene before species of hardwood trees characteristic of upland forests and occupying a site adapted to them could be replaced by hardwood species characteristic of overflow lands, and which require an entirely different site.

(4) Tree seed of the hardwood species characteristic of overflow lands was not present on the Big Terrace immediately after Ferry Lake came into existence. This seed was later produced by trees, in numerous cases, many miles away, and was subsequently deposited on this Terrace by the waves.

These seeds should have grown quite fairly soon.

(5) After being deposited by high water upon the floor of the Big Terrace, the seed of species characteristic of lands regularly overflowed must have experienced favorable conditions for germination. Doubtless, many seed were infertile, were destroyed by insects, animals, etc., or were otherwise incapacitated for germination.

(6) The seed of species characteristic of lands regularly overflowed was conveyed to the Big Terrace by the flowing water of Ferry Lake, which, doubtless, carried much floating seed down stream beyond the shores of the lake.

(7) There is no reason to believe that the seed of species characteristic of land regularly overflowed was more plentiful and available when Ferry Lake came into existence

Should we, therefore, see a gradual increase in the total # of these species on the Big Terrace. The oldest would signal a time period soon after creation of the lake.

than it is at the present time. Some seeds of these species are now regularly cast upon the shore by the waves, but the quantity is not great. This is demonstrated by careful examination of deposits in the drift material cast upon the beach.

(7) It was necessary, in order that seed of species characteristic of lands regularly overflowed, might germinate on the Big Terrace, first, that fertile seed be present; second, that high water should occasionally occur at the time the seed was present in order to deposit it at higher levels on the beach. That is to say, a combination of favorable circumstances must have occasionally prevailed, and they did actually occasionally occur during the first quarter of a century or so after Perry Lake came into existence.

The discussion covering seed dispersal in the paragraphs numbered from (1 to 6) inclusive, above, refers exclusively to those portions of the Big Terrace not in and adjacent to the valleys of the tributaries flowing into Perry Lake.

In the discussion in the paragraphs numbered (1 to 6) inclusive, above, it should be further noted that I have used the expression, "Species characteristic of lands regularly overflowed", to refer particularly, not to all the species now found on the Big Terrace, but specifically and practically to overcup oak, water hickory, and red gum. The seed of

cottonwood is conveyed by wind. The seed of swamp holly and crataegus is commonly conveyed by birds. The seed of Willow oak may and commonly is conveyed by water, etc.

THE BIG TERRACE IN AND ADJACENT TO THE VALLEYS OF THE TRIBUTARIES FLOWING INTO FERRY LAKE.

It is necessary, at this point, to discuss the Big Terrace in and adjacent to the valleys of the tributaries which cross it at various places around Ferry Lake. Where not cleared for farming purposes, the valleys of these tributaries at different levels are covered with a forest growth characteristic of lands inundated for a considerable portion of the year, with species characteristic of lands regularly overflowed, and on the higher portions of their water sheds with trees characteristic of the upland forest.

The overflow waters of the lake did not necessarily kill all of the trees characteristic of overflow lands growing in the valleys of the tributaries on what is now the Big Terrace. Many of these trees doubtless continued to live and produce seed for many years, although compelled to adapt themselves to greater quantities of soil moisture and to withstand the overflow conditions consequent to the existence of the lake.

That portion of the Big Terrace adjacent to the tributaries and crossed by them, had the seed of species characteristic of

lands regularly overflowed brought to it very soon after Perry Lake came into existence. So that, in and adjacent to the valleys of the tributaries crossing the Big Terrace, the seed of species characteristic of lands regularly overflowed, was deposited through the medium of the flood waters of the tributaries as well as by the flood waters of Perry Lake. We should expect, therefore, that, in these locations, the trees would be older, and this is actually found to be the case.

FOREST GROWTH ON THE BIG TERRACE BEFORE PERRY LAKE CAME INTO EXISTENCE.

The question might arise as to whether the Big Terrace, exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Perry Lake was not occupied by a hardwood forest, characteristic of lands regularly overflowed, consisting of trees, many of which were large and old, and which might antedate the older and larger trees now found thereon. This position is entirely untenable for many reasons, among which are the following:

(1) Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Perry Lake, there is absolutely no evidence whatever that the Big Terrace was occupied by a hardwood forest characteristic of overflow lands immediately antedating the older and larger trees now found

thereon. If such a forest had actually existed, immediately antedating the present forest growth, there would be evidences thereof in many places, as follows: stumps in various stages of decay, many of which would be large and old, the remains of a former forest growth; dead and down forest trees, many of which would be large and old, and in various stages of decay; fragments of logs, trees, stumps, roots, etc., not yet completely decayed, of various sizes and in various stages of decay, etc. There are no trees or remnants or remains thereof of species characteristic of lands regularly overflowed which germinated on the Big Terrace before Ferry Lake came into existence.

(2) Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Ferry Lake, the forest now found on the Big Terrace is simple in character. That is to say, the species are as yet comparatively few in number. On lands regularly overflowed in the lower Mississippi Valley, the forest flora is normally complex. That is to say, it consists of many species provided it has occupied the territory two or three hundred years or more. The oldest and largest hardwood trees now commonly found on the Big Terrace are overcup oak and willow oak. Large red gum and water hickory trees are occasionally seen, but they normally occur scatteringly. The remaining forest trees on the Big Terrace normally charac-

teristic of lands regularly overflowed, germinated in comparatively recent years.

(3) Except in the valleys of the tributaries flowing into Ferry Lake, the trees now found on the big terrace are, comparatively speaking, still young. If this Terrace had been occupied by species of trees characteristic of lands regularly overflowed for several hundred years, or even a century, immediately antedating the few larger and older trees now found thereon, there would now be numerous trees larger and much older than any now existing on the Terrace. The overflow waters of ferry lake would not have killed them and they would have continued to live on, some of them to the present time. Further, there would, at least, be some evidence of their existence. No such evidence exists.

(4) Exclusive of the territory in the valleys of the tributaries flowing into Ferry Lake the elevation of the Big terrace is such that, previous to the formation of Ferry Lake, it is altogether unlikely, if not impossible, for site conditions to have prevailed upon the Big Terrace favorable to the growth of forest trees characteristic of lands regularly overflowed, such as overcup oak, etc. To have enabled a forest growth characteristic of lands regularly overflowed to have maintained an existence for centuries on the Big Terrace previous to the formation of Ferry Lake, would have necessitated

overflow conditions thereon, such as prevailed on this terrace during the Raft Period and since. These conditions did not exist. The channel of Cypress Bayou was ordinarily sufficient to convey the waters coming down from the upper portions of the water shed, except during the flood water seasons. In flood seasons and times of occasional overflow, the lower portions of the valley below 173.09 foot contour, several miles in width in certain portions of Ferry Lake, were abundantly able to convey the excess waters, except possibly in seasons of occasional extraordinary temporary high water. That is to say, the carrying capacity of the basin of the valley below the 173.09 foot contour was sufficient to convey all ordinary excess waters. See sheet No. 7.

(5) Except in the valleys of the tributaries flowing into Ferry Lake, the Big Terrace, previous to the formation of the lake and immediately antedating the older and larger forest trees now found thereon, was covered with a forest growth characteristic of an upland forest, consisting of post oak, black jack oak, etc. The remains of that forest may still be seen in the form of post oak stumps, large, old, much decayed, and dilapidated, with their root systems entirely or almost completely exposed, still standing where they grew. See photograph No. 59. Remains of post oak trees, stumps, and roots, not yet completely decayed. See photograph No. 62. Living post oak trees on the upper portion of the Big Terrace, commonly

with their root crowns and the upper part of their root systems exposed by soil erosion at their bases, and more or less enlarged at base, decrepit, and defective. See photographs Nos. 60 and 61.

(6) When Surveyor Warren originally run the meander line of Ferry Lake in 1839, except occasionally in the valley of the tributaries flowing into the lake, he did not find a heavy forest on the Big Terrace, such as is found today, consisting of living trees which were numerous, large, old, and growing down to the 173.0 foot contour, for such a forest did not exist. If Mr. Warren had found such a forest, he would have undoubtedly meandered the shore at the mean high water mark to the Raft Period. Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into the lake, what he did find was a young forest growth consisting of trees which were comparatively small,-- overcup and willow oaks, with scattering water hickory, and red gum, occurring on the Big Terrace. He found, in addition, the remains of numerous dead trees, standing and down, consisting of species characteristic of the upland forest. The species of trees characteristic of lands regularly overflowed, had, comparatively speaking, recently commenced to come in on the Big Terrace. They were still comparatively small and scattered in 1839. This is further discussed in the heading, "The Mean High Water Mark of the Raft Period."

NOTES ON THE SPECIES NOW OCCURRING ON THE BIG TERRACE.

OVERCUP OAK is characteristic of lands regularly overflowed and was the first of the hardwoods to germinate on this Terrace. Its acorns readily float upon the water, and first reached this deforested and denuded territory through the agency of the flood waters of Ferry Lake, which brought the acorns from mother or seed trees occurring along the shores of Cypress and James Bayous and their tributaries and also along the shores of the tributaries of Ferry Lake, above and beyond the areas of submergence.

As soon as the young overcup oaks became large enough to bear acorns, seedlings of this species became more plentiful and since then, this oak has been the principal hardwood on this Terrace.

Growth analysis studies were made on stump cross-sections of numerous overcup oak trees on the Big Terrace on Sample Plot No. 3 and elsewhere, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	DATE CUT
21	2.1	18.2	65	175.32	---------
66	1.4	25.3	88	177.8	1/26/1914
78	1.6	16.8	92	177.2	1/16/1914
14	1.3	25.2	114	175.7	1/16/1914

→ Established prior to 1800

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	DATE CUT
15	1.4	32.2	108	176.3	1/17/1914
71	1.2	20.6	83	177.4	1/19/1914
9	1.4	18.8	104	173.7	1/20/1914
2	6.0	----	93	173.5	3/14/1914
5	1.6	20.4	74	174.8	3/14/1914
ST4	4.5	23.2	109	-----	3/14/1914

These established around 1800 or shortly thereafter

Tree No. 21 grew in Sec. 27. Trees Nos. 2 and 5 grew on Sample Plot No. 1. Tree No. ST4 grew a few chains east of Sample Plot No. 3. All the other trees grew on Sample Plot No. 3. It required several years to reach the stump height given. See Plats of Sample Plots Nos. 1 and 3.

Growth analysis studies were made on the stump cross-sections of six overcup oak trees on the Big Terrace on Sample Plot No. 6, on the shores of Clear Lake, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	SOIL EROSION AT BASE OF TREE INCHES
2	2.1	3.8	104	174.12	4
5	2.6	31.2	107	174.43	6
6	2.6	17.8	103	174.56	5
52	3.4	33.6	115	173.57	6
56	2.6	22.2	110	173.83	------
67	2.8	28.6	110	173.76	------

Established about 1800 or after

Established prior to 1800

or just prior to 1800

? cut when?

All of the above trees have been cut for several years, and a few years were required to reach the given stump height.

WATER HICKORY is characteristic of lands regularly overflowed, and its seed, readily floating on the surface of the water, was conveyed to the Big Terrace by the waves in the same manner as the acorns of overcup oak. It normally is an associate of overcup oak, but ordinarily occurs only scatteringly on the Big Terrace.

Growth analysis studies were made on the stump cross-sections of two water hickory trees on Sample Plot No. 3, with the following results:

TREE NO.	STUMP HEIGHT FEET.	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	DATE CUT.
77	1.3	10.8	77	177.0	1/20/1914
67	1.0	13.7	89	177.4	1/20/1914

See Plat of Sample Plot No. 3, where the location of the above trees is shown.

RED GUM is commonly found on lands regularly overflowed, but it also sometimes grows in better drained situations. Its seed is easily conveyed by water, and for this reason, soon germinated on the deforested and denuded Big Terrace, after Berry Lake came into existence. It grows scatteringly on the Big Terrace, but is an associate of overcup oak, water hickory, and other species which are found on areas regularly overflowed.

A few trees of this species have reached comparatively large size on this Terrace.

WILLOW OAK is an associate of other species normally found on lands regularly overflowed. It also is occasionally seen on uplands. It is a tree which possesses great ability to grow under a variety of conditions and is commonly planted on upland areas in cities as an ornamental tree. Its acorns may be, and commonly are, transported by water.

Growth analysis studies were made on the stump cross-sections of four willow oak trees on the Big Terrace, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP. INCHES	AGE AT STUMP HEIGHT YEARS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	AMOUNT OF SOIL EROSION AT BASE OF TREE SINCE GERMINATION INCHES.	DATE CUT.
22	2.3	20.0	56	175.90	------	---------
ST2	2.5	26.0	80	------	------	3/13/1914
3	2.0	28.0	63	180.5	------	3/21/1914
28	1.4	20.8	83	177.65	4	---------

Tree No. 22 grew in Sec. 27 on the south shore of Perry Lake, and has been cut for several years. Tree No. ST2 grew a few chains east of Sample Plot No. 3. Tree No. 3 grew on Sample Plot No. 4. Tree No. 28 grew on Sample Plot No. 6, and has been cut for several years. There are many large willow

oaks on the Big Terrace, which are hollow butted. A number were cut for the purpose of growth analysis study, and found to be so defective that accurate age data could not be obtained.

The fruit of Green haw and other species of crataegus is eaten by birds and the seed was conveyed to the Big Terrace in this manner. While green haw is normally characteristic of lands regularly overflowed, the other species of crataegus found are common both to upland areas and overflow lands.

The fruit of deciduous holly is a berry which was eaten by birds, and the seed distributed by them. This species is common on lands regularly overflowed. It also frequently occurs on upland areas.

PERSIMMON seed is commonly transported by water. The species is found on overflow lands, and also on uplands adjacent to Ferry Lake and elsewhere. It is a species which possesses great ability to adapt itself to a wide variety of moisture and soil conditions.

Growth analysis studies were made upon the stump cross-sections of two persimmon trees, occurring on Sample Plot No. 3, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE. FEET	DATE CUT
98	1.3	9.8	50	179.0	11/22/1914
97	1.0	7.2	57	178.3	1/15/1914

Not many older trees of this species are found on this Terrace. See photograph No. 28.

MULBERRY tree seed is scattered by birds, but as yet only a few trees have appeared at higher levels on the Big Terrace. These are of medium size only. It is a species occupying higher and better drained localities of overflow lands.

Growth analysis studies were made on a stump cross-section of a mulberry tree on Big Terrace on Sample Plot No. 4, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BANK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	DATE CUT
10	1.1	13.0	55	179.7	3/21/1914

WHITE ASH seed is conveyed by wind. On the Big Terrace as yet this species is of small to medium size and occurs scatteringly. It is found on the better drained localities of overflow land, and also occasionally in the upland forest.

Growth analysis studies were made on the stump cross-sections of two white ash trees on the Big Terrace on Sample Plot No. 4, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	AMOUNT OF SOIL EROSION AT BASE OF TREE SINCE GERMINATION INCHES	DATE CUT
2	1.17	14.0	66	179.2	8	3/21/1914
28	0.75	13.42	54	178.3	2	3.21/1914

Growth analysis studies were made on the stump cross-sections of two crataegus trees on Sample Plot No. 3, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	DATE CUT
42	0.2	8.6	50	172.5	1/19/1914
51	0.3	10.6	48	172.3	1/19/1914

Trees of this species on the Big Terrace which are larger and older than the above, are rare.

COTTONWOOD TREES are occasionally seen on the Big Terrace. This species is normally found on lands regularly overflowed. Its seed is dispersed by wind, but as yet there are only a few specimens which have germinated in this situation. Those that have, came in on the higher and better drained elevations of the Big Terrace. Most of the trees are of medium size only. One was noted which was a little less than 30 inches at breast height. The species is normally rapid growing.

LOBLOLLY PINE has comparatively recently germinated on the Big Terrace. Most of the trees are less than 20 years of age. One is noted which is 34 years of age. This species is characteristic of Upland forests, and required a sandy soil for its development. Only on a few areas on the Big Terrace, where sand has been washed from the adjacent upland has this species oftained a foothold. During the Raft Period, loblolly

pine did not germinate on the Big Terrace, due, in some measure at least, to the fact that wave action prevented the accumulation of a sandy surface soil washed from the adjacent upland. Its seed is scattered by wind.

The species will stand an occasional temporary overflow, and will even survive extensive soil erosion at its base. See photograph No. 65.

Growth analysis studies were made on a number of stump cross-sections of loblolly pine trees growing on the Big Terrace on the south shores of Perry Lake, in Sec. 28, T. 20 N., R. 16 W., Louisiana Meridian, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	DEPTH OF SANDY SOIL ABOVE ROOT CROWN WASHED FROM ADJACENT UPLAND INCHES	DATE CUT
1	0.4	12.0	16	4.0	3/14/1914
2	0.0	6.4	15	1.8	3/14/1914
3	0.2	8.4	11	3.5	3/14/1914
5	0.1	8.6	14	0.5	3/14/1914

See photograph No.

Growth analysis studies were made on the stump cross-sections of a number of loblolly pine trees, on the Big Terrace on Sample Plot No. 4, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	DEPTH OF SANDY SOIL ABOVE ROOT CROWN WASHED FROM ADJACENT UPLAND INCHES	DATE CUT
2-X	0.6	10.2	12	------	3/21/1914
3-X	0.5	8.4	12	1.5	3/21/1914
4-X	0.7	2.0	12	0.7	3/21/1914
5-X	0.8	1.5	15	1.5	3/21/1914
6-X	0.6	8.0	12	3.5	3/21/1914
7-X	0.7	7.6	12	6.0	3/21/1914
17	1.17	24.0	34	0.0	3/21/1914

There are very few if any loblolly pines on the Big Terrace as large or larger than tree No. 17. See Plat of Sample Plot No. 4.

HACKBERRY. Hackberry and prickly ash occur scatteringly as small trees on the upper and better drained portions of the Big Terrace.

RED CEDAR occurs scatteringly only as small seedlings on the upper portions of Big Terrace.

Persimmon very rarely germinates on old stumps in the water, and with this exception overcup oak and its hardwood associates on the Big Terrace and elsewhere on lands regularly overflowed, cannot germinate, grow, and develop into trees in a permanent body of water.

LIVING CYPRESS TREES ON THE BIG TERRACE.

Scattered among the oaks of the lower levels of the ground of Big Terrace above 173.09 foot contour, are cypress trees which germinated from seed cast upon this Terrace by the waves during high water periods in Ferry Lake during the Raft Period. Being above the mean high water mark, they obtained less soil moisture, but were also subjected to less soil erosion at their bases. They grew, therefore, under site conditions which differed from those prevailing on the lower levels of the Lower Terrace.

The cypress on the Big Terrace are normally of slower growth, have less swell at base, are taller, exhibit less taper, and, while frequently hollow butted, are usually more sound in the stump portions than are the larger cypress growing at lower levels. Indeed it is rare that a large cypress can be found on the Lower Terrace, which is not hollow at the but, making it impossible to accurately determine the total age of the tree.

Growth analysis studies were made on the stump cross-sections of a number of cypress trees occurring on the Big Terrace on the south shore of Ferry Lake, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	TOTAL HEIGHT FEET	DATE CUT
P1	4.5	19.0	110	173.0	----	2/26/1914
7	0.9	13.4	113	174.33	42.6	2/21/1914
XY	0.8	14.4	111	174.5	38.0	2/21/1914
13	1.6	20.6	88	173.5	59.0	2/21/1914

The age at the stump cross-section is less than the total age because it required several years for the trees to reach the stump height given. The locality where the above trees grew is shown below.

TREE NO.	LOCALITY.
P1	Just east of Sample Plot No. 1
7	On Sample Plot No. 2
XY	Just east of Sample Plot No. 2
13	On Sample Plot No. 1

See Plats of Sample Plots Nos. 1 and 2 and Sheet No. 7, and Topographic map of Perry Lake, where the location of the trees is shown.

OLD DRIFT CYPRESS TREES AT LOWER LEVELS ON THE BIG TERRACE.

At lower levels on the Big Terrace there are numerous old drift cypress trees. These differ in size, some being small, others medium to large. They are in various stages of decay.

These drift cypress trees grew at lower levels on the Lower Terrace. Soil erosion at their bases, due to wave action, continued for a long period of years, completely exposed their root systems. They finally fell over and were washed by the waves to their present position. This is clear, from the following discussion:

(1) They are found at lower levels on the Big Terrace, practically everywhere, both in exposed and non-exposed situations. See photographs Nos. 29, 32, 33, 47, 48, 51, etc.

(2) The trees are comparatively short, apparently stunted, exhibit rapid taper, possess large basal diameter, etc., and, in general, resemble in every way the trees now found growing on the Lower Terrace. See photographs Nos. 40, 47, 48, and 51.

(3) The root systems of the drift cypress are, in many cases, extensive, and exhibit every evidence that they were gradually exposed by soil erosion at the bases of the trees. See photographs Nos. 47, 48, and 51.

(4) There are now many dead standing [illegible] cypress trees at lower levels on the beach, with their root systems nearly completely exposed, which are on the point of falling over. See photographs Nos. 10, 21, and 42.

(5) Previous to the recent high water in Ferry Lake, in the spring of 1914, there were many fallen cypress trees in the Middle Terrace, which have not yet been washed to higher levels. See photographs Nos. 11, 42, and 43.

(6) The fallen cypress trees mentioned under heading No. 5 were washed to higher levels during recent high water in the spring of 1914. See photographs Nos. 34.

(7) The stump portions of the drift cypress trees, being broad and relatively light, are nearly always washed higher up on the beach than are the top portions of the trees. This feature is normally characteristic of the drift cypress on the Big Terrace.

(8) The living cypress trees on the lower portions of the Big Terrace.present strikingly different characteristics of form of stems, etc. See photographs Nos. 25,26,34,38, etc.

(9) In general, the amount of soil erosion on the non-exposed lower portion of the Big Terrace is not sufficient to have bared the extensive root systems of the drift cypress trees during their lifetime.

Numerous drift cypress trees are graphically shown on the Plats of Sample Plots Nos. 2, 3, and 4, which see.

Occasionally, dead and down, cypress trees are noted, which germinated and grew on the lower portion of the Big Terrace. These are readily distinguished from the drift cypress which germinated and grew at lower levels on the Lower Terrace.

SIGNIFICANCE OF THE FOREST GROWTH NOW FOUND ON THE BIG TERRACE.

Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Ferry Lake, the forest characteristic of lands regularly overflowed now found on the Bit Terrace is very similar to that which occupied the valley of Cypress Bayou before Ferry Lake came into existence.

The following features of the forest characteristic of lands regularly overflowed on the Big Terrace are of great significance:

(1) Species of trees.

(2) Size of trees.

(3) Density of stand.

(4) Age of trees.

SPECIES OF FOREST TREES NOW GROWING ON THE LOWER TERRACE.

The species growing on the Lower Terrace are, in general, those ordinarily found on lands subject to inundation during a considerable portion of the year in this latitude in the lower Mississippi Valley.

The principal species occurring are as follows:

COMMON NAME.	SCIENTIFIC NAME.
Bald cypress	Taxodium distichum (Linn.)
Water locust	Gleditsia aquatica (Marsh.)
Planer tree	Planera aquatica (Gmel.)

Water locust and planer tree are now comparatively rarely met with at higher levels on this Terrace. Planer tree is more numerous than water locust. At lower levels both species are more common.

The following species is occasionally met with at lower levels:

COMMON NAME.	SCIENTIFIC NAME.
Swamp privet	Forestiera acuminata, Poir.

Two other species were formerly common at lower levels on this Terrace as follows:

COMMON NAME.	SCIENTIFIC NAME.
Button bush	Cephalanthus occidentalis (Linn.)
Black willow	Salix nigra (Marsh.)

Since the complete removal of the Great Raft in the Red River, less than half a century ago, drainage conditions have been better on this Terrace, and the last two mentioned species, characteristic of lands inundated for a considerable portion of the year have encountered unfavorable site conditions, and, for this reason, now occur scatteringly, or rarely, except at lower levels.

A few young trees of the following species are growing on the shore of Clear Lake, Section 6, Township 20 North, Range 15 West, Louisiana Meridian:

COMMON NAME.	SCIENTIFIC NAME.
Sycamore	Platanus occidentalis (Linn.)

CHARACTERISTICS OF THE FOREST ON THE LOWER TERRACE.

Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Ferry Lake, the forest growing on the Lower Terrace possesses numerous characteristics, among which are the following:

(1) It consists of cypress and a few hardwoods. That is to say, it is simple in character.

(2) During the early and middle stages of the Raft Period, it consisted of a dense stand of young trees. During the latter portions of the Raft Period, the stand became thinner and is now comparatively scattering, or wholly absent

in certain localities.

(3) It contains numerous large cypress trees, which are comparatively short, apparently stunted, greatly enlarged at base, exhibit considerable taper, commonly dead topped, usually hollow butted, decrepit, etc. That is to say, the form and condition of the stems indicate that the trees have grown under unfavorable site conditions. See photographs No. 16, 40, etc.

(4) It contains numerous standing cypress trees, many of which are dead and dying, with their root systems almost or entirely exposed by soil erosion at their bases, due to wave action during the Raft Period, and since. See photographs Nos. 10, 21, 42, etc.

(5) It is situated on the site of a hardwood forest, which occupied this territory, before Ferry Lake came into existence.

(6) Exclusive of a few hardwood species which have germinated at higher levels in recent years, and a few stragglers of overcup oaks, at higher levels, it is characteristic of lands inundated for a considerable portion of the year.

(7) It germinated below 173.0 foot contour, the mean high water mark of the Raft Period, at low water stages of the lake.

(8) It is comparatively young, the oldest trees having germinated since Ferry Lake came into existence.

(9) It germinated from seed cast upon the beach by the waters of Ferry Lake after the lake came into existence.

(10) It does not contain species characteristic of the upland forest.

(11) Except a few stragglers of larger overcup oaks at higher levels and a few other hardwood species which have comparatively recently germinated at higher levels, it does not contain hardwood species characteristic of lands regularly overflowed.

THE CONDITION OF THE LOWER TERRACE FOR A NUMBER OF YEARS AFTER FERRY LAKE CAME INTO EXISTENCE.

This Terrace was covered with a hardwood forest before Ferry Lake came into existence. The waters of the lake killed the timber by submerging the bases of the trees for a greater or less period during consecutive growing seasons. Wind, insects, fungi, fire, etc., subsequently destroyed the wood of the dead trees. A greater or less period necessarily elapsed after the timber was killed before the wood of the dead trees was entirely destroyed. The principal destructive agencies were the following:

(1) Wind. Heavy winds frequently broke off tops and limbs of living trees, and very readily the tops and limbs of dead trees. When their hold upon the soil is loosened by root

decay, dead trees are easily wind thrown. Occasionally, heavy winds occur in this region, commonly uprooting even large living trees in the forest. Winds of sufficient force to fell trees which have been dead for a few years are common in this locality. Dead trees on this Terrace were more easily wind thrown on account of a weakened hold upon the soil, due to exposure of the upper portions of their root systems by wave action. Wind thrown trees on the ground exposed to the air soon rot.

(2) (2) Insects. Wood destroying forest insects are common. As soon as the forest trees on the Middle Terrace were killed by the waters of Ferry Lake, the wood was, undoubtedly, almost immediately infested with various species of forest insects. The openings in the wood made by the insects commonly also admits the spores of wood destroying fungi. Insects and fungi working together soon destroy the dead wood.

(3) Fungi. Many species of saprophytic fungi are abundant everywhere in the forest. As soon as the trees occupying the Lower Terrace were killed by the waters of Ferry Lake, the wood was almost immediately attacked by numerous species of fungi, causing it to rot. The wood of a few species, such as red cedar, black locust, etc., is comparatively durable in contact with the ground, lasting for many years. The wood of most forest trees, however, when dead and on the ground,

commonly rots quickly.

Varying with the species, portions of the stumps and roots below the ground surface may persist for many years after the wood above ground has disappeared. In such event, however, the wood is usually in a condition of advanced decay. The wood of overcup oak is, comparatively speaking, very durable in contact with the ground, and also when exposed to the air and elements. Portions of overcup oak stumps still remain at lower levels on the beach, commonly very much dilapidated, jagged, decayed, and worn down nearly to the ground level. See photograph No. 16, and Plats of Sample Plots Nos. 2 and 3.

(4) Fire. During dry seasons at low water stages of the lake, the dead material on the beach undoubtedly became dry and occasionally burned fiercely when ignited, soon destroying the dead timber. Drift material accumulating on the beach among the dead trees, becoming dry in seasons of drouth, undoubtedly, was the source of fuel for fires.

The killed timber on the Lower Terrace was, therefore, exposed to various destructive agencies, which, in the course of years, destroyed it.

DRIFT MATERIAL ON THE BEACH DURING THE RAFT PERIOD.

A few years after Perry Lake came into existence, drift material commenced to collect upon the beach. This drift

material was derived as follows:

(1) Twigs, limbs, and bark of dead trees in the water, which were broken off by wind and waves. Drift wood derived from this source soon accumulated on the beach.

(2) Decayed tops and stems of trees broken off above water by wind and waves. These were cast upon the beach at various times after the timber was killed, in largest quantity after the wood was considerably decayed and more or less continuously since.

(3) Pieces of decayed stems and trees broken off by the waves at various times since Ferry Lake has been in existence, but more generally, after the dead wood was considerably decayed.

(4) Entire dead trees cast upon the beach by the waves. Near the shores of Ferry Lake, wave action was continuous and severe, commonly eroded the soil away from the bases of the dead trees, to such an extent that they subsequently fell over and were washed to higher levels on the beach, or broken to pieces by the waves.

In times of low water in hot, dry seasons, drift material upon the beach became dry and undoubtedly burned fiercely when ignited by accident or otherwise, destroying the standing dead timber near the lines of drift.

BELT OF CYPRESS TIMBER ON THE LOWER TERRACE.

Associated with other species common to lands inundated for a considerable portion of the year, cypress constitutes a belt of timber surrounding Ferry Lake, which was much better defined during the later portions of the Raft Period than at the present time. Severe wave action at the bases of the trees on this Terrace, especially in exposed situations, during the Raft Period and later, has completely deforested the beach in many places. Soil erosion at the bases of the trees brought about the exposure of their root systems, and, later, the death of the trees, which subsequently fell over and were washed to higher levels on the beach where many of them are still in various stages of decay. In some places, however, the belt of living cypress is still well defined on the Lower Terrace. See photographs Nos.32,42,and Plat of Sample Plot No. 3.

ORIGIN OF THE BELT OF CYPRESS TIMBER ON THE LOWER TERRACE.

When Ferry Lake came into existence, a number of cypress trees were not killed outright by the submergence, but continued to live a number of years, a few of them surviving even to the present time. These, as well as cypress trees growing in the valleys of the tributaries flowing into Ferry Lake,

produced seed more or less regularly, which, in the cones, float upon the water, and were cast upon the beach by the water where they germinated. Cypress seed, therefore, was available and fairly plentiful upon the beach soon after Ferry Lake came into existence. The cypress seed soon germinated freely on the ground in the strip of territory between the low water mark and the 173.00 foot contour, which marked the mean high water position during the Raft Period.

Therefore, exclusive of the territory in and adjacent to the valleys of the tributaries which flow into Ferry Lake, the belt of cypress timber which germinated on the beach below the mean high water mark of the Raft Period, came in subsequent to the formation of Ferry Lake, and the age of the older cypress trees in this belt is a few years less than the age of the lake.

THE NON-EXISTENCE OF A CYPRESS FOREST ON THE LOWER TERRACE BEFORE FERRY LAKE CAME INTO EXISTENCE.

A question might arise as to whether the belt of cypress timber on the Lower Terrace is not the immediate successor of another belt of large and old cypress timber which might have occupied this territory previous to the germination of the older trees now found thereon. This position is entirely untenable for many reasons, among which are the following:

(1) There is absolutely no evidence whatever that the Lower Terrace, exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Ferry Lake, was covered with a belt of cypress timber, consisting of trees which were large, and old, or a cypress forest of any character, immediately antedating the oldest trees now found thereon.

(2) There is no reason to suppose that the Lower Terrace, exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Ferry Lake, was occupied by a cypress forest, consisting of trees, which were large and old, or a cypress forest of any character, immediately antedating the largest and oldest trees now found thereon.

(3) Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Ferry Lake, in order that a practically pure cypress forest, growing under site conditions suitable to it, consisting of trees which were large and old could have occupied the Lower Terrace for several centuries, more or less, it would have been necessary for Ferry Lake to have been in existence for several centuries, with a mean high water mark in approximately the same position as during the Raft Period.

All of the contributing evidence on this point shows that Ferry Lake has comparatively recently come into existence sometime during the latter part of the 18th century, and did not

occupy its position of the Raft Period for several centuries.

(4) Exclusive of the territory in and adjacent to the tributaries flowing into Ferry Lake, the oldest cypress trees on the Lower Terrace are still comparatively young. Cypress commonly lives to be 300 to 400 years of age, and occasionally 600 years, or older. The oldest tree found by me in this belt of timber was 133 years of age at stump height, while most of the larger trees were younger, averaging from 90 to 120 years of age.

It might be argued in this connection that, on account of extensive soil erosion at the base of the trees in numerous places which ultimately causes their death, that no trees could live to be more than approximately 133 years of age. This position is untenable, as a general proposition, because there are comparatively non-exposed places on the beach, where soil erosion has been relatively inconsiderable, and where cypress trees could have lived and continued to grow for a much longer period of time.

(5) The species, age, and character of the older and larger hardwoods on the Big Terrace, characteristic of lands regularly overflowed, which germinated a few years after the older and larger cypress now found on the Lower Terrace came in, as well as the species, age, and character of the hardwoods characteristic of upland forests, still found on the upper

portions of the Big Terrace, is proof that the Lower Terrace, exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Perry Lake, was not covered with a belt of cypress timber, consisting of trees, which were large and old, or a cypress forest of any character, immediately antedating the older and larger trees now found thereon.

(6) There is absolute evidence that this belt of cypress, exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Perry Lake, is growing on the site of a hardwood forest, which antedated the oldest cypress trees now found growing therein. This evidence is in the form of occasional fragments of stumps and roots of hardwood trees which have not yet completely decayed or been destroyed. These stumps are more in evidence on the lower portions of the Terrace and are large and numerous at adjacent lower levels where they have been preserved in the water, although they are commonly very jagged, dilapidated, decayed, and frequently worn down almost to ground level.

The seeds of water locust, planer tree, and button bush readily float on the water and were conveyed to the Lower Terrace in this manner.

FORM OF STEMS OR BOLES OF CYPRESS TREES WHEN GROWING UNDER UNFAVORABLE SITE CONDITIONS.

Unfavorable site conditions for cypress prevailed at lower levels on the Lower Terrace, because it was inundated for a considerable portion of the year, and also because of extensive soil erosion at the bases of many or most of the trees, especially in exposed situations. The unfavorable site conditions are reflected in the form of the tree stems, which are generally comparatively short and apparently stunted, usually considerably enlarged at base, commonly dead topped, ordinarily exhibit considerable taper, are frequently hollow butted, and otherwise decrepit. See photographs Nos. 10, 16, 21, 40.

FORM OF THE STEMS OR BOLES OF CYPRESS TREES WHEN GROWING UNDER FAVORABLE SITE CONDITIONS.

Cypress, when growing under favorable site conditions, commonly develops a tall stem, being normally a two, three, or four, sixty-to-eighty log tree; has comparatively speaking less taper, exhibits a less pronounced swell at base, and is commonly, especially above the butt, fairly healthy and thrifty until the approach of old age, unless affected by a peculiar heart rot giving rise to a condition known as peckyness. See photograph No. 41.

SIZE AND AGE OF CYPRESS TREES GROWING ON THE LOWER TERRACE.

A number of larger cypress trees on the Lower Terrace were cut for growth analysis study. Most of these were, however, found to be hollow, and so defective in the interior of the stump portions that accurate total age data could not be obtained. Many of the larger trees were found to be a few years over 100 years of age. The smaller trees are younger.

Growth analysis studies were made on the stump cross-sections of a number of smaller and soundor cypress trees on the Lower Terrace, on Sample Plot No. 3, with the following results:

So the larger trees would be expected to be older

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	AMOUNT OF SOIL EROSION AT BASE OF TREE INCHES	DATE CUT
0-3	2.8	16.2	55	----	------	1/21/1914
239	0.1	----	57	168.5	12	12/31/1913
230	10.4	6.6	67	168.7	13	11/24/1913
33-A	0.3	8.4	47	-----	-------	12/6/1913
0-4	0.5	11.8	62	-----	------	1/21/1914
31	0.3	17.6	64	168.7	4	12/6/1314.
0-2	3.9	22.0	93	-----	------	1/21/1914

Trees Nos. 230 and 239 were so defective in their stump portions that accurate age data could not be obtained below the stump height given.

See Plat of Sample Plot No. 3.

Growth analysis studies were made on the stump cross-sections of two cypress trees on the Lower Terrace on the south shore of Perry Lake, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	DATE CUT
ST-1	1.75	23.6	106	----	3/13/1914
95	3.80	30.8	133	166.66	1/20/1914

Established before 1781

173.09 was High water level during refr

167.00 was 1914 current water level ~ about same as pre refr

Tree No. ST-1 grew on the upper part of the Lower Terrace in Sec. 33, approximately 28 chains northeast of Sample Plot No. 3.

Tree No. 95 grew on Sample Plot No. 2. See photograph No.17 , and Plat of Sample Plot No. 2.

Several years were required to reach stump height.

This tree could easily have established prior to refr

Growth studies were made on the stump cross-sections of four cypress trees on the Lower Terrace on the west shore of James Bayou, in NW.¼ of Sec. 5, T. 20 N., R. 16 W., Louisiana Meridian, with the following results:

TREE NO.	STUMP HEIGHT FEET.	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET
CJB-1	2.70	23.3	132	171.76
CJB-2	3.22	23.6	107	171.33
CJB-3	3.00	23.4	103	172.24
CJB-4	2.70	21.2	118	172.16

Established prior to 1782

Established prior to 1796

The above trees grew on the Lower Terrace, in a belt of cypress which germinated after Ferry Lake came into existence, on the site of a hardwood forest which covered this Terrace previous to the existence of the lake. They grew in a territory not influenced by the small tributaries which flow in the James Bayou. Several years were required to reach the given stump height. See Sheet No. 7, Topographic map of Ferry Lake for the location of the above trees.

About 2 yrs in some case

Growth analysis studies were made on the stump cross-sections of three cypress trees on the Lower Terrace on the south shores of Ferry Lake. Lot 1, Sec. 28, T. 20 N., R. 16 W., Louisiana Meridian, in the valley of a small tributary coming in from the south, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS
CA	3.0	38.8	118
CB	3.2	27.2	98
CC	3.4	25.6	91

Est. 6½ shed prior to 1796

The above trees were tall, sound, and healthy when cut recently for construction timbers. They germinated after Ferry Lake came into existence.

Not permanently flooded

Cypress seed germinates freely on the ground in the presence of sufficient moisture but, except when cypress trees germinate on old decaying logs and stumps in the water, mixed

forests of cypress and its associated hardwoods cannot germinate, grow, and develop into trees in a permanent body of water. PLA PLANER TREE is an associate of cypress on lands inundated for a considerable portion of the year. It is a small tree, low and bushy, commonly occurring only scatteringly, and is relatively shorter lived. Its occurrence in this connection is not significant.

WATER LOCUST is also an associate of cypress on lands inundated for a considerable portion of the year. Its seed, contained in pods, readily floatsupon the water, and was quickly conveyed to the Lower Terrace after Ferry Lake came into existence. Like planer tree, it is relatively small. It is comparatively short lived, and its occurrence in this connection is not particularly significant.

A growth analysis study was made on the stump cross-sections of a water locust tree upon the Lower Terrace on the Sample Plot No. 3, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	DATE CUT
241	0.5	10.4	43	168.62	12/3/1913

Not many larger trees of this species are found on the Lower Terrace.

BUTTON BUSH is merely a shrub growing at lower levels with cypress on land inundated during a considerable portion

of the year.

BLACK WILLOW is normally found bordering the water at or near low water mark around Ferry Lake, commonly forming a narrow belt along the shore. It is a very rapid growing species, reaching maturity very young. It germinates on the ground but is capable of enduring a submergence for a considerable part of the year. Being a relatively short lived species, its occurrence is not significant.

Water locust and willow rarely germinate on old stumps in the water, and, with this exception, water locust, planer tree, and black willow cannot germinate, grow, and develop into trees in a permanent body of water.

SPECIES OF TREES CHARACTERISTIC OF LAND REGULARLY OVERFLOWED ON THE UPPER PORTIONS OF THE LOWER TERRACE.

Due to better drainage conditions at higher levels in recent years tree species characteristic of lands regularly overflowed are coming in. Chief among these are the following:

COMMON NAME.	SCIENTIFIC NAME.
Overcup oak	Quercus lyrata (Walt.)
Willow oak	Quercus phellos (Linn.)
Red gum	Liquid-amber styraciflua (Linn.)
Green haw	Crataegus viridis (Linn.)
Red haw	Crataegus (Species)

Occasionally a few small seedlings of loblolly pine, pinus taeda, are seen on the upper levels of the Terrace.

There are occasionally seen on the Lower Terrace a few stragglers of larger overcup oaks which germinated during the latter portions of the Raft Period. An examination of stump cross-sections of these show that they made a very slow growth previous to the coming of better drainage conditions something less than half a century ago.

Growth analysis studies were made on the stump cross-sections of two overcup oak trees growing on the upper portion of the Lower Terrace, on Sample Plot No. 2, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	DATE CUT	
102	0.6	15.0	49	170.6	3/14/1914	1865
103	0.0	14.0	46	170.3	3.14/1914	1868

Both of the above trees, pioneers on this Terrace, grew comparatively slowly for the first 14 or 15 years, indicating unfavorable site conditions. Drainage conditions later became better, and since then, both trees made good growth. There has been some soil erosion at the base of both the trees. Overcup oak trees on the upper part of the Lower Terrace as large and old as trees Nos. 102 and 103 are rare. or intense competition

Growth analysis studies were made on the stump cross-sec-

tions of several other oak trees, on the upper portion of the Lower Terrace, with the following results:

TREE NO.	SPECIES	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	DATE CUT	
40	Willow oak	0.6	8.8	22	11/21/1913	1871
RYS	Overcup oak	0.1	9.2	16	3/14/1914	1897
RYS-1	Willow oak	0.1	8.4	16	3/14/1914	1897

Willow oak No. 40 grew on Sample Plot No. 3. Willow oak No. RYS, and overcup oak RYS-1 grew just west of Sample Plot No. 2. Willow oaks on the Middle Terrace older than tree No. 40 are rare.

A growth analysis study was made on the stump cross-section of an overcup oak on the Lower Terrace on the west side of James Bayou, in the NE.¼ of Sec. 5, T. 20 N., R. 16 W., Louisiana Meridian, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES.	AGE AT STUMP HEIGHT YEARS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET	DATE CUT	
OC-1	8.5	12.2	25	172.63	3/4/1914	1888

Overcup oaks on the Lower Terrace larger and older than tree No. OC-1 are rare.

SIGNIFICANCE OF THE OLDER FOREST GROWTH NOW FOUND ON THE LOWER TERRACE.

The older forest growth now found on the Lower Terrace germinated after Ferry Lake came into existence. The age of the older trees is therefore of great significance.

It should be stated that the above paragraph refers only to the forest growth found on those portions of the Lower Terrace not in and adjacent to the valleys of the tributaries flowing into Ferry Lake.

RECESSION OF THE WATERS OF FERRY LAKE SINCE THE FINAL COMPLETE REMOVAL OF THE GREAT RAFT IN THE RED RIVER.

Something less than a half a century ago, drainage conditions became better at lower levels on the Lower Terrace, due to several causes, among which were the following:

(1) Improvement of the natural drainage around the Great Raft in the RedRiver a few years before the final removal of the Raft.

(2) Final complete removal of the Great Raft in the Red River by the United States Government, approximately in 1872.

The causes mentioned above brought about a gradual recession or lowering of the waters of Ferry Lake, the mean high water level dropping from 173.09 foot contour to, finally, its present position, approximately at the 167 foot contour. ← By when?

At the lower levels on the Lower Terrace and above the present mean low water mark there is a strip of territory which is now inundated only for a considerable portion of the year. Upon this strip species of trees characteristic of such overflow lands has been enabled to germinate, forming the belt of timber discussed under the next heading.

BELT OF YOUNG TIMBER
ON THE LOWER LEVELS OF THE LOWER TERRACE,
ABOVE THE MEAN LOW WATER MARK OF RECENT YEARS.

This belt of your timber germinated on the beach, above mean low water mark, at low water stages of the lake, in comparatively recent years. It occupies a portion of the site of the hardwood forest, which covered the valley of Cypress Bayou, before Ferry Lake came into existence. The remains of this hardwood forest may still be seen at lower levels in this belt in the shape of numerous oak stumps still standing in place, commonly very much dilapidated, jagged, decayed, and worn down nearly to the ground level. See Plats of Sample Plots Nos. 2 and 3.

This indicates that the 1911 mean low water level is higher than the present mean low water level

In some places this stand of young timber is dense. In others, where the shore gradient is steeper, it is thin, scattered, or practically absent.

At lower levels above low water mark, the stand is not of uniform height, younger seedlings of cypress and planer tree which have germinated in comparatively recent years being common.

SPECIES OF TREES GROWING IN THE BELT OF YOUNG TIMBER ON THE LOWER LEVELS OF THE LOWER TERRACE, ABOVE MEAN LOW WATER MARK OF RECENT YEARS.

The species commonly occurring are as follows:

COMMON NAME.	SCIENTIFIC NAME.
Bald cypress	Taxodium distichum (Linn.)
Water locust	Gleditsia aquatica (Marsh.)
Planer tree	Planera aquatica (Gmel.)
Swamp privet	Forestiera acuminata (Poir.)
Black Willow	Salix Nigra (Marsh.)
Button bush	Cephalanthus occidentalis (Linn.)

CHARACTERISTICS OF THE BELT OF YOUNG TIMBER ON THE LOWER LEVELS OF THE LOWER TERRACE, ABOVE THE MEAN LOW WATER MARK OF RECENT YEARS.

This belt of young timber possesses numerous characteristics, among which are the following:

(1) It consists of cypress and a few hardwoods; that is to say, it contains but few species or is simple in character.

(2) Where the shore gradient is less steep the stand is commonly dense; where the shore gradient is steeper the stand is commonly thin, scattering, or practically absent.

(3) It is situated on the site of the hardwood forest,

which formerly occupied this terrace, before Ferry Lake came into existence.

(4) It germinated at lower levels on the Lower Terrace, above low water mark, at low water stages of the lake.

(5) It germinated from seed cast upon the beach by the waters of Ferry Lake, and also from seed which grew upon mother or seed trees upon the Lower Terrace.

(6) It is, comparatively speaking, the youngest belt of timber occurring on the shores of Ferry Lake, having germinated since drainage conditions became better on the Lower Terrace during the last half century, the trees ordinarily averaging between 20 and 40 years of age.

(7) It is characteristic of lands inundated for a considerable portion of the year.

(8) It does not contain species of hardwood trees characteristic of lands regularly overflowed.

(9) It does not contain species of hardwood trees characteristic of the upland forest.

NOTES ON THE VARIOUS SPECIES.

Cypress occurs more numerously in this belt than its associated species and in some places the stand is dense, more especially, where the shore gradient is comparatively slight. In other places where the shore gradient is steeper,

the stand is thin, scattering, or practically absent. See photographs Nos. 9, 33, 40.

Growth analysis studies were made on the stump cross-sections of a number of representative and average cypress trees growing in this belt on Sample Plot No. 3, with the following results:

TREE NO.	STUMP HEIGHT FEET.	DIAMETER INSIDE BARK ON STUMP INCHES.	AGE AT STUMP HEIGHT YEARS.	TOTAL HEIGHT OF TREE FEET.	DATE CUT.
A-1	0.9	4.6	30	8.5	11/21/1913
A-2	0.2	6.4	32	11.2	11/21/1913
A-3	0.1	5.4	42	11.0	11/21/1913
A-4	0.1	3.2	42	6.0	11/21/1913
A-5	0.2	3.5	37	9.0	11/21/1913
A-6	0.2	3.2	32	-----	11/21/1913
C-6	0.2	6.0	38	14.0	1/21/1914
C-7	0.1	3.7	29	9.1	1/21/1914
C-7	0.1	4.6	27	9.5	2/4/1914
C-3	0.1	5.2	33	16.7	1/17/1914
C-4	0.2	5.2	24	15.6	1/17/1914

Likely overestimate of age for trees this size

Water conditions are fairly favorable for cypress growth where the above trees grew. The soil, however, is a stiff clay, wholly unsuited to the rapid and best development of the species. See Plat of Sample Plot No. 3.

Growth analysis studies were made on the stump cross-

section of a cypress tree growing in this belt on Sample Plot No. 1, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	TOTAL HEIGHT OF TREE FEET	DATE CUT.
X-7	0.2	7.0	27	20.0	1/21/1914

Total height, diameter at breast height, and other measurements were made on several representative and average cypress trees growing in this belt on Sample Plot No. 1, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER AT BREAST HEIGHT INCHES.	TOTAL HEIGHT FEET	DATE CUT
X-1	0.2	4.6	20.0	1/21/1914
X-2	0.2	4.1	21.0	1/21/1914
X-3	0.2	4.5	27.3	1/21/1914
X-4	0.3	5.4	29.7	1/21/1914

The above trees average between 25 and 35 years of age.

There has been some fill about the bases of the trees in this belt on Sample Plot No. 1, due to sediment deposited by the waters of a tributary flowing into Ferry Lake. On account of better soil conditions, the young timber has made more rapid height and diameter growth than have the young trees on Sample Plot No. 3.

Planer Tree, ordinarily low and bushy, has as yet hardly passed the shrub stage.

Growth analysis studies were made on the stump cross-sections of three representative and average planer trees growing in this belt on Sample Plot No. 3, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP HEIGHT YEARS	TOTAL HEIGHT FEET	DATE CUT.
A-7	0.1	4.1	32	----	11/21/1913
P-1	0.1	4.8	22	8.0	1/17/1914
P-2	0.1	5.8	25	14.9	1/17/1914

See Plat of Sample Plot No. 3.

Water Locust in this belt is still a small tree.

Growth analysis studies were made on the stump cross-sections of two representative and average water locust trees growing in this belt on the Sample Plot No. 3, with the following results:

TREE NO.	STUMP HEIGHT FEET	DIAMETER INSIDE BARK ON STUMP INCHES	AGE AT STUMP YEARS	TOTAL HEIGHT FEET	DATE CUT
A-6	0.4	6.4	28	----	11/21/1913
W-1	0.2	6.6	26	14.5	1/17/1914

See Plat of Sample Plot No. 3.

Black Willow grows rapidly and matures in a comparatively few years. It is commonly found skirting the borders of lakes and streams above low water mark, and has the ability

to grow at comparatively lower levels than its associated species. That is to say, it is a more water loving tree.

SIGNIFICANCE OF THE BELT OF YOUNG TIMBER ON THE LOWER LEVELS OF THE LOWER TERRACE ABOVE LOW WATER MARK OF RECENT YEARS.

The stand of young timber on the lower levels of the Lower Terrace is typical in many ways of the stand of young timber which germinated on the Lower Terrace soon after Ferry Lake came into existence, when it was as old as the stand under consideration. Exclusive of the territory in the valleys of the tributaries flowing into Ferry Lake, however, the trees ordinarily have made a less diameter and height growth in the same number of years, because, while water conditions were suitable, soil conditions were generally unfavorable, in that the trees germinated and grew usually in a hard clay soil, containing little humus, unsuited to rapid diameter and height growth.

The final complete removal of the Great Raft in the Red River a little less than half a century ago caused better drainage conditions to prevail at lower levels on the Lower Terrace, and the belt of timber under consideration soon germinated thereon, water conditions being suitable and tree

seed of species characteristic of lands inundated for a considerable portion of the year being present.

The average age of the older young timber in this belt is, therefore, of great significance.

THE LIVING FOREST OCCUPYING THE VALLEY OF CYPRESS BAYOU, NOW THE BED OF FERRY LAKE, WHEN THE LAKE CAME INTO EXISTENCE.

The living forest occupying the valley of Cypress Bayou at the time Ferry Lake came into existence was at lower levels adjacent to the Bayou and elsewhere, composed of species characteristic of lands inundated for a considerable portion of the year. At higher levels, mostly above the 158 foot contour, it was composed of species characteristic of lands regularly overflowed, such as are now found on the Big Terrace. In fact, the forest now found on the forested portions of the Big Terrace as on Sample Plot Nos. 2, 3, and 6, is typical and representative in many ways of the forest growth as it existed over the greater part of the valley of Cypress Bayou before submergence.

CHARACTERISTICS OF THE LIVING FOREST OCCUPYING THE VALLEY OF CYPRESS BAYOU WHEN FERRY LAKE CAME INTO EXISTENCE.

The living forest occupying the valley of Cypress Bayou when Ferry Lake came into existence possessed numerous characteristics among which were the following:

(1) At lower levels mostly below the 158 foot contour

and between this contour and the banks of Cypress Bayou a forest characteristic of lands inundated for a considerable portion of the year, consisting of cypress, planer tree, water locust, willow, and button bush was found.

Above the 158 foot contour and at higher levels a forest characteristic of lands regularly overflowed consisting of overcup oak, willow oak, red gum, water hickory, persimmon, cottonwood, hackberry, white elm, mulberry, white ash, crataegus, swamp holly, etc., was found.

At still higher levels species characteristic of the Upland Forest, such as loblolly pine, post oak, etc., was found.

That is to say, the forest consisted of numerous species and was, therefore, complex in character.

(2) The hardwood forest consisted of a dense stand of trees of various sizes from small trees up to trees which were from 24 to 30 inches in diameter or larger.

(3) The hardwood trees were of various ages ranging from young seedlings up to 240 years of age or older.

(4) The individual trees of this hardwood forest were the descendants of species of trees occupying this valley before the forest under consideration germinated.

(5) At lower and intermediate levels it was more or less regularly overflowed by the overflow waters of Cypress Bayou.

(6) It was a magnificent, virgin, primaeval forest up to the time of the submergence which produced its death.

(7) It had occupied its position for many centuries before Ferry Lake came into existence.

AGE OF THE OLDER LIVING HARDWOOD TREES OCCUPYING THE VALLEY OF CYPRESS BAYOU, NOW THE BED OF THE LAKE, WHEN THE LAKE CAME INTO EXISTENCE.

The age of the older hardwood trees above referred to is obtained by growth analysis studies of the old stumps now found in the water.

Growth analysis studies were made of cross-sections and remnants of cross-sections of many of the old hardwood stumps in the water. The rate of growth varies with the species, elevation of ground surface, degree of crowding in the forest, etc. The age varies with the rate of growth, the size of the tree, etc.

The hardwood stump representing the oldest tree found by me exhibited approximately 240 annual rings of growth at a stump height of 6.5 feet. This was an oak stump, 24 inches in diameter, elevation of hard ground surface at base of tree 167.5 feet. Doubtless there are many larger hardwood stumps in the lake which represent older trees.

Many of the larger hardwood trees killed by submergence

were from 150 to 240 years of age or older when killed. Many stumps are now in such an advanced stage of decay that accurate growth analysis thereof is impossible.

BELT OF HARDWOOD STUMPS BETWEEN THE SUBMERGED BANKS OF THE CHANNEL OF CYPRESS BAYOU AND THE SHORES OF FERRY LAKE.

This belt of hardwood stumps is absolutely unique and presents a most remarkable spectacle. It extends from the submerged banks of Cypress Bayou to the shores of Ferry Lake. The stumps are the remains of a magnificent mixed hardwood forest which covered the valley of Cypress Bayou before Ferry Lake came into existence. The stump portions of the trees are smaller than they were at the time the trees were killed because portions have decayed and have been broken off by the waves. Stumps and snags of the more durable species are now most commonly met with. The stumps of species less durable have practically disappeared. Indeed, very many stumps everywhere have either completely rotted, or have been broken to pieces by the waves and totally destroyed. See photographs Nos. 2 to 6, inclusive.

ORIGIN AND SUBSEQUENT HISTORY OF THE BELT OF OLD STUMPS BETWEEN THE SUBMERGED BANKS OF CYPRESS BAYOU AND THE SHORES OF FERRY LAKE.

The old stumps in this belt are only the remains of a magnificent virgin, mixed, hardwood forest, which formerly occupied the valley of Cypress Bayou, now the bed of Ferry Lake. When the valley was submerged the forest trees were alive and the stump portions were covered with bark and were larger than they now are. The dead trees were formerly very numerous. The several stages in the origin of the old stumps, snags, and stems now found in the water may be stated as follows:

(1) Dense Living Forest of Mixed Hardwood Trees and Cypress before submergence.

The forest before submergence is discussed under the heading, "The Forest Occupying the Valley of Cypress Bayou, now the Bed of Ferry Lake, When the Lake Came into Existence."

(2) Living Forest Trees in the Water After Submergence.

The hardwood trees remained alive one or two years after the submergence, the valley of Cypress Bayou during this time being simply a flooded forest of living trees. The trees finally all died, however, being in reality actually drowned to death. A number of cypress trees, however, were not killed by the submergence, some of them surviving even to the present time.

(3) Dead Standing Trees in the Water, Which Remained Standing a Few Years Before Decay was Noticeable.

For a few years after the trees were killed they stood with their bases in the water, leafless and bare, before they commenced to materially decay. The valley of Cypress Bayou during this time was in reality simply a flooded forest of standing dead trees.

(4) State of Progressive Decay and Deterioration Continuing to the Present Time.

A few years after the trees were killed, spores of saprophytic fungi borne by the wind soon germinated in the tissues of the dead wood and since then, the killed timber has been in a state of progressive decay. As the years passed wood rotting fungi have been constantly at work in the dead tree stems projecting out of the water, and the waves have been constantly at work wearing away and breaking to pieces the tissues of the wood, until at the present time many stumps and stems have completely rotted, and others have been broken to pieces by the waves. The stems remaining are only scattered remnants of the stump and stem portions of the trees killed by submergence.

For many years after the floor of the wooded valley of Cypress Bayou was submerged, the valley itself, except in Cypress Bayou proper, was simply a flooded woods differing

from the valley before submergence only in the following particulars:

(1) The standing hardwood trees were dead.

(2) The bases of the trees were submerged in water which fluctuated in depth during different seasons of the year.

CONDITION OF FERRY LAKE IN 1812.

In 1812 Ferry Lake had been in existence approximately a little more than 30 years.

At this time the submerged valley of Cypress Bayou presented a most remarkable spectacle. There was presented to view a standing forest of great extent consisting of dead trees in a progressive state of decay, with their bases submerged in water. These standing dead trees may be classified as follows:

(1) Large standing dead cypress trees marking the submerged Banks of the channels of Cypress Bayou and its tributaries through the bed of Ferry Lake.

(2) A number of <u>living</u> cypress trees in various parts of the Lake especially along the banks of the submerged channels of the tributaries flowing into Cypress Bayou, and in some instances extending for considerable distances back away from the tributary channels. Many cypress trees were

not killed outright by the submergence which produced Ferry Lake, but continued to live on a number of years before finally succumbing to the unfavorable environment.

(3) A dense forest of dead standing hardwood trees, considerably decayed, from which most of the branches had fallen.

In most cases the entire tree trunks of both cypress and hardwoods, especially of larger trees of the more durable species, were standing in 1812, although many of them were in an advanced state of decay.

When the wooded valley traversed by Cypress Bayou became flooded the drowned forest was given the name of Ferry Lake.

CHARACTERISTICS OF THE BELT OF STUMPS BETWEEN THE SUBMERGED BANKS OF CYPRESS BAYOU AND THE SHORES OF FERRY LAKE.

This belt of stumps possesses numerous characteristics, among which are the following:

(1) It consists of scattered cypress and numerous hardwood stumps of species characteristic of lands regularly overflowed; overcup oak, willow oak, red gum, water hickory, persimmon, cottonwood, hackberry, elm, mulberry, ash, etc.

(2) The stumps vary in size from small to large.

(3) The stumps are ordinarily jagged, dilapidated, decayed, and worn down in many instances to low water levels

(4) In many places the hardwood stumps are still very numerous, indicating the density of the hardwood forest formerly occupying the site.

(5) Normally, only the upper portions of the stumps project above the water surface. In times of occasionally temporary excessively high water practically all the hardwood stumps are covered. In times of low water the tops of thousands of hardwood stumps may be seen projecting from one to three feet or more above the water surface.

(6) There are thousands of stumps beneath the surface, which normally do not project above the water.

(7) There are numerous prostrate trees and snags which lie partly or wholly buried in the soft mud, which covers the bottom of the lake. See photograph No. 9.

(8) The stumps are in a state of progressive decay and this, together with wave action, will ultimately result in their complete destruction.

(9) The stumps are only remnants of the stump and stem portions of the hardwood trees killed by submergence.

(10) An examination of the wood tissues of many old stumps indicate that the rate of growth more especially at higher levels was comparatively slow during the life time of the trees.

(12) Since the time when navigation on Ferry Lake has been possible, the stumps and prostrate portions of trees in the water have always been a dangerous menace and in times of low water have practically prevented navigation, except for small light draft boats elsewhere than in the channel of Cypress Bayou.

See photographs Nos. 2 to 9, inclusive.

On March 16, 1914, an examination and study was made of a number of hardwood and cypress stumps projecting above the water in various places along and both north and south of the submerged channel of Cypress Bayou in Ferry Lake, in Sections 25 and 26, Twn. 20 N., R. 16 W., L. M., with the following results:

STUMP NO.	SPECIES	DEPTH OF WATER ABOVE GROUND SURFACE AT BASE OF STUMP FEET	THICKNESS OF FILL OR SOFT MUD LAYER, IF ANY, AT BASE OF STUMP FEET	ELEVATION OF HARD GROUND SURFACE AT BASE OF STUMP FEET
1	Cypress	10.2	4.0	153.8
2	Oak	7.7	0.0	160.3
3	Cypress	10.3	3.9	153.8
4	Red gum	7.0	0.2	160.8
5	Oak	6.7	0.0	161.3
6	Oak	6.8	0.0	161.4
7	Oak	6.4	0.0	161.6
8	Red gum	6.4	1.0	160.4
9	Mulberry	6.5	1.1	160.4

STUMP NO.	SPECIES	DEPTH OF WATER ABOVE GROUND SURFACE AT BASE OF STUMP FEET	THICKNESS OF FILL OR SOFT MUD LAYER, IF ANY, AT BASE OF STUMP FEET	ELEVATION OF HARD GROUND SURFACE AT BASE OF STUMP FEET
10	Mulberry	6.7	1.0	160.3
11	Red gum	6.8	0.7	160.5
12	Red gum	6.9	1.0	160.1
13	Red gum	7.0	0.8	160.2
14	Cypress	7.2	0.3	160.5
15	Cypress	7.3	0.5	160.2
16	Red gum	7.0	0.8	160.2
17	Red gum	.7	0.7	160.3
18	Red gum	6.7	1.1	160.2
19	Cypress	8.0	0.2	159.8
20	Red gum	7.2	0.3	160.5
21	Red gum	7.0	0.8	160.2
22	Oak	4.8	1.9	161.3
23	Oak	4.6	1.6	161.8
24	Oak	4.5	1.9	161.6
25	Oak	5.0	1.3	161.7
26	Oak	4.5	0.0	163.5
28	Oak	7.8	0.7	159.5
29	Oak	7.8	0.7	159.5
30	Red gum	7.8	1.5	158.7

Elevation of the water surface March 16, 1914 --- 168 feet.

The hardwood stumps are of various sizes, varying from a few inches up to 12 or 14 inches or more in diameter at the water surface. On the above date the hardwood stumps projected from one to three feet out of water.

On March 17, 1914, an examination and study was made of two oak stumps projecting above the water in Ferry Lake, on the south side of the submerged channel of Cypress Bayou, in the SW.¼ of Sec. 20, T. 20 N., R. 15 W., Louisiana Meridian, with the following results:

STUMP NO.	SPECIES	DEPTH OF WATER ABOVE GROUND SURFACE AT BASE OF STUMP FEET.	THICKNESS OF FILL OR SOFT MUD LAYER, IF ANY, AT BASE OF STUMP FEET.	ELEVATION OF HARD GROUND SURFACE AT BASE OF STUMP FEET.
32	Oak	2.7	3.0	162.27
33	Oak	3.2	3.5	161.27

Diameter of stump No. 32 is 24 inches. Diameter of stump No. 33 is 30 inches.

Elevation of water surface March 17, 1914 --- 167.97 feet.

On March 23, 1914, an examination and study was made of a number of stumps projecting above the water of Ferry Lake in Secs. 13 and 24, T. 20 N., R. 15 W., Louisiana Meridian, with the following results:

STUMP NO.	SPECIES	DEPTH OF WATER ABOVE GROUND SURFACE AT BASE OF STUMP FEET	THICKNESS OF FILL OR SOFT MUD LAYER, IF ANY, AT BASE OF STUMP FEET	ELEVATION OF HARD GROUND SURFACE AT BASE OF STUMP FEET
1	Oak	5.6	0.4	161.5
2	Oak	5.9	0.1	161.5
3	Oak	5.9	0.1	161.5
5	Cypress	6.0	1.2	158.3
6	Oak	6.0	1.1	158.2
7	Cypress	6.0	1.1	158.2
8	Cypress	6.0	0.7	158.8
9	Oak	6.0	1.0	158.5
10	Cottonwood	6.1	0.8	158.6
11	Cypress	6.0	0.5	159.0
12	Red gum	6.0	1.2	158.3
13	Oak	6.0	1.1	158.4
14	Red gum	6.1	0.8	158.6
15	Red gum	6.2	1.2	158.1
16	Red gum	6.1	1.4	158.0
17	Red gum	6.1	0.9	158.5
18	Red gum	6.0	1.5	158.0
19	Cypress	6.2	1.3	158.0
20	Cypress	6.1	1.4	158.0
21	Cypress	6.8	0.5	158.2
22	Red gum	9.2	0.3	158.0

STUMP NO.	SPECIES	DEPTH OF WATER ABOVE GROUND SURFACE AT BASE OF STUMP FEET	THICKNESS OF FILL OR SOFT MUD LAYER, IF ANY, AT BASE OF STUMP FEET	ELEVATION OF HARD GROUND SURFACE AT BASE OF STUMP FEET
23	Red gum	8.0	1.5	158.0 ——
24	Red gum	8.0	1.5	158.0 ——
26	Oak	6.3	0.4	160.8
27	Oak	5.6	0.1	167.4

Elevation of the water surface March 23,1914 -- 167.5 feet.

The stumps vary in size up to 12 to 15 inches in diameter or larger at the water surface, and on the above date projected from 1 to 3 feet out of water.

On March 26, 1914, an examination and study was made of a number of stumps projecting above the water of Perry Lake in Secs. 13 and 24, T. 20 N., Range 16 W., Louisiana Meridian, with the following results:

STUMP NO.	SPECIES	DEPTH OF WATER ABOVE GROUND SURFACE AT BASE OF STUMP FEET	THICKNESS OF FILL OR SOFT MUD LAYER, IF ANY, AT BASE OF STUMP FEET	ELEVATION OF HARD GROUND SURFACE AT BASE OF STUMP FEET
1	Oak	3.7	0.4	163.1
2	Oak	3.4	0.5	163.2
3	Oak	3.3	0.7	163.2
4	Oak	3.1	0.4	163.7
5	Oak	3.1	0.4	163.7
6	Oak	3.2	0.6	163.4
7	Oak	2.8	0.2	164.2

Elevation of the water surface March 30,1914 --- 157.2 feet.

On March 31, 1914, an examination and study was made of a number of stumps projecting above the water of Perry Lake, in Sec. 24, T. 20 N., R. 16 W., Louisiana Meridian, with the following results:

STUMP NO.	SPECIES	DEPTH OF WATER ABOVE GROUND SURFACE AT BASE OF STUMP FEET	THICKNESS OF FILL OR SOFT MUD LAYER, IF ANY, AT BASE OF STUMP FEET	ELEVATION OF HARD GROUND SURFACE AT BASE OF STUMP FEET
1	Cypress	10.0	1.0	158.5 —
2	Cypress	11.1	0.9	157.5 —
3	Cypress	11.4	2.4	155.7 —
4	Cypress	11.0	1.3	157.2 —

The following additional data applies to the four stumps above:

STUMP NO.	PRESENT DIAMETER AT WATER SURFACE. INCHES.	HEIGHT OF STUMP ABOVE WATER SURFACE. FEET.
1	23.5	----
2	43.6	20.1
3	52.0	14.0
4	33.0	8.7

Elevation of the water surface March 31,1914 -- 169.5 feet.

THE BELT OF CYPRESS STUMPS WHICH MARKS THE CHANNEL OF CYPRESS BAYOU THROUGH FERRY LAKE.

This belt of stumps, also discussed on page 13 of this Report, represents only remnants of the dead trees which were killed by submergence. Before submergence the living cypress forest covering the Banks of Cypress Bayou consisted of large trees of comparatively great age.

Site conditions were good for the growth of the species and they therefore grew to be large, tall, and old. The trees stood close together, not only along the banks but also in a narrow belt on the sides of the channel below the Banks, down to an elevation of 154 feet or lower.

Most of the cypress trees growing along the channel were killed by submergence, or enduring the unfavorable site conditions for a few years finally succumbed. A few trees have, however, survived even to the present time. Growth analysis studies made upon the stump cross-sections of several of the old dead cypress trees in the water show that the older trees varied from 150 to 400 years of age or over, when killed. These older trees germinated on the ground during the long wooded valley period preceding the existence of Ferry Lake.

DURATION OF STANDING DEAD TREE TRUNKS IN THE WATER.

The dead standing trees in the water have been preserved below the water surface to a varying degree. Wood completely submerged in water may be preserved for a long period, if it remains constantly submerged, and is otherwise protected from destructive agencies.

Above the water, the dead tree trunks were exposed to various destructive agencies as follows:

(1) Fungi. Various species of saprophytic fungi have destroyed portions of the dead trees projecting above the water, the spores of the saprophites being borne by the wind from the fruiting bodies of the fungi to the trunks of the projecting trees. The action of the fungous mycelia is more or less interrupted at low water level, so that less decay is induced in the portions of the wood below the surface of the water, due, among other things, to the lack of aeration in the tissues of the wood. After the wood was altered and softened in the projecting tree trunks by the fungi, the trees were readily wind thrown. As stated elsewhere, heartwood of the bald cypress is especially durable.

(2) Wind. Heavy winds have undoubtedly occasionally occurred on Ferry Lake since the submergence which killed the trees, breaking off portions of the projecting tops. After the tissues of the wood above the water were softened

by fungous action, the heavy tops were easily wind thrown. It should be stated that practically the entire stems of quite a number of dead cypress trees are standing in the water at the present time.

(3) Wave action. Wave action at the base of the stumps is effective in shoal water, is greater near the shore and culminates at the shore line.

The wearing and breaking effect of the waves on the dead stumps and stems is greatest near the surface of the water. At the present time many more stumps are visible during low water than at ordinary levels. The stumps in the shallow water are fewer in number, ordinarily shorter, present a much more broken up and jagged appearance, and have been subjected to more erosion at their bases than stumps in deeper water. In fact, very many, or most of the old stumps near the shore have disappeared, due to causes mentioned above. The greater the depth, the less wave action at the base. The dead trees in the deep water have been subjected to less erosion at their bases than have the dead trees in shallow water. Also, the portions of the stems which remain are longer in deeper water. The tops, especially of the oak stumps, are ordinarily just below or near the water level. The stumps which remain are shorter near the shore, or have disappeared due to the wearing and breaking effect of the shifting water upon the upper portions,

to the eroding action of the water at their bases, and to decay.

(h) Fire. During the early history of the drowned forest under consideration, fire undoubtedly destroyed many standing dead trees and parts thereof which projected out of the water. These fires possibly started in the dead material on the shore and extended to the dead standing trees in the water. In the presence of a fairly strong wind, it was possible for fires to have occasionally burned over various portions of the area of standing dead trees. Many stumps in the water present a charred appearance indicating that they have been burned. It should be stated however that during low water periods in years past, many stumps in the water have been set on fire in order to remove obstructions to navigation.

The following factors have also influenced the durability of the standing dead tree trunks in the water:

(1) Species of trees. Nearly all of the old stumps now found in the water of Berry Lake are either cypress or oak. The cypress has ordinarily a well developed root system, somewhat modified by varying environment, which commonly descends laterally and firmly anchors the tree to the ground. Much erosion must take place at the base of the tree before an individual of this species will fall.

Both overcup oak and willow oak commonly develop a strong tap root and an extensive descending root system, which anchors the tree firmly to the ground. As long as the tap root remains intact, much erosion must take place before the stump falls.

Under the water overcup oak stumps commonly remain in position until the wood composing them is broken to pieces or destroyed by wave action. Overcup oak wood is very hard and heavy and when exposed to the air and soil is very durable, the wood being among the hardest and most durable of our native oaks. The heartwood of the bald cypress is also very durable, being especially resistant to attacks of fungi. The stumps of many other species of dead trees in the water have practically all disappeared, their wood being less resistant to the various destructive agencies.

(2) Size of trees. The larger the trees, other factors being equal, the longer the stumps will remain without complete obliteration. Many of the smaller stumps in Ferry Lake have disappeared, and even the larger oak stumps have been worn by wave action in many cases to a core, or a broken and dilapidated shell.

DATE OF THE SUBMERGENCE WHICH PRODUCED FERRY LAKE.

The approximate date of the submergence which produced Ferry Lake may be ascertained ecologically as follows:

(1) By the age of the older hardwood trees characteristic of lands regularly overflowed which have germinated on the Big Terrace since Ferry Lake came into existence. To the age of the older hardwood trees must be added the interval which necessarily intervened between the time when the overflow waters of the lake first submerged the Big Terrace and the time when the older hardwood trees germinated thereon. The minimum interval varied with the individual trees but was approximately twelve to fifteen years or more.

The oldest hardwood trees characteristic of lands regularly overflowed which have germinated on the Big Terrace since Ferry Lake came into existence, vary in age up to approximately 124 years. Most of them are younger. Adding 12 years to the oldest trees we have 136 years. We therefore obtain 1770 as the approximate date of the origin of the lake.

(2) By the age of the older cypress trees which have germinated on the Lower Terrace since Ferry Lake came into existence. To the age of the older cypress trees must be added the interval which necessarily intervened between the time when the waters of Ferry Lake first submerged the Lower

more probably 2 or 3 years

Terrace and the time when the older cypress trees germinated thereon. The minimum interval varied with the individual trees but was approximately at least one year. The reason for this short interval was due to the fact, fully discussed in the preceding pages, that an abundance of cypress seed was undoubtably present on the Lower Terrace the same year it was first submerged and likewise each year thereafter for a number of years.

The oldest cypress trees which have germinated on the Lower Terrace since Ferry Lake came into existence, vary in age up to approximately 136 years. Most of them are younger. We obtain therefore the year 1777 as the approximate date of the origin of the lake.

The date of the origin of Ferry Lake may be stated approximately as being in the decade between 1770 and 1780, with the probability that its origin dates between 1775 and 1780.

The approximate age may also be ascertained by traditions and by historical and geological evidence, all of which are fully discussed in the Report of Mr. Leverett, the geologist assigned to the case.

ELEVATION OF THE MEAN HIGH WATER SURFACE OF FERRY LAKE IN 1838.

The "Manual of Instructions for the Survey of Public Lands of the United States" issued January 1, 1902, reads as follows: Page 62, Section 154, "Lands bounded by waters are to be meandered at mean high water mark. This term has been defined in a state decision (47 Iowa, 370), in substance as follows:

"High water mark in the Mississippi River is to be determined from the river bed and that only is river bed which the river occupies long enough to wrest it from vegetation."

Again, at page 64, Section 168, "Meander lines will not be established at the segregation line between dry and swamp or overflowed land, but at the ordinary high water mark of the actual margin of the river, or lakes, on which such swamp or overflowed lands border."

That the mean high water mark of 1839, the line below which the hardwood species characteristic of lands regularly overflowed, were wrested from the land, was approximately at the 173.09 foot contour, appears from the following discussion:

(1) During the larger part of the Raft Period and antedating 1812, the Big Terrace immediately above the 173.09 foot contour and elsewhere was covered with a forest, con-

sisting of hardwood species characteristic of lands regularly overflowed, such as overcup oak, water hickory, red gum, etc. The mean high water mark was, therefore, not above the 173.09 foot contour. See Plats of Sample Plots 1 to 6 inclusive, and Photographs Nos. 24, 25, and 27 to 38, inclusive.

(2) During the Raft Period and antedating 1812, the Lower Terrace below the 173.09 foot contour was covered with a forest, consisting of species characteristic of lands inundated for a considerable portion of the year, growing up to the 173.09 foot contour, and occasionally growing slightly above it. That is to say, the mean high water mark was not below the 173.09 foot contour. See Plats of Sample Plots 1 to 6 inclusive, and Photographs Nos. 24, 25, and 27 to 38, inclusive.

(3) During the Raft Period, overcup oak, red gum, water hickory, and other species of trees common to lands regularly overflowed grew down to the 173.09 foot contour, but rarely slightly below it. That is to say, the mean high water mark was approximately at the 173.09 foot contour. See Plats of Sample Plots 1 to 6, inclusive, and Photographs Nos. 27 to 38.

The propositions stated under paragraphs (1) to (3) inclusive above were clearly demonstrated by numerous growth analysis studies made on the stump cross-sections of hardwood trees growing just above the 173.09 foot contour and elsewhere on the Big Terrace, and on the stump cross-sections

of cypress trees growing just below the 173.09 foot contour and elsewhere on the Lower Terrace.

That the 173.09 foot contour was the mean high water mark in 1839 is well authenticated historically as follows:

In 1839, Surveyor Warren, when running his lines from the adjacent upland down to the shores of Ferry Lake very commonly placed his fractional sectional corners approximately at or just above the 173.09 foot contour, all around both Ferry and Clear lakes in T. 20 N., R. 16 W., L. M. See sheet No. 7, Topographic map of Ferry Lake, and the discussion of this subject by Mr. Kidder.

CONDITION OF THE BIG TERRACE IN 1839.

Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Ferry Lake, the condition of the Big Terrace in 1839 may be stated as follows:

(1) The upper portion of the Big Terrace especially in exposed situations was in a raw and more or less denuded condition, much of the surface soil having been eroded and removed in times of high water in Ferry Lake, between the time when it came into existence and the date of Warren's survey. That is to say, the escarpment on the upper side of the Big Terrace exhibited considerable recent cutting and recession at the date of Warren's survey.

(2) There were numerous remains of dead trees of species characteristic of the Upland Forest, standing and prostrate on the ground on the Big Terrace.

(3) The living forest growth on the Big Terrace excepting a few large living post oak trees on the upper portion thereof, consisted of smaller and younger forest trees of species characteristic of lands regularly overflowed. The young trees, while fairly numerous, were comparatively small and different in appearance from the forest growth in the upland forest.

UNTENABLE THEORIES

I. That a lake with the mean high water mark at or near the 180 foot contour, antedating the present Perry Lake by a comparatively few years, occupied the valley of Cypress Bayou and that the dead remains of the hardwood and cypress forest now found in the water have existed through both lakes.

That this theory is untenable appears from the following discussion:

(1) An adequate cause for the existence of such a lake must be established. The existence of such an alleged lake is mere assumption.

(2) If such a lake had actually existed, there would be a strip of territory above the mean high water mark on the Upland Terrace which would have been regularly overflowed every year in times of high water in this alleged lake. If such a lake had existed for only a few years, the upland forest on this strip of territory would have been killed. If the lake had existed for many years, a forest of overcup oak, red gum, water hickory, etc., species characteristic of lands regularly overflowed would have germinated, grown and developed into trees on this strip. At the present time therefore there would be a belt of large and old living trees, large and old dead trees, or the remains of such trees consisting of species characteristic of lands regularly

overflowed on this strip of territory on the Upland Terrace.

Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Ferry Lake, there are no large and old living trees, no large and old dead trees, and no remains of such trees of species characteristic of lands regularly overflowed on the Upland Terrace.

See Plat of Sample Plots No. 5 and 6 and Photographs Nos. 66, 68, 69, and 70.

(3) If such a lake had actually existed, there would be a strip of territory on the Big Terrace below the mean high water mark which would have been inundated for a considerable portion of the year by the waters of this alleged lake. If such a lake had existed for only a few years, the upland forest on this strip of territory would have been killed. If this lake had existed for many years, a forest of cypress, planer trees, water locust, etc., species characteristic of lands inundated for a considerable portion of the year would have germinated, grown and developed into trees on this strip. At the present time therefore on the upper portions and elsewhere on the Big Terrace there would be a belt of large and old living cypress trees, large and old dead cypress trees or the remains of such trees.

Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Ferry Lake, there are no

large and old living cypress trees, no large and old dead cypress trees, and no remains of large and old cypress trees anywhere on the Big Terrace which germinated thereon before the present Perry Lake came into existence.

(4) The large living post oaks and other species of trees characteristic of the Upland forest growing approximately at the 180 foot contour and at higher elevations on the Upland Terrace show but little soil erosion at their bases, and are from 150 to 250 years of age. In order for soil conditions to have become suitable for species entirely characteristic of the Upland forest such as upland hickories, post oaks, etc., to have germinated and grown on this strip of territory regularly overflowed by the waters of this alleged lake would require a long period of time. It follows therefore that the lower portions or any other parts of the Upland Terrace have not been regularly overflowed by the waters of an alleged lake for several centuries at least.

(5) If such an alleged lake had existed, and any considerable number of years had intervened between it and the present Perry Lake, the dead timber in the lake would have completely rotted and disappeared and in its place would have appeared after a few years a scattered forest of young trees of only a comparatively few species characteristic of overflow lands. The remains of the hardwood forest now found in Perry Lake indicate that the forest occupying the

valley of Cypress Bayou before Perry Lake came into existence consisted of a dense stand of various species, numerous individual trees of which were comparatively large and old. The entire hypothesis is therefore shown to be untenable.

(6) If such an alleged lake had actually existed for any length of time, there would be a more or less well defined escarpment at the upper limit of the overflow waters on the Upland Terrace. There is no escarpment on the Upland Terrace except on its extreme upper side, which escarpment was formed either in full or in part when the Upland Terrace was formed. If there ever was an escarpment on the Upland Terrace between the top of the escarpment on the upper side of the Big Terrace and the escarpment on the upper side of the Upland Terrace, it has been practically completely effaced by subsequent erosion. For ordinary rain wash to completely efface a well defined escarpment in this situation would require several centuries at least.

(7) Before the hypothesis can be established it must be shown not only that there was an adequate cause for the existence of such a lake, but that it had an actual existence, and that it actually disappeared. The entire hypothesis is mere assumption.

II. That a lake with the mean high water mark approximately at or near the 173.00 foot contour, antedating the present Perry Lake by a comparatively few years, occupied the valley of Cypress Bayou and that the dead remains of the hardwood and cypress forest now found in the water have existed through both lakes:

That this theory is untenable appears from the following discussion:

(1) An adequate cause for the existence of such a lake must be established. The existence of such an alleged lake is mere assumption.

(2) If such a lake had actually existed, there would be a strip of territory above the mean high water mark practically identical with the present Big Terrace, which would have been regularly overflowed every year in time of high water in this alleged lake. If such a lake had existed for only a few years, the upland forest on this strip of territory would have been killed. If the lake had existed for many years, a forest of overcup oak, red gum, water hickory, etc., species characteristic of lands regularly overflowed would have germinated, grown and developed into trees on this strip. At the present time therefore there would be a belt of large and old living trees, large and old dead trees, or the remains of such trees consisting of species characteristic of lands regularly overflowed on this

strip. When the present Perry Lake came into existence, its overflow waters would not have killed them.

Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Perry Lake, there are no large and old living trees, no large and old dead trees, and no remains of such trees consisting of species characteristic of lands regularly overflowed on the Big Terrace which germinated thereon before the present Perry Lake came into existence.

(3) If such a lake had actually existed, there would be a strip of territory practically identical with the present Lower Terrace, below the mean high water mark which would have been inundated for a considerable portion of the year by the waters of this alleged lake. If such a lake had existed for only a few years, the hardwood forest existing on the Lower Terrace would have been killed. If this alleged lake had existed for many years, a belt of cypress, planer trees, water locust, etc., species characteristic of lands inundated for a considerable portion of the year, would have germinated, grown, and developed into trees on the Lower Terrace. At the present time, therefore, there would be a belt of large and old living cypress trees, large and old dead cypress trees or the remains of such trees on the Lower Terrace.

Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into Perry Lake, there is no belt of large and old living trees, no large and old dead trees, and no remains of large and old cypress trees anywhere on the Lower Terrace which germinated thereon before Perry Lake came into existence.

(4) If such an alleged lake had actually existed, and any considerable number of years had intervened between it and the present Perry Lake, the dead timber in the lake would have completely rotted and disappeared and in its place would have appeared after a few years a scattered forest of young trees of only a comparatively few species characteristic of overflow lands. The remains of the hardwood forest now found in Perry Lake indicate that the forest occupying the valley of Cypress Bayou before Perry Lake came into existence consisted of a dense stand of various species, numerous individual trees of which were comparatively large and old. The entire hypothesis is, therefore, shown to be untenable.

(5) Before the hypothesis can be established it must be shown not only that there was an adequate cause for the existence of such a lake, but that it had an actual existence, and that it actually disappeared. The entire hypothesis is mere assumption.

III. That a lake with the mean high water mark approximately at or near the 165 foot contour, antedating the present Ferry Lake by a comparatively few years, occupied the valley of Cypress Bayou and that the dead remains of the hardwood and cypress forest now found in the waters have existed through both lakes.

That this theory is untenable appears from the following discussion:

(1) An adequate cause for the existence of such a lake must be established. The existence of such an alleged lake is mere assumption.

(2) If such a lake had actually existed, there would be a strip of territory below the mean high water mark which would have been inundated for a considerable portion of the year by the water of this alleged lake. If such a lake had existed for only a few years, the hardwood forest on this strip of territory would have been killed. If this lake had existed for many years, a belt of cypress, planer trees, water locust, etc., species characteristic of lands inundated for a considerable portion of the year would have germinated, grown, and developed into trees on this strip. At the present time therefore there would be the remains of such a belt of timber in the water immediately below the 165 foot contour. Exclusive of the territory in and adjacent to the valleys of the tributaries flowing into the Cypress Bayou,

there are no remains of such a belt of cypress timber. The remains of the forest immediately below and for a considerable distance below the 165 foot contour are remnants of a hardwood forest characteristic of lands regularly overflowed, such as overcup oak, red gum, cottonwood, etc.

(3) If such an alleged lake had actually existed, and any considerable number of years had intervened between it and the present Ferry Lake, the dead timber in the lake would have completely rotted and disappeared and in its place would have appeared after a few years a scattered forest of young trees of only a comparatively few species characteristic of overflow lands. The remains of the hardwood forest now found in Ferry Lake below the 165 foot contour indicate that the forest occupying the valley of Cypress Bayou before the present Ferry Lake came into existence consisted of a dense stand of various species, numerous individual trees of which were comparatively large and old. The entire hypothesis is therefore shown to be untenable.

(4) Before the hypothesis can be established it must be shown not only that there was an adequate cause for the existence of such a lake, but that it had an actual existence, and that it actually disappeared. The entire hypothesis is mere assumption.

IV. That a lake with the mean high water mark between the 173.00 foot contour and the 165 foot or a lower contour, antedating the present Perry Lake by a comparatively few years, occupied the valley of Cypress Bayou and that the dead remains of the hardwood and cypress forest now found in the water have existed through both lakes.

That this theory is untenable appears from the following discussion:

(1) An adequate cause for the existence of such a lake must be established. The existence of such an alleged lake is mere assumption.

(2) The evidence which invalidates the theory that a previous lake existed with the mean high water mark approximately at the 165 foot contour, also invalidates the theory that a previous lake existed with the mean high water mark at any other contour. See the discussion under heading No. XII.

(3) Before the hypothesis can be established it must be shown not only that there was an adequate cause for the existence of such a lake, but that it had an actual existence, and that it actually disappeared. The entire hypothesis is mere assumption.

V. That a lake with the mean high water mark somewhere below the 180 foot contour, antedating the present Perry Lake by a comparatively few years and existing for only a few years, occupied the valley of Cypress Bayou and that the dead remains of the hardwood and cypress forest now found in the water have existed through both lakes.

That this theory is untenable appears from the following discussion:

(1) An adequate cause for the existence of such a lake must be established. The existence of such an alleged lake is mere assumption.

(2) That such a lake could not have had a mean high water mark approximately at the 180 foot contour is shown by the discussion under heading No. I. As there stated the overflow waters in times of high water in such an alleged lake would have killed the timber characteristic of the upland forest which was growing approximately at and just above the 180 foot contour. Large living post oaks and other species of trees characteristic of the upland forest from 150 to 250 years of age are now growing close to and just above the 180 foot contour. The mean high water mark therefore could not have been approximately at the 180 foot contour. See Plats of Sample Plots Nos. 3 and 6 and Photographs Nos. 66, 68, 69, and 70.

(3) If such an alleged lake existed even for a very few years with a mean high water mark somewhere below the 100 foot contour, the timber in the water would have been killed. When the lake receded the dead timber would have been exposed to the destructive agencies of fire, wind, insects, and fungi, and would have rotted and disappeared in a comparatively few years. If such an alleged lake had existed for only a very few years and the interval between it and the present Ferry Lake was only a very few years, then the existence of the first lake becomes practically continuous with the present Ferry Lake. Even if it could be shown that such a lake actually existed, its existence would, therefore, be immaterial.

(4) Before the hypothesis can be established it must be shown not only that there was an adequate cause for the existence of such a lake, but that it had an actual existence, and that it actually disappeared. The entire hypothesis is mere assumption.

VI. That a series of lakes following one another at intervals of only a few years, each lake lasting but a few years, the last lake antedating the present Ferry Lake by only a few years, with the mean high water marks of the several lakes at various contours, occupied the valley of Cypress Bayou and that the dead

remains of the hardwood and cypress forest now found in the water have existed through the series of lakes.

That this theory is untenable appears from the following discussion:

(1) Anaadequate cause for the existence of such a series of lakes must be established. The existence of such an alleged series of lakes is mere assumption.

(2) If such a series of lakes had actually existed, the dead timber. in the intervals between the various lakes, would have been exposed to the destructive agencies of fire, wind, insects, and fungi, and would have rotted and disappeared in a comparatively few years. The hypothesis is therefore entirely untenable.

(3) If such a series of lakes had actually existed, the intervals between the lakes were not long enough for a hardwood forest of various species to germinate, grow, and develop into large trees. The living dense hardwood forest, at the time of submergence in the waters of Ferry Lake, besides numerous smaller and younger trees consisted of numerous larger and older trees from 150 to 250 years of age. The hypothesis is therefore absolutely untenable.

(4) Before the hypothesis can be established it must be shown not only that there was an adequate cause for the

existence of such a series of lakes, but that they had an actual existence, and that they actually disappeared. The entire hypothesis is mere assumption.

VII. That a lake or series of lakes occupying the valley of Cypress Bayou, the last lake antedating the present Ferry Lake by only a comparatively few years, with the mean high water marks approximately at or somewhere below the 150 foot contour, produced entirely or in large part the escarpment on the upper side of the Big Terrace all around Ferry Lake. That this theory is untenable appears from the following discussion:

(1) An adequate cause for the existence of such a lake or series of lakes must be established. The existence of such an alleged lake or series of lakes is mere assumption.

(2) It is shown by the preceding discussion under headings I to VI, inclusive, that no such lake or series of lakes could possibly have existed in the valley of Cypress Bayou for many centuries before the present Ferry Lake came into existence. The hypothesis is therefore absolutely untenable.

(3) Before the hypothesis can be established it must be shown not only that there was an adequate cause for the existence of such a lake or series of lakes, but that they had an actual existence, and that they actually disappeared. The entire hypothesis is mere assumption.

VIII. That a lake occupying the valley of Cypress Bayou, existing at some remote period in the past and long antedating the present Ferry Lake, with the mean high water mark approximately at or somewhere below the 180 foot contour, produced entirely or in large part the escarpment on the upper side of the Big Terrace all around Ferry Lake.

That this theory is untenable appears from the following discussion:

(1) The Big Terrace was regularly overflowed by the waters of Ferry Lake during the Raft Period. This is demonstrated in numerous ways among which are the following:

(a) By the deforested condition of the Big Terrace in exposed situations.

(b) By the raw, and denuded condition of the Big Terrace in more exposed situations.

(c) By the presence on the Big Terrace of the remains of species of trees characteristic of the Upland Forest killed by soil erosion at their bases.

(d) By the presence on the forested portions of the Big Terrace of a forest characteristic of lands regularly overflowed.

(e) By the growth analysis studies made upon cross-sections of trees characteristic of lands regularly overflowed, growing on the Big Terrace. The rate of

growth as determined by these studies show that the lands were regularly overflowed during the Raft Period.

(2) When Ferry Lake first came into existence the surface soil on the Big Terrace was the ordinary soil found on the Upland Terrace and in the Upland Forest. It was readily eroded and removed by the overflow waters of the lake in times of high water, resulting in a bare and raw condition of the ground surface.

(3) After the Upland grasses, herbs, shrubs, and trees had been killed by the overflow waters and soil erosion, there was nothing to hold the surface soil and it was more readily eroded and removed by wave action than before.

(4) The raw and denuded condition of the ground surface of the Big Terrace prevailed until species of grasses, herbs, shrubs, and trees adapted to lands regularly overflowed germinated thereon. During this time soil erosion was at its maximum.

(5) The seed of forest trees germinate in the surface soil. The root system develops downward while the stems develop upward. The junction of the stem and root system is known as the root crown. The root crown develops approximately at the ground surface. When the root system is exposed by soil erosion, the depth of soil removed by erosion is approximately equal to the vertical distance

between the root crown and the ground surface. That the overflow waters of Ferry Lake in times of high water during the Raft Period, cut into the ground surface, eroded and removed much soil from both the Lower and the Big Terrace, especially in exposed situations, is shown by the following discussion:

(a) That the overflow waters of Ferry Lake in times of high water during the Raft Period, cut into the ground surface, eroded, and removed much soil from the Lower Terrace especially in exposed situations, is proven by the exposed root systems of cypress trees growing upon the Lower Terrace, by the exposed root systems of dead and down cypress trees upon the Lower Terrace, by the depth and extent of the root systems of old drift cypress trees upon the Big Terrace, etc. In certain situations, the soil has been eroded and removed to a depth of from 12 to 24 inches or more.

See photographs Nos. 10, 11, 20, 21, 34, 38, and 40.

(b) That the overflow waters of Ferry Lake in times of high water during the Raft Period cut into the ground surface, eroded, and removed much soil from not only the upper portions but also the lower portions of the Big Terrace especially in exposed situations, is proven by the exposed root systems of overcup oak and other hardwood trees growing on the lower portion

of the Big Terrace. In certain situations, the soil has been eroded and removed to a depth of 36 to 58 inches or more.

See photographs Nos. 49 and 50.

(c) That the overflow waters of Perry Lake cut into the ground surface, eroded, and removed much soil from the upper part of the Big Terrace, is proven by numerous exposed root systems of trees growing upon the upper portions of the Big Terrace in exposed situations around Perry Lake. Many of these are post oaks which germinated before Perry Lake came into existence. The soil has been eroded and removed to a depth of 18 to 24 inches or more below the root crowns, depending upon the elevation and position of the trees, exposed situation of the shore, etc.

See photographs Nos. 59, 60, 61, 66, and 67.

(6) There has been a considerable recession of the escarpment on the upper side of the Big Terrace in many exposed situations around Perry Lake. This is shown by the amount of erosion at the base of large living post oak trees on the upper part of the Big Terrace; by the amount of erosion at the base of old post oak stumps and snags on the upper part of the Big Terrace, etc.

See photographs Nos. 60 to 67, inclusive.

It should be stated that in many non-exposed situations around Ferry Lake and on the west shore of Clear Lake there is no well defined escarpment on the upper side of the Big Terrace, the slope of the ground surface being comparatively even, regular, and uniform from the 173.09 foot contour back away from the lake occasionally for a considerable distance. Also in certain situations on the south shore of Ferry Lake there are well defined Bluffs which during times of high water during the Raft Period and occasionally since, were exposed to the eroding action of the waters of Ferry Lake so that even now in some places they present the appearance of being freshly cut.

See photographs Nos. 15, 68, to 71, inclusive.

It is not here maintained that the entire escarpment on the upper side of the Big Terrace was formed entirely by the overflow waters of the present Ferry Lake. It is maintained however that the waters of the present Ferry Lake produced a considerable part of it at least, and that the small portion not produced by the overflow waters of the present Ferry Lake, if any, was produced by another body of water antedating the present Ferry Lake by many centuries at least.

Before the hypothesis discussed under heading VIII. can be established it must be shown not only that there was

an adequate cause for the existence of such a lake, but that it has an actual existence, and that it actually disappeared. The entire hypothesis is mere assumption.

UPLAND AREAS OMITTED FROM THE EARLY OFFICIAL SURVEYS.

The upland areas omitted from the early official surveys are, in general, similar to the surveyed upland areas adjacent to Ferry Lake.

The unsurveyed areas may be classified as follows:

(1) Portions of the Big Terrace above the 173.09 foot contour. The Big Terrace above the 173.09 foot contour was, during the Raft Period, above the mean high water mark of the water of Ferry Lake. Its upland character has been fully discussed on pages 20 to 23 inclusive, and pages 30 to 60 inclusive of this report. In 1939, in non-exposed places, it was covered with a young hardwood forest of overcup oak, willow oak, water hickory, red gum, etc. See photographs F Nos. 24 to 27, 29 to 34, 37, 38, 45, 47 to 51, and 56 to 67.

(2) Upland areas above the Big Terrace, including portions of the Upland Terrace and adjacent uplands.

The unsurveyed upland areas are shown on sheet No. 7, Topographic Map of Ferry Lake. Where they have not been cleared for farming or other purposes, they are covered with a heavy forest, consisting of trees of numerous species common to upland areas, such as post oak, black jack oak, Spanish oak, upland hickories, pine, etc. The forest growth on these areas differs in no essential way from the forest growth on other upland areas adjacent to Ferry Lake. See discussion of the

upland forest on pages 23 to 25 inclusive and pages 27 to 38 inclusive of this report.

Many of the larger and older hardwood trees on the unsurveyed upland areas above the Big Terrace are from 150 to 250 years of age or older. The trees occurring are descendants of other hardwood trees of the same species which formerly occupied this site. There is every indication ecologically that these upland areas have not been covered by a permanent body of water for many centuries.

See the discussion of the above areas by Mr. Kidder.

THE LONG WOODED-VALLEY PERIOD OF CYPRESS BAYOU ANTEDATING FERRY LAKE.

The long wooded-valley period antedating Ferry Lake lasted many centuries. The proof of this proposition is as follows:

(1) The larger living hardwood trees which were killed by the submergence which produced Ferry Lake, varied in age up to 240 years or older, and were the descendants of other hardwood forest trees which formerly occupied the same situations. These hardwood trees germinated on the ground and grew to maturity during the wooded-valley period. None of the hardwood trees growing in the valley of Cypress Bayou before the submergence which produced the lake, can germinate, grow, and develop into trees in a permanent body of water.

No way to prove this

(2) The larger cypress trees along the channel of Cypress Bayou, which were killed by the submergence which produced the lake, varied in age up to 400 years or older. These trees germinated on the ground during the long wooded-valley period antedating Ferry Lake.

(3) The channel of Cypress Bayou is rather deeply cut into the bed of the lake and in some places has developed ox-bow loops and cut-offs. To develop this channel system has required a very long period of time, many centuries at

at least. See sheet No. 7, Topographic Map of Ferry Lake.

(4) Under the heading "UNTENABLE THEORIES," page 121, it is shown that no permanent body of water, antedating the present Ferry Lake has occupied the valley of Cypress Bayou for many centuries.

DEFINITIONS.

Ecology. This term is defined on page 5 of this report.

Escarpment. The more or less steep face of the bank of earth occasionally seen on the upper side of the Upland Terrace; in exposed situations, fairly well developed on the upper side of the Big Terrace; and also, in exposed situations, developed to a less degree on the upper side of the Lower Terrace.

See photographs Nos. 26, 33, 51, 53, 56, 60, 63 to 67 inclusive, 30 to 33 inclusive, 37 and 38.

Terrace. One of the series of shelves or platforms of earth on the shores of Ferry Lake, varying in width with the shore gradient, and commonly, but not everywhere bounded on the upper side by a more or less well defined bank of earth. These terraces are discussed on pages 11 to 13 inclusive of this report. See photographs Nos. 23 to 38, 45,47,48,49, and 51 to 65.

Raft Period. The time between the submergence which produced Ferry Lake and the final removal of the Great Raft in the Red River by the United States Government, approximately in 1872.

Great Raft. This name is given to the log jams, or series of log jams formerly occurring in the Red River, which caused the latter to overflow its banks, thereby producing

the series of shallow lakes formerly covering the lowlands adjacent to Red River.

Lands regularly overflowed. This expression I have used in connection with the Big Terrace surrounding Ferry Lake. I mean thereby the area above mean high water mark of the Raft Period, submerged by the overflow waters of Ferry Lake during times of high water therein.

These overflows occurring at various times during the year, more commonly during rainy seasons, continued for a longer or shorter period of time but were always more or less temporary. Much of the wooded valley of Cypress Bayou was also regularly overflowed in times of high water in Cypress Bayou during the long wooded-valley Period preceding Ferry Lake.

Species characteristic of lands regularly overflowed. This expression I have used principally with reference to species which germinated and grew on the Big Terrace during the Raft Period. During the long wooded-valley period of Cypress Bayou, antedating Ferry Lake, other species besides those mentioned as occurring on the Big Terrace, were common on the lands regularly overflowed by the overflow waters of Cypress Bayou. In other situations in the lower Mississippi Valley and Gulf Coastal Plain, species other than those mentioned as occurring on the Big Terrace and in the wooded-valley of Cypress Bayou before submergence,

are common to lands regularly overflowed.

Species characteristic of lands inundated for a considerable portion of the year. I have used this expression to refer to the species of trees found on the Lower Terrace surrounding Perry Lake, which germinated thereon during the Raft Period, some of these species are also common to lands regularly overflowed. Other species than those mentioned as occurring on the Lower Terrace are common to lands inundated for a considerable portion of the year, in other situations in the lower Mississippi valley and Gulf coastal plain.

SAMPLE PLOTS.

Six Sample Plots were selected by the present writer on the shores of Ferry and Clear Lakes, in Twn. 20 N., R. 16 W., L. M. These Sample Plots were accurately mapped and the topographic and ecologic features of interest occurring graphically represented on the large sized Plats.

The Plats of the Sample Plots exhibit the parallel belting of the timber on the shores of Ferry Lake, the relative position and elevation of the parallel belts and individual trees composing them, etc. In connection with the photo-descriptive section of the Report, and the detailed technical discussion, the Plats are of great value in interpreting the topographic and ecologic features occurring on the shores and in the water of Ferry Lake.

Much time and effort was expended in making the Plats complete and accurate in every detail, which it was desired to illustrate. The numbers in connection with the symbols representing the different species of trees on the Sample Plots are used for convenience of reference only. The data of ecologic interest in connection with each tree occurring may be found in the discussion opposite the various tree numbers on pages to .

See Plats of Sample Plots No. 1 to 6, inclusive.

PLATS OF THE SAMPLE PLOTS.

The Plats of the Sample Plots exhibit, among other things:

1. Unsurveyed land on the shores of Ferry Lake.
2. The general character of shore.
3. Elevation and gradient of the shore terraces where the Sample Plots were taken.
4. Escarpments on the lower and upper sides of the Big Terrace.
5. The position of the mean high water marks of 1812, 1839, and 1913.
6. Species of trees growing on the shore terraces.
7. Plant associations on the shore terraces and contiguous uplands.
8. Position and elevation of the individual trees of the various species on the Sample Plots.
9. Overlapping of the overcup oak and cypress belts at the 173.09 foot contour, which marks the mean high water position of 1839 and 1812.
10. Drift cypress trees at various levels on the Big Terrace.
11. Position and elevation of old stumps in the water on the lower portions of the Sample Plots.
12. The absence of overcup oak, cypress, etc., species characteristic of lands regularly overflowed or inundated for a considerable portion of the year on the Upland Terrace, and in the Upland Forest.
13. The absence of bald cypress, a species characteristic of lands inundated for a considerable portion of the year, on the upper part of the Big Terrace.
14. The absence of large hardwood trees of species common to lands regularly overflowed on the upper part of the Lower Terrace.

15. Position of lines of drift material on the Big Terrace which indicate temporary high water marks.

16. Parallel belting of the timber on the shores and in the water.

17. Example of high grade and unusually excellent graphic representation.

18. An original graphic representation of Ecologic data.

See Plats of Sample Plots Nos. 1 to 6, inclusive.

THE CAUSE OF THE SUBMERGENCE WHICH PRODUCED FERRY LAKE.

Mr. Leverett, the Geologist assigned to this case, has determined that the submergence which produced Ferry Lake was caused by what is known as the Great Raft in the Red River. See the report of Mr. Leverett.

DURATION OF THE GREAT RAFT IN THE RED RIVER.

There is appended a copy of the first six pages of Senate Document No. 78, 20th Congress, Second Session, a "Letter from Dr. Joseph Paxton, of Hemstead County, to the Honorable A. H. Sevier, Delegate to Congress from the Territory of Arkansas, in Relation to the Raft of the Red River."

In this letter Dr. Paxton discusses, among other things, the initial cause, date of origin, rate of progress, and rate of decay of the Great Raft in the Red River.

Dr. Paxton believed:

(1) That the Great Raft in the Red River was the consequence, probably an immediate one, of the union of the Red River with the Mississippi.

(2) That the date of origin of the Great Raft was not much less than 300 years before the date of his letter (1828).

(3) That the rate of progress of the Great Raft up the Red River was approximately one mile per year.

(4) That the lower end of the Great Raft decayed off

approximately at the same rate that it accumulated above.

(5) That after the Great Raft commenced to form, it continued to accumulate and extend itself up the river at the rate of approximately one mile per year, for about the term of 80 years, or until it had occupied a space of approximately 80 miles, at which time it began and thereafter continued to decay off.

(6) That the fact that the Great Raft occupied only a space of approximately 80 miles in 1828, after having existed for such a length of time and progressed such a distance upward, was a proof that the rate of decay of the Great Raft had been, and a presumption that it would continue to be commensurate with its accumulation.

With the conclusions of Dr. Paxton the present writer agrees.

See also the Report of Mr. Levcrett.

An Ecologic Survey. Ferry Lake, Caddo Parish, La. Sample Plot No. 1.

Sec. 32, Twn. 20 N., Range 16 W., L. M.

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
1	Cypress	12.5	174.1	Dead
2	Overcup oak	30.9	173.5	
3	" "	16.3	174.4	
4	Water hickory	5.7	176.0	
5	" "	18.3	174.8	
6	" "	17.5	173.8	
7	Willow oak	21.6	174.4	
8	Overcup oak	18.2	174.6	
9	Willow oak	14.8	175.0	
10	Cypress	14.0	173.09	
11	Willow oak	16.6	176 0	
12	Overcup oak	31.5	173.09	
13	Cypress	15.4	173.5	
14	"	18.9	174.5	
15	Red gum	15.3	175.5	
16	" "	11.0	176.6	
17	Water elm	13.2	171.6	
18	Water locust	8.3	169.8	
19	Cypress	12.5	169.7	
20	"	9.2	169.8	
21	Water elm	9.7	171.0	
22	Cypress	15.3	171.1	
23	Water elm	8.6	171.5	
24	" "	9.1	171.4	
25	Cypress	14.7	170.8	
26	Water locust	7.4	170.2	
28	Overcup oak	16.1	175.4	
29	Water hickory	7.4	175.3	
30	Red haw	6.4	176.0	
31	Cypress	4.5	177.8	
32	"	8.9	174.8	
33	Overcup oak	18.0	174.4	
34	Persimmon	5.0	173.8	
35	"	5.1	173.3	
36	Cypress	7.7	173.3	
37	"	9.8	173.4	
38	Water elm	13.2	172.3	

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
39	Water elm	6.0	173.2	
40	" "	7.5	173.5	
41	Post oak	8.3	186.2	
42	" "	6.4	185.9	
43	" "	10.8	186.2	
44	" "	9.3	186.2	
45	" "	13.2	185.9	
46	" "	10.8	185.1	
47	Swamp Spanish oak	14.2	185.1	
48	Post oak	9.4	186.0	
49	" "	8.0	182.6	
50	Red haw	4.8	185.5	
51	Winged elm	8.0	182.0	
52	" "	6.0	183.0	
53	Cypress	54.8	167.6	
54	"	39.0	167.4	
55	Willow	17.0	167.4	
56	"	9.1	167.4	
57	"	14.0	-----	3-pronged.
58	"	18.0	-----	
59	Cypress	37.3	167.5	
60	"	35.6	167.5	
61	"	33.6	167.5	
62	"	33.0	167.6	
63	"	32.9	167.5	
65	"	27.7	167.7	
66	"	28.3	167.8	
67	"	33.6	167.8	
68	"	34.8	167.7	
69	"	27.9	167.9	
70	"	34.7	167.8	
71	"	26.4	167.8	
72	"	25.2	167.9	
73	Willow	18.9	167.7	
74	"	12.0	167.7	
75	"	16.5	167.6	
76	"	19.1	167.5	
77	"	17.7	169.3	
78	Cypress	5.2	168.9	
79	"	5.6	168.7	
80	"	6.2	168.6	

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
81	Water locust	8.3	168.4	
82	Willow	12.6	167.7	
83	"	8.3	167.7	
84	"	14.3	167.6	
85	"	14.2	167.7	
86	Water locust	8.8	167.8	
87	" "	8.0	167.9	
88	" "	14.0	167.9	

An Ecologic Survey. Ferry Lake, Caddo Parish, La. Sample Plot No.2.

Sec. 32, Twn. 20 N., Range 16 W., L.M.

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	CROWN DIAMETER LINKS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
1	Cypress	18.9		174.4	
2	Willow oak	11.3		173.5	
3	Cypress	13.4		172.8	
4	"	8.4		174.0	
5	"	12.0		173.09	
6	Willow oak	15.0		173.09	
7	Cypress	10.2		174.3	
8	Willow oak	14.7		173.09	
9	" "	8.0		173.5	
10	Cypress	10.7		173.2	
11	"	7.9		174.2	
12	Red haw	12.2		174.2	Diameter measured on stump
13	Cypress	10.5		-----	
14	Overcup oak	6.3		-----	
15	" "	15.7		-----	
16	" "	7.3		-----	
17	" "	6.2		-----	
18	" "	6.1		173.5	
19	" "	7.1		174.0	
20	" "	7.4		174.1	
21	" "	4.7		173.5	
22	" "	6.5		174.9	
23	Willow oak	8.1		174.9	
24	" "	9.4		174.4	
25	Overcup oak	9.5		174.2	
26	" "	9.0		174.8	
27	Willow oak	13.4		175.4	
28	" "	10.5		175.6	Dead
29	Overcup oak	10.3		175.6	
30	Willow oak	8.7		175.4	
31A		13.8			
31	Overcup oak	19.5		176.4	
32A	Red haw	6.9			
32	Overcup oak	19.7			
33	Willow oak	20/4		176.9	
34	" "	11.5		177.3	

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	CROWN DIAMETER LINKS	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
35	Overcup oak	8.4		177.4	
36	" "	10.1		177.3	
37	" "	17.3		176.8	
38	Cypress	7.1		174.9	
39	Overcup oak	25.8		174.8	
40	Water hickory	6.3		175.3	
41	Overcup oak	13.0		175.5	
42	" "	7.1		175.5	
43	Willow oak	28.8		175.5	
44	" "	25.6		177.5	Hollow
45	Persimmon	8.5		177.2	
46	Overcup oak	9.6		177.7	
47	Persimmon	10.4		178.5	
48	"	9.7		178.5	
51	Overcup oak	21.7		179.4	
52	" "	9.9		179.5	
53	Hickory (Water)	15.0		179.0	
54	Water hickory	8.0		178.7	
55	" "	7.0		178.6	
56	Overcup oak	13.6		178.2	
57	" "	19.5		177.6	
58	" "	17.2		177.3	
59	" "	6.8		-----	
60	" "	14.9		178.5	
61	Willow oak	9.8		178.8	
62	Overcup oak	10.3		179.4	
63	" "	8.0		179.4	
64	Willow oak	12.5		179.9	
65	" "	7.3		179.8	
66	" "	23.1		175.1	
67	Overcup oak	16.8		180.4	
68	Willow oak	18.5		180.7	
69	" "	10.0		182.5	
70	Wing elm	7.7		181.8	
71	Post oak	34.2	78	179.4	Hollow
72	Post oak	28.0	71	178.9	
73	" "	13.5		184.0	
74	" "	15.5		184.0	
75	" "	35.4	84	178.3	Hollow
76	Overcup oak	10.1		174.9	
76A	Post oak	18.7		.....	

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES.	CROWN DIAMETER LINKS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
77	Overcup oak	14.1		175.3	
78	" "	14.0		175.3	
79	Hickory	6.8		175.0	
80	Overcup oak	21.2		175.0	Dying
81	Willow oak	14.5		174.7	
82	Overcup oak	15.8		175.6	
83	Red haw	9.0		176.1	
84A	Overcup oak	11.4		175.9	
84	" "	19.1		176.8	
85A	Water hickory	11.4		175.8	
85B	Cypress	16.1		167.8	Dead.
86	"	7.5		167.9	
87	"	7.9		167.8	
88	"	17.6		157.7	
89	"	7.6		167.8	
90	"	13.5		168.4	Dead
91	"	17.5		167.7	
92	"	27.0		166.6	
93	"	34.5		166.8	
94	"	53.5		167.4	
95	"	31.7		166.5	
96	"	28.0		166.5	
97	"	19.2		166.5	
98	"	16.6		166.5	
99	"	25.5		166.5	
00	"	28.0			
101	Willow oak	23.6			
102	Overcup oak	13.0		170.6	
103	" "	10.0		170.3	
104	Cypress	17.4		170.2	Dead.
105	"	15.7		170.0	"
106	"	13.0		169.7	"
107	"	18.4		169.5	"
108	"	8.3		168.2	"
109	"	8.6		168.0	
110	"			166.1	Standing in water.
111	"			165.6	" " "
112	Overcup oak	12.0		166.6	Stump
113	" "	20.0		166.3	"
114	" "	25.0		166.2	"
115	" "	24.0		165.9	
116	" "	18.0		166.7	"
118	" "	19.0			

An Ecologic Survey. Ferry Lake, Caddo Parish, La. Sample Plot No. 3.

Sec. 33, Twn. 16 N., Range 20 W., L.M.

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	CROWN DIAMETER. LINKS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
1	Overcup oak	20088	59	171.5	
2	" "	12.6	37	171.5	
3	" "	17.1	46	171.9	
4	" "	24.6	60	172.9	
5	" "	22.9	29	172.8	Dying and defective
6	" "	13.5	32	172.7	
7	" "	14.1	11	172.7	Dying and defective
8	" "	13.8	40	173.3	
9	" "	17.2	41	173.7	
10	" "	26.9	49	174.3	
11	" "	28.6	69	175.5	
12	Water hickory	12.4	34	175.0	
13	Overcup oak	9.2	29	174.7	
14	" "	20.7	57	175.7	
15	" "	26.3	63	176.3	
16	" "	12.8	----	174.8	
17	" "	13.6	40	175.3	
18	Cypress	23.3	32	170.1	
19	"	26.3	34	170.0	
20	"	30.2	37	168.9	Hollow
21	"	19.0	32	169.7	
22	"	16.3	32	169.8	Hollow
23	"	12.7	16	169.7	"
24	"	27.8	37	169.2	"
25	"	23.4	24	169.3	"
26	"	10.3	17	169.8	
27	Overcup oak	24.3	47	170.5	Hollow
28	Cypress	21.3	28	168.6	"
29	"	18.7	25	168.5	
30	Overcup oak	4.1	30	168.7	
31	Cypress	11.7	27	168.7	
32	"	29.0	35	168.7	
33	"	13.3	35	168.7	
34	"	34.5	48	169.0	Hollow
35	"	6.4	17	170.5	
36	"	6.6	14	170.5	

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	CROWN DIAMETER. LINKS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
37	Cypress	6.2	11	170.7	
38	"	4.1	7	169.7	
39	"	5.6	12	169.7	
40	Willow oak	6.9		171.5	
41	Crataegus	7.8	30	172.3	
42	"	6.6	29	172.5	
43	"	6.1	23	172.7	
44	"	7.0	29	172.4	
45	"	6.3	26	172.9	
46	"	6.0	23	173.5	
47	"	8.3	37	173.8	
48	"	7.4	35	173.9	
49	"	7.3	31	173.9	
50	"	10.6	27	173.5	
51	"	7.2	34	172.9	
52	"	6.7	33	172.6	
53	"	8.2	32	173.6	
54	Persimmon	6.4	16	173.4	
55	"	4.3	13	171.7	
56	Willow oak	5.0	24	169.2	
57	Cypress	22.5	28	168.8	Hollow
58	"	4.6		168.5	Dead.
59	"	17.9	30	169.4	"
60	"	21.5	26	169.2	"
61	"	18.3	17	169.2	"
62	"	13.3	16	170.0	"
63	Willow oak	3.7		171.7	
64	Crataegus	8.0	24	174.0	
65	Persimmon	6.0	19	174.3	
66	Overcup oak	23.3	53	177.8	
67	Water hickory	12.4	28	177.4	
68	" "	12.1	26	177.0	
69	Overcup oak	10.3	38	176.9	
70	Water hickory	10.0	31	177.8	
71	Overcup oak	17.0	50	177.4	
72	" "	11.8		175.7	
73	Water hickory	7.0	21	176.6	
74	Overcup oak	6.3	23	176.8	
75	Crataegus	6.2	26	176.3	
76	Water hickory	12.3	38	176.8	
77	" "	10.7	31	177.0	
78	Overcup oak	21.1	52	177.2	

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	CROWN DIAMETER. LINKS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
79	Water hickory	6.2	25	177.3	
80	" "	8.8	23	177.4	
81	" "	8.6	25	177.6	
82	Persimmon	4.7	16	177.4	
83	Water hickory	9.3	32	178.0	
84	" "	6.9	29	178.5	
85	Persimmon	8.5	19	178.9	
86	"	4.7		178.8	
87	"	9.2	28	179.0	
88	"	9.0		179.0	Age, 50 years
89	Water hickory	6.1	22	179.9	
90	" "	5.3		179.5	
91	Overcup oak	7.7	27	179.6	
92	Water hickory	5.3	14	179.5	
93	Crataegus	7.6	27	179.3	
94	Water hickory	9.7	27	179.2	
95	" "	9.6	22	179.0	
96	Crataegus	5.6	21	179.1	
97	Persimmon	6.6	28	178.3	
98	Overcup oak	10.8	28	179.0	
99	Elm	12.3	36	179.0	
100	Water hickory	9.5	32	178.9	
101	" "	5.2		179.3	
102	" "	8.1	33	179.4	
103	Crataegus	5.7	34	179.4	
104	Water hickory	5.8	7	179.3	
105	Persimmon	4.5	16	178.9	
106	Water hickory	9.9	35	179.0	
107	" "	8.3	28	178.7	
108	" "	5.4	11	179.0	
109	" "	11.7	25	179.8	
110	" "	7.4	24	180.1	
111	Crataegus	9.2	31	180.3	
112	Water hickory	7.1	28	180.4	
113	Crataegus	8.2	27	180.0	
114	Water hickory	10.2	32	180.2	
115	" "	8.1	32	180.2	
116	Overcup oak	10.6	27	180.4	
117	Elm	34.3	40	180.3	
118	Water hickory	4.7	18	180.0	
119	" "	6.7	25	180.1	
120	" "	7.4	29	180.3	

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	CROWN DIAMETER. LINKS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
121	Water hickory	5.8	25	180.5	
122	" "	6.0	23	180.5	
123	" "	6.9	18	180.3	
124	" "	5.0	19	180.4	
125	Crataegus	7.3	29	180.4	
126	Persimmon	5.7	21	180.2	
127	Water oak	29.7	61	179.2	
128	Water hickory	11.4	41	179.5	
129	Crataegus	6.0	23	179.7	
130	"	7.0	27	180.4	
131	Post oak	22.0	44	179.0	
132	" "	31.7	66	179.0	
133	Overcup oak	29.5	53	177.3	
134	Water oak	20.8	39	179.3	
135	" "	20.3	30	179.6	
136	Swamp Spanish oak	13.2	40	180.5	
137	Water oak	14.8	41	180.9	
138	Post oak	20.1	37	181.6	
139	" "	12.1	27	182.2	
140	Water oak	20.0	56	180.0	
141	Elm	17.4	64	179.9	
142	Persimmon	7.0	31	181.7	
143	"	6.0	26	182.0	
144	Water oak	23.0	53	182.5	
145	White hickory	13.6	36	182.2	
146	" "	11.8	27	182.6	
147	Water oak	19.5	67	182.5	
148	Swamp Spanish oak	14.0	76	181.8	
149	Water oak	20.7	60	182.5	
150	Elm	12.0	41	182.0	
151	"	16.4	21	182.0	
152	Spanish oak	15.6	65	182.1	
153	Overcup oak	46.5	86	179.4	
154	Water hickory	13.0	58	178.5	
155	Overcup oak	20.2	39	178.1	
156	Elm	9.7	28	177.5	
157	Persimmon	5.3		177.8	Dead
158	"	7.3	25	177.8	
159	Crataegus	5.4	23	178.0	
160	Persimmon	6.2	27	178.5	
161	Overcup oak	14.0	41	178.9	
162	Water hickory	9.9	31	178.8	

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	CROWN DIAMETER. LINKS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
163	Persimmon	9.0	21	179.4	
164	Post oak	26.2	66	180.1	
165	" "	19.8	67	180.3	
166	" "	30.2	71	180.7	
167	" "	16.0	37	180.5	
168	" "	25.6	54	179.7	
169	" "	33.5	71	178.8	
170	Elm	9.1	25	178.9	
171	Water hickory	11.6		179.5	
172	" "	7.8		179.4	
173	" "	9.8		179.3	
174	Water oak	30.3		179.5	
175	Post oak	21.9		178.6	
176	" "	26.5		178.5	
177	" "	31.0	67	179.8	
178	" "	25.9	62	179.8	
179	" "	24.7	80	180.8	
180	" "	21.2	64	181.1	
181	Water oak	29.3		180.3	
182	Overcup oak	18.4		177.3	
183	Persimmon	8.1		176.7	
184	Water hickory	8.0		177.3	
185	" "	7.4		176.9	
186	Elm	9.9		176.8	
187	Overcup oak	19.8		176.2	
188	" "	14.3		176.0	
189	" "	9.3		176.3	
190	Water hickory	8.2		175.0	
191	Overcup oak	10.7		175.0	
192	" "	22.1		175.2	
193	" "	12.5		174.8	
194	Water hickory	13.6		174.3	
195	" "	6.7	22	177.2	
196	" "	7.0	27	177.4	
197	" "	10.2	30	177.5	
198	" "	9.7	33	177.7	
199	Overcup oak	8.9	29	177.5	
200	Water hickory	9.5	23	177.5	
201	" "	13.0	37	177.2	
202	" "	6.9	17	176.8	
203	" "	11.0	33.	176.8	
204	" "	11.8	29	177.0	

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	CROWN DIAMETER. LINKS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
205	Water hickory	8.8	23	176.5	
206	" "	8.5	28	176.7	
207	" "	11.9	27	176.8	
208	" "	8.7	27	176.1	
209	Overcup oak	17.2	44	175.7	
210	" "	10.6	32	175.7	
211	Water hickory	9.0	22	176.4	
212	Overcup oak	16.0	47	177.0	
213	" "	25.2	62	176.2	
214	Water hickory	9.1	30	176.6	
215	" "	11.3		177.2	Dead
216	" "	8.1	23	176.9	
217	Persimmon	6.6		175.8	
218	"	6.3	12		
219	Water hickory	16.6	52	175.3	
220	" "	9.1	28	175.2	
221	Persimmon	7.0	21	175.7	
222	Water hickory	6.7	22	174.1	
223	Persimmon	7.2	16	174.1	
224	"	6.6	21	173.7	
225	"	5.5	22	174.7	
226	Overcup oak	16.2	35	173.1	
227	" "	20.2	38	172.0	
228	" "	19.6	53	170.3	
229	Cypress	10.4	11	168.9	
230	"	22.6	32	168.7	
231	"	14.8	13	168.8	
232	"	19.4	24	168.6	
233	"	14.0	18	168.8	
234	"	13.5	17	168.9	
235	"	18.7	11	169.3	
236	"	15.6	20	169.2	
237	"	17.2	20	168.9	
238	"	22.0	34	168.7	
239	"	28.3	30	168.5	
240	Water locust	8.6	29	168.7	
241	" "	5.5		173.9	
242	Water hickory	6.5		173.4	
243	" "	6.0		171.0	
244	Cypress	8.4		169.5	
245	Water hickory	7.2		172.5	

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	CROWN DIAMETER. LONKS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS
246	Overcup oak	23.6		173.09	
247	" "	22.0		172.5	
248	" "	14.0		174.3	
249	" "	13.4		165.1	Stump in water
250	Cypress	5.4		165.0	Growing on an old over cup oak stump in water
251	Overcup oak	27.1		165.0	Stump in water
252	" "	14.6		164.8	" " "
253	" "	7.8		165.2	" " "
254	" "	5.8		165.1	" " "
255	" "	6.6		164.9	" " "
256	" "	12.1		165.3	" " "
257	" "	5.4		164.8	" " "
258	" "	6.3		164.7	" " "
259	" "	6.1		164.6	" " "
260	" "	39.0		164.6	" " "
261	" "	25.0		164.1	" " "
262	Cypress	19.3		164.0	Unhealthy
263	"	6.0		164.7	Short and Stubby
264	Overcup oak	18.0		164.4	Stump decayed and hollow.
265	" "	20.0		164.5	Stump much decayed
266	" "	28.0		164.5	Worn to water level
267	" "	18.0		164.6	Much decayed
268	" "	27.0		164.7	" "
269	" "	30.0		165.1	" "
270	" "	40.0		165.2	" "

An Ecologic Survey. Ferry Lake, Caddo Parish, La. Sample Plot No. 4.

Sec. 13, Twn. 20 N., Range 16 W., L. M.

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	CROWN DIAMETER LINKS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
1	Loblolly pine	13.0	28.0	183.3	Living tree
2	White ash	11.7	----	179.2	" "
3	Willow oak	18.7	42.0	177.5	" "
4	Loblolly pine	18.5	35.5	184.0	" "
5	" "	7.0	20.5	183.5	" "
6	Persimmon	5.1	21.0	177.6	" "
7	Loblolly pine	6.2	18.0	180.3	" "
8	Willow oak	23.6	71.0	180.5	" "
9	Loblolly pine	8.5	25.0	180.6	" "
10	Mulberry	12.8	39.0	179.7	" "
11	Cypress	9.7	16.0	178.1	Overtopped by Nos.11&13.
12	"	7.0	----	177.9	Living tree
13	"	8.0	18.0	177.9	" "
14	"	8.5	17.5	178.3	" "
15	"	9.1	18.5	178.5	" "
16	Loblolly pine	9.3	21.0	179.2	" "
17	" "	21.8	42.5	178.8	" "
18	" "	8.7	22.0	177.5	" "
19	" "	8.1	26.0	176.9	" "
20	Willow oak	11.1	31.0	174.5	" "
21	Loblolly pine	5.5	----	174.1	" "
22	" "	9.1	28.0	176.0	" "
23	" "	7.5	23.0	175.9	" "
24	Cypress	7.5	20.5	176.3	" "
25	"	9.1	23.0	177.0	" "
26	"	7.5	19.0	176.4	" "
27	"	7.4	20.5	177.8	" "
28	White ash	9.6	24.5	178.3	" "
29	Winged elm	12.1	36.0	185.2	" "
30	Loblolly pine	15.1	30.0	184.5	" "
31	Cypress	12.8	38.0	176.7	Shows no knees
32	"	6.9	15.0	175.1	Living tree
33	"	9.7	21.0	174.2	" "
34	"	25.3	23.0	169.2	Tree practically dead.
35	"	10.5	25.0	166.0	Living tree.
36	Overcup oak	5.5	11.5	169.4	" "

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	CROWN DIAMETER LINKS.	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
37	Cypress	9.7	18.0	166.2	Living trees
38	"	8.4	21.0	169.4	" "
39	"	14.9	----	173.2	" "
40	"	12.6	----	166.3	" "
41	"	23.7	----	166.8	" "
42	Willow oak	10.7	35.0	178.8	" "
43	Shortleaf pine	4.0	----	183.0	" "
44	Post oak	24.0	----	183.0	Old stump on escarpment much decayed.
45	" "	24.0	----	182.5	An old stub, burned on one side.
46	" "	16.4	----	183.9	Old dead stub.
47	" "	16.1	----	-----	Old log on ground.
48	" "	27.0	----	178.3	Old projecting stub still standing, much decayed.

An Ecologic Survey.Ferry Lake,Caddo Parish,La. Sample Plot No. 3.

Sec. 4, Twn. 20 N., Range 16 W., L.M.

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
1				
2	Overcup oak		172.5	
3	Red gum		175.2	
4	Willow oak		175.6	
5	Willow oak		175.7	
6	Red gum		173.7	
7	Overcup oak		172.9	
8	" "		172.8	
9	" "		173.6	
10	" "		173.4	
11	" "		172.09	
12	Water hickory		174.3	
13	Overcup oak		173.9	
14	Water hickory		174.2	
15	Overcup oak		173.6	
16	" "		174.0	
17	" "		173.8	
18	" "		174.3	Dead
19	" "		175.3	
20	" "		174.7	
21	" "		175.2	Stump
22	Red gum	5.6	172.6	
23	" "	4.3	171.9	
24	" "	3.6		
25	" "	7.4	171.6	
26	Cypress	23.3	171.3	Stump
27	"	33.2	170.3	Hollow stump
28	"	35.2	170.3	" "
29	"	24.0	170.3	Living tree
30	"	33.8	170.0	" "
31	Overcup oak	4.5	169.9	" "
32	Cypress	22.8	170.3	
33	"	25.1	170.0	Old stump
34	"	35.3	169.2	Hollow stump
35	"	31.3	169.3	" "
36	"	30.3	169.4	Old stump,very defective
37	"	33.6	168.8	Sound stump

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
38	Cypress	34.0	167.5	Stump, fairly sound
39	"	22.7	167.5	
40	"	42.5	167.1	Two trees or a double tree
41	"	36.1	167.5	Stump
43	"	26.0	167.7	Defective stump
44	"	37.0	167.5	" "
45	"	45.0	167.0	Forked near ground
46	"	17.3		Living tree
47	"	24.6		" "
48	"	22.9		" "
49	"	14.1		" "
50	"	36.0	166.8	Forked near ground
51	"	23.8		Living tree
52	"	13.2		" "
53	"	15.2		" "
54	"	29.0	166.5	" "
55	"	40.2	167.3	Defective stump
56	"	24.5	166.9	Stump, some defective
57	"	31.0	167.2	
58	"	33.7	167.8	
59	"	43.0	167.7	Tri-forked tree
60	"	44.0	167.2	Really 4 trees growing together at base
61	"	35.5	169.2	Stump defective
62	"	34.5	169.3	Defective stump
63	"	24.7	169.3	" "
64	"	32.0	169.4	Really two trees.
65	-------			
66	-------			
67	Cypress	35.0	167.7	Living tree
68	"	26.3	167.5	" "
69	"	31.1	167.1	" "
70	"	28.7	167.1	" "
71	"	31.1	166.9	
72	"	28.8	167.3	Sound stump
73	"	34.7	167.7	Living tree
74	"	30.6	168.0	" "
75	"	25.6	167.7	" "
76A	"	26.7		" "
76	"	27.5	168.3	" "
77	"	30.3		" "
78	"	32.6	167.9	" "

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
79	Cypress	36.0	167.2	Living tree
80	"	34.3	167.1	" "
81	"	24.6		" "
82	"	19.7	166.9	" "
83	"	17.0	166.8	" "
84	"	29.0	166.8	" "
85	"	26.3	166.9	" "
86	"	34.5	167.0	" "
87	"	33.0	167.1	" "
88	"	35.8	167.0	Stump fairly sound
89	"	21.3	166.9	
90	"	20.7	167.3	Old burnt stump
91	"	30.4	166.9	Sound stump
92	"	28.6		
93	"	29.6	166.8	Sound stump
94	"	33.8		
95	"	25.9		" "
96	"	45.5		
97	"	29.0	170.7	Old stump
98	Overcup oak	18.3	172.0	" "
99	" "	17.3	173.3	" "
100	Cypress	22.2	170.1	Living tree
101	"	38.0	166.5	" "
102	"	17.3	166.1	" "
103	"	23.5	166.3	" "
104	"	11.5	166.0	
105	"	22.5	166.3	Living tree
105A	"	33.5		" "
106	"	25.5	166.2	" "
106A	"	29.5		" "
107	"	24.5	166.3	Stump
107A	"	37.7		Living tree
108	"	25.9	166.3	" "
108A	"	22.4		" "
109	"		166.7	" "
109A	"	13.5		" "
110	"	23.0	165.0	" "
111	"	34.0		" "
112	"	36.7		" "
113	"	44.0		" "
114	"	43.0		" "
115	"	37.8		" "

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
116	Cypress	32.4		Living tree
117	"	35.0		" "
118	"	23.2		" "
119	"	48.0		" "
120	"	28.0		" "
121	"	27.7	166.2	" "
122	"	28.2	166.5	" "
123	"	15.4		" "
124	"	40.0	166.3	" "
225	"	33.9	166.3	" "
126	"	26.0		" "
127	"	22.0		" "
128	"	14.1	166.4	" "
129	"	26.4	166.3	" "
130	"	24.8	166.5	
131	"	29.0	166.4	
132	"	43.5		" "
133	"	32.0		" "
134	"	26.4		" "
135	"	35.5	166.1	" "
136	"	23.6		" "
137	"	26.6		" "
138	"	32.0		" "
139	"	26.2		" "
140	"	59.1		" "
141	"	29.0		" "
142	"	31.7		" "
143	"	21.7		" "
144	"	40.5		" "
145	"	38.0		In water
146	"	35.0	166.0	" "
147	Red gum	26.1	177.4	Living tree
148	Black gum	21.2	176.8	" "
149	Willow oak	17.0	177.8	" "
150	" "	15.2	178.0	" "
151	Water oak	25.0	178.2	" "
152	Overcup oak	13.7	179.2	" "
153	Willow oak	6.4	178.1	" "
154	Red gum	21.2	179.1	" "
155	" "	19.0	178.3	" "
156	Willow oak	28.0	179.5	" "

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
158		30.0		Double tree
159		33.5		

The elevation of the ground surface at the base of the following trees on Sample Plot No. 5 is greater than 165 feet, but less than 166 feet: 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 126, 132, 133, 134, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146. The elevation is mostly slightly less than 166 feet.

An Ecologic Survey. Clear Lake, Caddo Parish, La. Sample Plot No. 6.

Sec. 1, Twn. 20 N., Range 16 W., L.M., and
Sec. 6, Twn. 20 N., Range 15 W., L. M.

Data collected April 3, 1914.

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
1	Overcup oak	44.4	174.13	Large forked tree. Dominant.
2	Overcup oak	34.0	174.12	Stump. Tree cut several years ago, but stump still sound enough for growth analysis.
3	Water hickory	16.4	174.12	Leaning living tree
4	Overcup oak	33.0	173.72	Stump. Tree cut several years ago. Still sound enough for growth analysis study.
5	" "	35.4	174.43	Stump. Tree cut several years ago. Still sound enough for growth analysis study.
6	" "	18.7	174.56	Stump. Tree cut several years ago. Still sound enough for growth analysis study.
7	" "	6.3	174.68	A living tree. One of the bearing trees.
8	Willow oak	14.1	174.96	Living tree
9	" "	25.4	175.38	" " Dominant
10	" "	37.6	175.62	" " " Hollow at base.
11	" "	10.3	175.06	Living tree
12	" "	32.7	176.66	Stump. Tree has been cut for several years. Stump still sound enough for growth studies
13	Overcup oak	19.8	174.72	Living tree
14	" "	16.8	173.83	" "
15	Persimmon	9.2	174.95	" "
16	Willow oak	39.0	176.72	" " Dominant
17	" "	14.0	177.35	" " Overtopped. One side decayed
18	" "	12.0	177.67	" "
19	" "	19.1	178.11	" "
20	Red gum	9.3	179.78	" " Overtopped
21	Post oak	25.9	180.42	" " Intermediate
22	Willow oak	17.8	180/19	Living tree. Codominant
23	" "	9.4	179.39	" " Dead topped
24	" "			" " Dominant

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
25	Willow oak	12.5	178.59	Living tree. Codominant
26	" "	16.0	177.50	" " "
27	" "	14.4	177.11	" " "
28	" "	23.7	177.63	Stump, still suitable for growth analysis
29	" "	9.1	178.13	Living tree
30	Post oak	30.6	180.86	Stump. Fairly sound.
31	Loblolly pine	31.1	182.07	" " "
32	White ash	12.1	181.98	Living tree
33	Willow oak	9.7	180.99	" "
34	White elm	8.1	182.22	Stump
35	" "	9.6	181.96	"
36	" "	15.0	180.28	Living tree. Dominant
37	Post oak	34.5	181.51	Dead tree
38	Black hickory	10.4	182.42	Living tree
39	" "	10.0	183.50	" "
40	" "	11.6	182.00	" "
41	" "	13.5	183.24	" "
42	" "	13.0	183.50	" "
43	Willow oak	13.8	180.45	" "
44	" "	16.5	180.37	" "
45	" "	10.3	179.64	" " Overtopped
46	White elm	24.9	178.51	" "
47	Willow oak	23.7	176.55	" " Dominant
48	Overcup oak	24.6	175.11	" " "
49	Willow oak	26.5	175.46	" "
50	Overcup oak	18.4	174.24	" "
51	Water hickory	17.0	173.60	" "
52	Overcup oak	29.9	173.57	Stump. Fairly sound
53	" "	5.4	172.99	Living tree
54	" "	32.6	172.78	" "
55	" "	25.7	172.60	" "
56	" "	24.8	173.83	Stump. Fairly sound
57	" "	10.2	174.24	Bearing tree
58	" "	22.5	173.88	Forked tree
59	Water hickory	17.4	173.88	
60	" "	13.2	173.88	Double tree
61	Overcup oak	21.6	173.88	Forked tree
62	" "	10.0	173.83	Overtopped tree
63	" "	14.5	173.60	
64	" "	27.4	------	Rotton stump
65	" "	17.2	------	" "

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
66	Overcup oak	31.7	173.55	Sound stump
67	" "	29.0	173.76	" "
68	" "	22.0	173.39	Living tree
69	" "	20.5	173.39	" "
70	" "	34.0	174.02	Sound stump
71	" "	10.4	174.80	Living tree
72	" "	17.6	174.55	Rotton stump
73	" "	31.0	175.35	" "
74	" "	20.4	172.95	Living tree
75	Persimmon	9.6	172.95	" "
76	"	12.5	172.19	" "
77	Overcup oak	7.5	173.69	" "
78	" "	20.2	175.41	" "
79	" "	8.9	175.41	" "
80	Water hickory	12.6	174.82	" "
81	Willow oak	18.4	175.56	" "
82	" "	34.2		Rotton stump
83	Overcup oak	34.0	178.48	Living tree
84	" "	25.4	174.88	Rotton stump
85	Willow oak	16.7	177.58	Living tree
86	Honey locust	5.7	178.71	" "
87	Crataegus	5.4	178.34	" "
88	Willow oak	24.6		Dead tree. Killed by oil
89	" "	29.1	177.13	Dying. Being killed by oil
90	" "	21.87	177.53	Sound stump
91	" "	21.6	178.03	Living tree
92	Crataegus	8.2	177.90	" "
93	Willow oak	19.0		Rotton stump
94	Post oak	14.9	179.43	Living tree
95	Willow oak	21.2	180.13	" "
96	" "	9.5	180.80	" "
97	White ash	24.7	180.80	Stump. Fairly sound
98	Elm	8.1	181.79	Forked tree
99	Elm	8.4	181.75	Living tree
100	Willow oak	16.0	180.72	Tree practically dead
101	Elm	20.5	182.25	Living tree
102	White ash	14.5	1182.55	" "
103	White ash	9.3	183.17	" "
104	Willow oak	18.5	183.13	" "
105	" "	18.8	182.01	" "
106	Cypress	28.9	171.55	

TREE NO.	SPECIES COMMON NAME	DIAMETER AT BREAST HEIGHT INCHES	ELEVATION OF GROUND SURFACE AT BASE OF TREE FEET.	REMARKS.
107	Overcup oak	26.3	172.34	Stump. Sound
108	" "	22.2	171.60	Living tree
109	Cypress	21.6	171.30	" "
110	"	15.8	171.21	" "
111	"	15.1	172.04	" "
112	Planer tree	16.1	171.96	" "
113	Cypress	16.5	171.86	" "
114	"	18.6	172.35	Stump. Sound
115	Water locust	13.0	170.39	Living tree
116	Planer tree	14.3	171.20	" "
117	Cypress	23.0	171.23	" "
118	"	35.7	171.86	Stump. Hollow
119	"	30.2	171.12	Living tree
120	"	29.3	171.12	" "
121	"	28.2	171.02	Stump. Hollow
122	"	28.7	171.20	Living tree
123	"	36.9	171.06	" "
124	Willow oak	16.0		Dead tree. Killed by oil.
125	" "	23.4		" " " " "
126	" "	15.0		" " " " "
127	" "	11.0		" " " " "
128	" "	17.8		Living tree. But top broken off. Just a mere stub.

20th CONGRESS,
2d SESSION.

L E T T E R

FROM

DR. JOSEPH PAXTON, OF HEMPSTEAD COUNTY,

T. THE

HON. A. H. SEVIER,

Delegate to Congress from the Territory of Arkansas,

IN RELATION TO THE

RAFT OF RED RIVER.

---o---

FEBRUARY 16, 1829.--Laid on the table by Mr. Hendricks, and ordered to be printed, and that 200 additional copies be also printed.

---o---

MOUNT PRAIRIE, August 1st, 1828.

DEAR SIR: Your note of the 20th of February last, dated Washington City, requesting my opinion concerning the Great Raft of Red river, was duly received. Circumstances, not within my control, have hitherto prevented me from answering it. It would appear, however, from the caption of the bill that was then passed for the purpose of opening the Raft, that information might still be desirable to you. I shall therefore proceed to lay before you such observations on that subject, as my limited means and capacity will enable me, and shall be guided in prosecuting the subject by the plan laid down in your note.

First, then, of the time of its existence, and cause of its origin. On this part of the subject I will premise, that the face of the more south-western section of the United States is situated as an inclined plane, and that its point of declination, is somewhere between a south and a south-east course. This position will scarcely be denied by any one; but as it leads directly to my opinion of the cause

of the origin of the raft, I will, by way of illustration, rather than proof, add the following statements in support of it, and will use the terms right and left, as applicable alone to a river in its course downwards.

Those rivers in the above section, whose course is not in direction of the above point of declination, are prevented from assuming it by inequalities on the surface, as is evident from the circumstance, that all those that have their course to the right of said point are evidently encroaching on, and washing their left banks; while those that have their course to the left, are as evidently encroaching on, and washing their right; and, in either case, are in proportion receding from their opposite banks.

I know of no river in the above section, that in its general character will form an exception to the above description. The cause is evident. The strata composing the base of the hills and bottom of the rivers, probably possess the above declination.

The water composing those rivers, governed by the common laws of gravitation, and assisted by the declination of the strata at their bottom, is endeavoring to gain the point of declination assumed, and were it not for those inequalities would doubtless succeed: as the Mississippi, running to the right, actually has done, in its delta below Baton Rouge; where those inequalities on its left, which had prevented and been washed by it, and had controlled its course on its left, for one thousand miles, had ceased.

Red river, above the present site of the Raft, has the course and charatter in this respect, common to the rivers of this Territory; that is, to the left, consequently washing its right bank. But in the vicinity of Natchitoches it changes its course to the right; and it is remarkable, and adds much in support of our premises, that when it changes its course, it also, in this respect, changes its character, and assumes that of the Mississippi.

Appearance in the country to the right of Red river, and below where this change of course takes place, render it extremely probable, that the channel of this river in this part, has been, in time, far to the right of where it now is; and that all the right side of the great delta of the Mississippi has been formed by the alluvia of Red River. The presence every where in this section, (if not immediately on the surface, always to be found below,) of a soil so

exactly resembling that of Red river, and so very different from that of the adjoining hills, where all the water-courses that traverse it have their sources, cannot otherwise be accounted for.

It is also worthy of remark, that though the Mermenteau, Calcasiau, and other water courses to the right or west of Vermillion Bay, have their sources in the same white sandy hills with those that are on the left; yet never, in their course, as the others assume this red appearance, but retain to their mouths that which ought to be expected from their sources. The cause is evident. They enter the Gulf of Mexico to the right of where the original mouth of Red river is supposed to have been; consequently, as they never enter, nor pass through, any part of this delta, they cannot as the others have their appearance influenced by it.

From the above, and from many other reasons that might be advanced, the opinion becomes irresistible, that the channel of this river was formerly to the right of where it is now; and that, most probably, its mouth was once as far west as Vermillion bay; and that in endeavoring to gain the point of declination, according to the above premises, it has for ages been continually encroaching on and washing its left bank, and receding from its right; and thus, in a lateral direction, had traversed all the country between the site of its former channel, and that of its present one, in which were comparatively no obstacles to retard its progress; and was then in the act of approximating the Mississippi. That river, in the mean time, had evidently washed its left bluffs, opposite the present mouth of Red river, and even across the neck of Rackasee bend, but had been prevented by them from progressing farther to the left, or point of declination, and was then, in that bend, temporarily in the act of retrograding, and at its bottom met Red river in its approach, and bisected it.

A geographical representation of this point renders this opinion extremely probable; and appearances in the Achafalaya scarcely leave a doubt, but that it was once a continuation of Red river. It would be difficult for a person well acquainted with the peculiar appearance of Red river, and notwithstanding its sui generis character, to be brought, for the first time, to the banks of the Achafalaya, and (so exact is the resemblance,) not suppose himself still on some part of Red river. It is true, since this union,

the banks of the Achafalaya are occasionally covered with a mixture of this and the blue soil of the Mississippi, vut this adds support to the opinion; for wherever this blue soil is washed off, or the banks undermined, the contrast becomes more striking, and the unadulterated soil of Red river more evident. The original banks of this river, or those that existed previous to the union, are every where easily distinguished from those that have been formed since. Perhaps the soil of no two rivers show a greater contrast. As well might you mistake an American for a British soldier, in their respective uniforms, as the blue banks of the Mississippi for the red alluvia of Red river.

It will, I trust, appear from the sequel, that the raft was a consequence of this union, probably an immediate one; and that if this was the case, it could not have taken place much less than three hundred years ago. How it produced this effect, and how the time of its existence is accounted for, I will proceed to relate. The following fact, well known to those acquainted with Red river, and particularly to the conductors of steam-boats, is evidently a consequence of the above union, and consequently could never have taken place previous to it; and is, I believe, the immediate cause of the great raft; that is, that every rise of the Mississippi, since it first took place, creates an eddy in the mouth of Red river, and that the distance that this eddy is extended up, is always in a ratio proportionable to the relative height of both those rivers at the time; also, always when this eddy commences, a small floating raft also commences forming, and continues to accumulate as long as the rivers continue up, at the point where the head of this eddy and the current meet.

This floating raft is at this time composed along of the small quantity of drift wood that the river furnishes below the great raft, as none since its commencement ever passes through it. The sight of the head of this eddy, with the above floating raft always accompanying it, at common high water, is extended up Red river about fifty miles, or to a well known place called the Rappeyons; but it ascends, and descends, as the rivers fall, and at the latter part of the season, or when the annual fall of the Mississippi takes place, it finally passes out of that

river, and floats off. Thus it happens every year, in the present state of things; but it would be far otherwise, if, as we suppose, immediately after the above union, the great raft had yet no existence, and consequently that all the drift wood that it now intercepts should then be added to the above floating raft. I believe few years occur, in which enough would not pass down Red river, so celebrated for its quantity, and lodge against this floating raft, to choke up the river, and thus to cause the great raft to commence. But this effect would more certainly be produced, if the quantity of drift wood should be increased by a season of frequent freshets, immediately succeeding several dry ones; and particularly, if, after the season had advanced, and the drift wood had collected, that it should so happen that the falling of the rivers at this time, should be so proportioned to each other as to cause the eddy, with its accompanying raft, instead of descending, to remain at the same place, until, by this proportionate falling, it should rest on the bottom; or, that at this time, a considerable fall of Red river should take place simultaneously with an additional rise of the Mississippi. The raft, in that case, instead of descending, would ascend; and if this was not already the case, from its large quantity would rest on the bottom at the first shallows it encountered in its ascent; and in either case, the annual fall of the Mississippi afterwards, instead of floating it out, as from its small quantity is always the case at present, would then only have a tendency to fix it, by letting it rest more firmly on the bottom.

The rising of the rivers the next season, though they might rise so as again to cause it to float, would have no tendency to float it out, as the current of Red river cannot set out, so as to produce this effect, previous to the annual fall of the Mississippi, at the latter part of the season; consequently, as the drift wood in the mean time during the season would continue to collect, there would now be two seasons' drift wood collected here; and every succeeding season, by enlarging the raft, would increase the difficulty, until even a possibility of its removal by the river would cease.

Thus, and from the above causes, I suppose the raft to have commenced; and having thus commenced, would, from the same causes, continue to accumulate, and ascend the river at a rate proportioned to the quantity of drift wood added to it in a given time. This rate, as appears

from the following data, will average about one mile up the valley, in each year. But owing to the number of bends in this river, it in the same time occupies a larger space in the channel, in proportion to their number and size.

It is a fact well known in this part of the country, that when the first keel boat ascended Red river through the raft, its head was then immediately below and in sight of a well known outlet called Bee Bayou. At this time, twelve years since, the head of the raft is twelve miles above said point, and has continued to progress every intermediate season since, at about the same rate. This boat was conducted by Major Moss, who is known to you.

A Mr. Wallace, whose veracity no one doubts, who has resided many years in the vicinity of the raft, and is well acquainted with it, states, and is willing to testify, that thirty-five years ago the head of the raft was nearly opposite the middle of Bodcau Lake, then a beautiful prairie. At this time, this point is computed to be thirty-five miles below its present head.

The appearance of the state of decay of timber in this lake, and others near the head of the raft, compared to that in those below, also proves their more recent formation, and the consequent progress of the raft. The raft, as it ascends, chokes up and stops the mouth of the bayous, as they descend from the hills, forming lakes in their valleys, gradually enlarging as the raft approaches, killing the timber in them as the water rises, first in the middle where the surface is lower, and subsequently near the margin, where, in this lake and others near the head of the raft, the timber still retains small limbs, in a partial state of decay; proving the relatively recent formation, compared to that in those below, even far below the present site of the raft, when, as in lake Noir, there is scarcely a vestige of it remaining. The state of decay of timber in all of them, being always advanced in proportion to, and is an index of their distance below the present head of the raft, leaving no room to doubt as to the mode, time, and cause, of their formation. I know of but one bayou that is in this respect an exception; but it adds proof, if proof were wanted, that the above is the true cause of formation. Sibley's creek runs into Red river from a bluff called Grandechor; it has no lake in its mouth. The cause is evident; its channel lies above the level of the river.

"It is also known that the raft is ascending from the following circumstances. The time is yet within the memory of some of the oldest inhabitants in and near Natchitoches, when the lower end of the raft was still below that place; and that the then Governor ordered out the troops in command, to break down and cause to float off, all the part then below. This circumstance wonderfully accords with, and supports the above data. Some of the French families here are celebrated for longevity; and the lower end of the raft is some sixty or seventy miles above. It involves also the evident and curious fact, not hitherto fully appreciated, that the lower end of the raft is decaying off, at the same rate it is accumulating above.

"After the raft had commenced, it continued to accumulate, and extend itself up the river at the above rate, about the term of eighty years, or until it had occupied a space of about eighty miles; at which time it began, and still continues to decay off: and the fact of its occupying only that space now, after having existed such a length of time, and progressed such a distance upward, is a proof that its decay has been, and a presumption that it will continue to be, commensurate with its accumulation; and that it will still continue in its progress up to occupy that space, otherwise the whole channel of the river must now necessarily be occupied by it, from where it first commenced to its present site.

"This phenomena is easily accounted for.--In its first formation, the raft was composed of a variety of species of timber, a large proportion of which is already in a far advanced state of decay. Other kinds, as the willow and cotton-wood, are known to be very susceptible of corruption, particularly when exposed in such a situation as this. The consequence is, that immediately after its first formation, the raft begins to decay, and it is found, that in some twelve or fifteen years, there is scarcely any other timber left then the most durable, as the cedar, bois de ark, and some of the most durable oaks, forming mere skeletons of what they were once; and, in about eighty years, even these skeletons, or remains, unsupported by the timber that formerly composed so considerable a part of them, give way, and are carried off by freshets.

"From the above facts and deductions, we probably arrive nearly at the time of its origin from the Rappeyons to its present site. The space over which it is supposed, at the above rate, to have progressed, is, by the bends of the valley, about three hundred miles; consequently fixes nearly the time of its existence.

"The great raft is composed of a large number of small ones. The cause of this mode of formation it may be necessary to explain; and for this purpose I will premise, that this river possesses, in an eminent degree, the elevated banks

so characteristic of alluvial rivers. The last raft, by obstructing the course of the water downwards, causes it to rise immediately above it, even in time of low water, to a level with this bank; consequently, as the raft rests on the bottom, and fills the whole channel, its surface is on a level with the top of this bank. When the last of those small rafts has been formed, it continues to become more compact and impervious, as long as any water can pass through it; the interstices filling up with leaves, mud, &c., causing the water above to accumulate, until necessarily it forces a passage through this elevated bank somewhere, most commonly, as will appear from the sequal, in the next bend. As soon as an opening is made, the current stopped below runs thither with rapidity, accompanied with the drift wood, which, while the opening is enlarging above, begins soon to lodge against and fill up the lower side, and even to extend itself diagonally across the river to the opposite bank. This new raft, thus formed, continues to accumulate, and become more impervious, as above observed, as long as any water passes through it; until again, by obstructing the course of the water downward, it again causes another opening above; and, again in the same way, and from the same cause, another raft to commence. From the sequel the cause will appear why these openings always take place on the right or left side of the river, as they occur in a right or left bend, and also why the rafts are most commonly situated in or near their bottoms.

"Thus it progresses up. Keel-boats that pass this river downwards, leave the channel of the river by these openings, are carried diagonally towards the margin of the valley, and pass the raft through the lakes above described; and their outlets. They seldom leave the channel by the same opening more than a few freshets together; and never more than two years at a time before they are stopped up, and they are compelled to find a new one higher up the river.

"As the margin of the valley is the lower part of it, the water that leaves the channel by the above openings principally runs thither to the right, or to the left margin, as it leaves the channel by a right or left bend, but part of it finds its way into it again below, particularly in the time of freshets, and assists in washing off the leaves, mud, and rotting timber, from the decaying rafts, leaving such only as has not yet decayed, loosely connected together, rising and falling with the water --Perogues are known frequently to pass this old river channel, to and from a small settlement hear the head of the raft, and are constantly in the habit, while passing, of moving the loose timber to form themselves a passage.

"These detached, loosely connected rafts, before they finally break loose, are frequently for a while suspended only by a few large logs, placed advantageously for that

purpose; and it is not always the case that the lower raft breaks loose first, but that occasionally a large collection of them are formed here by those from above lodging against it. When this collection gives way together, there is danger of the river becoming choked up again, at some narrow point below. This actually took place not long since, far below the raft, and was with difficulty started again, by several boats passing down at that time, and who could not have otherwise got out themselves. Doubtless this accounts for the rafts that choke up the old river below Natchitoches, for those that remain in the Rigolet de Bondieu, and also for those in the Achafalaya. These immense floating rafts are frequently seen passing the settlement below, apparently in nearly the same situation as when they started. No one here is at a loss correctly to account for them, as it is well known no drift wood ever passes through the great raft.

INDEX.

Respectfully submitted,

Lionel L. James,

Ecologist,

General Land Office.

DESCRIPTION OF WOOD SPECIMENS

New Orleans
Land
376180

EXAMINATION OF FERRY LAKE, CADDO PARISH, LOUISIANA,

Township 20 North, Range 16 West, Louisiana Meridian.

AN ECOLOGIC SURVEY

In Pursuance of Instructions of the Commissioner of the

General Land Office

under date of September 27, 1913,

by

Lionel L. Janes, Ecologist,

General Land Office.

DESCRIPTION OF WOOD SPECIMENS.

July 14, 1914.

Submitted through
Arthur D. Kidder,
Supervisor of Surveys,
General Land Office.

An Ecologic Survey, Ferry Lake, Caddo Parish, Louisiana.

Specimen No. A.

Date of collection March 18, 1914.

Species. Oak.

Locality: Just west of Sample Plot No. 4, Sec. 16, T. 20 N., R. 16 W., L. M.

Depth of water March 26, 1914, above ground surface at base of stump ---------- 3.8 feet.

Thickness of fill or soft mud layer, if any, at base of stump ---------- 0.0 feet.

Elevation of hard ground surface at base of stump--- 164.9 feet.

Remarks. The present stump diameter at water level is 24 inches. It is very much worn and dilapidated.

Neither this species nor any of its associated hardwoods can germinate, grow, and develop into trees in a permanent body of water.

An Ecologic Survey, Ferry Lake, Caddo Parish, Louisiana.

Specimen No. 2.

Date of collection March 26, 1914.

Species. Oak.

Locality: In the water of Ferry Lake, in the NW.¼ of Sec. 13, T. 20 N., R. 16 W., L. M.

Depth of water March 26, 1914, above ground surface at base of stump ---------- 5.9 feet.

Thickness of fill or soft mud layer, if any, at base of stump ---------- .1 feet.

Elevation of hard ground surface at base of stump --- 161.5 feet.

Remarks: The stump is now very much decayed at top. It projected two feet above water on the above date. It is now approximately 20 inches in diameter at breast height.

Neither this species nor any of its associated hardwoods can germinate, grow, and develop into trees in a permanent body of water.

An Ecologic Survey, Ferry Lake, Caddo Parish, Louisiana.

Specimen No. 9.

Date of collection March 23, 1914.

Species. Oak.

Locality: In water of Ferry Lake approximately 200 feet east of the Gulf Refining Company's Ferry Lake, producing oil well, No. 16, Sec. 24, T. 20 N., R. 16 W., L. M.

Depth of water March 23, 1914, above ground surface at base of stump ---------- 8.0 feet.

Thickness of fill or soft mud layer, if any, at base of stump ---------- .7 feet.

Elevation of hard ground surface at base of stump--- 158.5 feet.

Remarks: This tree has at present a diameter at breast height of approximately 20 inches. It required 16 years to make a radial growth of 1.3 inches.

Neither this species nor any of its associated hardwoods can germinate, grow, and develop into trees in a permanent body of water.

An Ecologic Survey, Ferry Lake, Caddo Parish, Louisiana.

Specimen No. 10.

Date of collection March 16, 1914.

Species. Red (or sweet) Gum, Liquidamber styraciflua (Linn.)

Locality: In water of Ferry Lake, south of the submerged channel of Cypress Bayou in Sec. 26, T. 20 N., R. 16 W., L. M.

Depth of water March 16, 1914, above ground surface at base of stump ---------- 6.7 feet.

Thickness of fill or soft mud layer, if any, at base of stump ---------- 1.0 feet.

Elevation of hard ground surface at base of stump---160.3 feet.

Remarks. One of the many thousands of hardwood stumps projecting above the surface in the water of Ferry Lake during times of low water.

Neither this species nor any of its hardwood associates can germinate, grow, and develop into trees in a permanent body of water.

An Ecologic Survey, Ferry Lake, Caddo Parish, Louisiana.

Specimen No. 13.

Date of collection March 23, 1914.

Species

Locality: In water of Ferry Lake approximately 400 feet north of the derrick of the Gulf Refining Company's producing oil well No. 16, Sec. , T. 20 N., R. 16 W., L. M.

Depth of water March 23, 1914, above ground surface at base of stump ---------- 8.0 feet.

Thickness of fill or soft mud layer, if any, at base of stump ---------- 1.1 feet.

Elevation of hard ground surface at base of stump---158.4 feet.

Remarks. This stump projected 2 feet above water on the above date. It is very much dilapidated, jagged, and worn. Present diameter at breast height 10 inches. It required 21 years to grow 2.4 inches in diameter. It required approximately 12.35 years to make a radial growth of one inch. It is one of the many thousands of hardwood stumps projecting above the surface water of Ferry Lake in times of low water.

Neither this species nor any of its hardwood associates can germinate, grow, and develop into trees in a permanent body of water.

An Geologic Survey, Ferry Lake, Caddo Parish, Louisiana.

Specimen No. 14.

Date of collection March 23, 1914.

Species . Red (or sweet) Gum, Liquidamber styraciflua (Linn.)

Locality: In water approximately 500 feet north of the Gulf Refining Company's Ferry Lake oil well No. 16, Sec. 8. T. 20 N., R. 16 W., L. M.

Depth of water March 23, 1914, above ground surface at base of stump ---------- 8.1 feet.

Thickness of fill or soft mud layer, if any, at base of stump ---------- .8 feet.

Elevation of hard ground surface at base of stump---158.6 feet.

Remarks. This stump on the above date projected three feet above the water surface.

The diameter at breast height is approximately six inches.

Neither this species nor any of its hardwood associates can germinate, grow, and develop into trees in a permanent body of water.

An Ecologic Survey, Perry Lake, Caddo Parish, Louisiana.

Specimen No. 16.

Date of collection March 23, 1914.

Species. Red (or sweet) Gum, Liquidamber styraciflua (Linn.)

Locality: In the water of Perry Lake approximately 600 feet north of the Gulf Refining Company's producing Perry Lake oil well No. 16, Sec. 13, T. 20 N., R. 16 W., L. M.

Depth of water March 23, 1914, above ground surface at base of stump ---------- 8.1 feet.

Thickness of fill or soft mud layer, if any, at base of stump ---------- 1.4 feet.

Elevation of hard ground surface at base of stump--- 158.0 feet.

Remarks. The diameter at breast height of this stump is now 10 inches. It is very much dilapidated, jagged, and worn. It is one of the many old hardwood stumps now projecting above the surface of the waters of Perry Lake during times of low water therein.

Neither this species nor any of its associated hardwoods can germinate, grow, and develop into trees in a permanent body of water.

An Ecologic Survey, Perry Lake, Caddo Parish, Louisiana.

Specimen No. 17.

Date of collection March 23, 1914.

Species. Red (or sweet) Gum, Liquidamber styraciflua (Linn.)

Locality: In water of Perry Lake approximately 700 feet north of the Gulf Refining Company's producing Perry Lake oil well No. 16, Sec. , T. 20 N., R. 16 W., L. M.

Depth of water March 23, 1914, above ground surface at base of stump ---------- 8.1 feet.

Thickness of fill or soft mud layer, if any, at base of stump ---------- 1.4 feet.

Elevation of hard ground surface at base of stump--- 158.0 feet.

Remarks: This stump even now has a diameter at breast height of approximately 9 inches. It formerly was much larger. It is one of the many hardwood stumps projecting above the surface water of Perry Lake.

Neither this species nor any of its associated hardwoods can germinate, grow and develop into trees in a permanent body of water.

An Ecologic Survey, Ferry Lake, Caddo Parish, Louisiana.

Specimen No. 20.

Date of collection March 16, 1914.

Species. Red (or sweet) Gum, Liquidamber styraciflua (Linn.)

Locality: In the water of Ferry Lake south of the submerged channel of Cypress Bayou in Sec. 26, T. 20 N., R. 16 W., L.M.

Depth of water March 16, 1914, above ground surface at base of stump ---------- 7.2 feet.

Thickness of fill or soft mud layer, if any, at base of stump ---------- .3 feet.

Elevation of hard ground surface at base of stump--- 160.5 feet.

Remarks: The stump has at present a diameter of 15 inches at breast height. It projected approximately three feet above the water surface on the above date.

Neither this species nor any of its associated hardwoods can germinate, grow, and develop into trees in a permanent body of water.

An Ecologic Survey, Ferry Lake, Caddo Parish, Louisiana.

Specimen No. 26.

Date of collection March 23, 1914.

Species. Oak.

Locality: In the water of Ferry Lake approximately 20 chains east of the Gulf Refining Company's producing oil well No.11, Sec./4, T. 20 N., R. 16 W., L. M.

Depth of water March 23, 1914, above ground surface at base of stump ---------- 6.3 feet.

Thickness of fill or soft mud layer, if any, at base of stump ---------- .4 feet.

Elevation of hard ground surface at base of stump--- 160.8 feet.

Remarks: It required approximately 14.07 years to make a radial growth of 1.7 inches. This stump has at present a diameter of 30 inches. It is one of the many oak stumps projecting above the water of Ferry Lake at times of low water therein.

Neither this species nor any of its associated hardwoods can germinate, grow, and develop into trees in a permanent body of water.

An Ecologic Survey, Ferry Lake, Caddo Parish, Louisiana.

Specimen No. 27.

Date of collection March 23, 1914.

Species. Oak.

Locality: In water of Ferry Lake approximately 30 chains east of the Gulf Refining Company's producing oil well No.11, Sec. 14, T. 20 N., R. 16 W., L. M.

Depth of water March 23, 1914, above ground surface at base of stump ---------- 5.6 feet.

Thickness of fill or soft mud layer, if any, at base of stump ---------- .1 feet.

Elevation of hard ground surface at base of stump--- 157.4 feet.

Remarks. This tree undoubtedly was at least 24 inches in diameter at breast height when it was killed by the submergence which produced Ferry Lake. It required 40 years to make a radial growth of 1.9 inches. The stump from which this specimen was taken is typical of a large number of oak stumps in the water of Ferry Lake.

Neither this species nor any of its associated hardwoods can germinate, grow, and develop into trees in a permanent body of water.

EXAMINATION OF FERRY LAKE, CADDO PARISH, LOUISIANA,
Township 20 North, Range 16 West, Louisiana Meridian.
AN ECOLOGIC SURVEY
In Pursuance of Instructions of the Commissioner of the
General Land Office
Under date of September 27, 1913,
by
Lionel L. Janes, Ecologist,
General Land Office.
SPECIMENS OF WOOD.
July 14, 1914.

The wood specimens include the following:

Specimen No.	Species.	Date of collection.
A	Oak	March 13, 1914
2	"	March 26, 1914
9	"	March 23, 1914
10	Red Gum	March 16, 1914
13	" "	March 23, 1914
14	" "	March 13, 1914
16	" "	March 13, 1914
17	" "	March 23, 1914
20	" "	March 16, 1914
22	Oak	March 16, 1914
26	"	March 23, 1914
27	"	March 23, 1914.

Lionel L. Janes,
Ecologist
General Land Office.

Submitted through Arthur D. Kidder,
Supervisor of Surveys,
General Land Office.