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Progress Report of Peat Deposits in Texas

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Introduction

Since the preliminary report[1] on the occurrence of peat in Texas, opportunity has been offered through the courtesy and assistance of the Lone Star Peat Moss Company to investigate in detail five typical peat bogs located in Lee and Milam counties in east Texas. This circular is the result of a three-weeks study and detailed mapping of these bogs during the fall and winter of 1945. The location of the bogs is shown on the map, figure 1.

Development of the Peat Industry in Texas

Peat in east Texas is said[2] to have been recognized first by Mr. A. W. Joiner of McDade, Texas, who in 1937 leased most of the J. H. Patschke land located in Lee County on the Rankin survey in the valley of Spring Creek, a branch of Yegua Creek. In 1940 Mr. Joiner began mining and selling peat from the Patschke bog. At the same time Mr. M. S. Sanguinet leased the remainder of the Patschke bog not leased by Mr. Joiner and all of the Ender land in the Ender bog, located three-fourths of a mile southwest of the Patschke bog. In the same year Mr. B. P. Atkinson secured the west one-half of the Joiner lease on the Patschke bog and purchased outright a bog in Milam County (fig. 1) located 5½ miles east and 1¼ miles north of Milano; this latter bog is now known as the Atkinson bog.[3] Also Mr. Ira Dippel of Giddings, Texas, leased the Ender land covering the west one-fourth of the Ender bog. About this time Mr. Atkinson joined Mr. Homer Mitchell and others of Dallas in organizing the Lone Star Peat Moss Company and began mining peat from the Patschke bog. A little later this company leased a bog in Robertson County, known as the Robertson County bog. The beginning of the European war cut off the shipments of peat moss from Europe, made it difficult to obtain peat from the northern United States and Canada, and greatly increased the demand for Texas peat. In 1941 the following companies and individuals were operating.

Operators in Texas peat bogs in 1941.

Owner	Bog	Approximate acreage
A. W. Joiner of McDade	Enger	2.5
Lone Star Peat Moss Co. of Dallas	Ender	3.79
Ira Dippel of Giddings	Ender	0.27[4]
M. S. Sanguinet of Mathis	Patschke	2.74
Unleased; Ender Estate	Patschke	1.27
Lone Star Peat Moss Co. of Dallas	Atkinson	4.6

In 1943 the Sanguinet interests were purchased by the Lone Star Peat Moss Company. In 1945 the fee land and lease covered by the Dippel lease was sold to the Pharr Nurseries Company of Pharr, Texas. Now (1945) the Lone Star Peat Moss Company and A. W. Joiner are the only operators engaged in marketing peat. The decreased activity is due to scarcity of and high cost of labor and materials rather than to any decrease in market demand.

Methods of Mining Peat in Texas

The methods of mining and conditioning peat in Texas practiced at first were the same as those employed in the peat bogs of the northern states and Canada. Two trenches 4 to 5 feet deep were dug on each side of the plot to be mined and the ditches extended to the nearest creek in order to drain the bog and lower the water table, which rises to within 0 to 18 inches of the surface. The peat is cut along the fact of the trenches into bricks about 6 by 6 by 10 inches in size. A special type of blade known as a "slane" is used for this purpose. The wet and soggy brick is then placed on a wire frame 7 by 4 feet in size and the frame laid on a wooden track or tramway raised about 3 feet above the ground and leading from the peat pit to the shredding and bagging sheds (fig. 2). The peat is allowed to dry on the frames from six weeks to two months and then is slid along by hand on the tramways to the shredding and bagging sheds. At the

[1]Plummer, F. B., Peat deposits in Texas: Univ. Texas, Bur. Econ. Geol., Min. Res. Cir. 16, 10 pp., April, 1941.

[2]Personal communication from Mr. J. H. Patschke.

[3]This bog was first discovered by Mrs. Annie Stallworth and Miss Lillian Atkinson.

[4]The Dippel acreage contains a much larger amount of peat than indicated by these figures. Most of it, however, is overlain and interbedded with so much sand that it has not been classified as commercial peat. See cross sections, figure 3.

shredding sheds it is fed into a shredding machine constructed very similarly to an ice chipping machine and driven by a gasoline engine. This shredder breaks up the peat into a black powdery fibrous soil-like mass, so that it can be fed through conveyors or troughs into 100-pound paper sacks. The peat is then ready for the market. Care is exercised in the drying process so that the peat does not set too dry and too hard, else upon grinding it will become too powdery to handle easily. Ordinarily only about 50 percent of the water is taken out by the outdoor drying process, and the volume shrinks about one-half.

Since 1944 due to the scarcity, and in most cases entire lack, of labor and equipment, the Lone Star Peat Moss Company has been obliged to modify greatly their methods of mining and handling the peat. A drag line and gasoline-driven shovel are used to trench a wide ditch through the bog, to a depth of 4 or 5 feet, for drainage purposes. Peat is then excavated by means of the shovel from pits located at the end or any place along the drainage ditch (fig. 3). The peat is loaded directly from the shovel onto trucks and hauled to Milano or Lexington. At Milano it is spread along an abandoned concrete highway to dry where it remains from three to six months. From Milano it is hauled to a central shredding mill located at Lexington and from the shredding mill loaded on trucks or railway cars by means of tractors and power-driven shovels and sold in bulk in carload lots to nurseries and orchards.

Classification of Peat

Three types of peat occur in the bogs, as follows:

(1) Fibrous peat. This peat consists of a very fibrous product, light brown in color, high in sphagnum, very light in weight, highly porous, and containing almost no black organic powdery material, silt, or clay ingredients. This peat can be designated as peat moss and resembles in every way the peat moss of the northern bogs. It occurs mostly in a layer or layers 6 inches to 1 foot thick, 2 to 3 feet below the surface in the Atkinson bog. The layers are not continuous, and this special grade of peat is not very plentiful. The pH of this moss is about 4.5.

(2) Black colloidal peat. This consists of a black, highly colloidal, organic ooze containing 3 to 10 or 15 percent fiber in a matrix of black colloidal muck which dries to a grayish, light-weight, rather hard, brittle mass and contains finely comminuted organic material, fiber, pollen, etc., mixed with a minor amount of clay or very fine silt particles. The main bulk of the peat in the Patschke and Ender bogs, except around the edges of the bogs, belongs to this class. In most cases it is quite acid, ranging from pH 3.3 to pH 5. This should be classified as a peat soil or peat, not peat moss.

(3) A black silty and clayey peat or peaty clay. This material may or may not contain much fibrous material but contains a high percentage of silt or clay. It occurs in thin layers in the lower part of the peaty soil and in most cases constitutes the bulk of the material around the edge and at each end of the bogs. The pH of this material ranges from 3.5 to 5.5. It should be classified as carbonaceous or peaty clay rather than as true peat.[5] It is heavier than true peat and dries to a hard, compact, brittle, clay-like mass.

Description of the Bogs

The shape, size, and depth of the bogs described in this circular are shown by means of the accompanying maps and cross sections (figs. 2, 3, and 4) and are described briefly in following paragraphs. All the bogs were mapped by cutting pathways or *sinderos* through the thick tangle of bog vegetation, setting numbered stakes 50 feet apart along the cut ways, and by locating all stakes and traverse lines with a planetable. Then blunt steel rods were jabbed through the peat to the hard bottom below to obtain the thickness of the peat and depth to the bog bottom at the points marked by stakes. Finally a core barrel sampling device was run to obtain continuous cores of the peat at numerous points along the lines of traverse through the bogs in order to obtain accurate data for constructing the cross sections and a knowledge of the quality of the peat.

Patschke bog.—The Patschke bog is located on the Rankin survey in the valley of Spring Creek, 7 miles southwest of Lexington in Lee County (fig. 1). It is roughly quadrate in outline, 650 feet long north and south, 550 feet wide east and west (fig. 2). The bog has rather steep banks and an average depth over most of its western and middle portions of 15 to 20 feet. The depth of its eastern one-fourth ranges from 5 to 8 feet. The best grade of peat in the central portion included within the dashed line on the map covers an area of approximately 3 acres. The outer portion contains mostly peaty silt and peaty clay. The reserve of peat to a depth of 8 feet[6] in the area embraced by the dotted lines amounts to about 52,950 cubic yards.[7] The pH determinations in the Patschke bog are shown in the table:

Patschke peat bog pH determinations.
Determinations made by Dr. C. R. Johnson, Department of Chemistry, The University of Texas.

Core test No. 15			Core test No. 44		
Depth in inches	pH		Depth in inches	pH	
0-18	4.19	27	4.39	69	3.51
30-36	4.59	38	4.41	90	4.27
42-52	4.82	45	4.40	103	4.39
67-72	4.92	54	4.18	119	3.84
89-94	5.49	63	4.32	132	4.02
104-114	4.32				

[5]According to most soil classifications, all peat is classified as a soil.

[6]Although good peat extends below 8 feet, it is considered that at present at least it would be much cheaper to purchase and move to another bog than to drain one of the bogs now in operation below 8 feet.

[7]This figure represents the volume of peat in place in the bog. Since peat shrinks 40 to 50 percent upon drying this figure should be divided by 2 to arrive at the approximate volume of salable peat.

Analyses of water in milligrams per liter from the Patschke bog.
Analysed by W. W. Hastings, Chemist, Quality of Water Division, U. S. Geological Survey, Austin, Texas.

	Patschke Springs*	Lone Star Peat Moss Company pit
Iron	0.1	0.2
Bicarbonate	6	0
Sulphate	24	10
Chloride	26	15
Nitrate	0	0
Total hardness	33	21
pH	5.3	4.4

*Spring water coming from sand in stream bed.

Ender bog.—The Ender bog is located in the valley of Spring Creek, three-fourths of a mile west of the Patschke bog and 8 miles southwest of Lexington in Lee County (fig. 1). It is pear-shaped in outline, about 1400 feet long by 600 feet wide at its eastern end and 100 to 300 feet wide at its western end (fig. 3). The peat varies greatly in thickness and quality in different parts of the bog. In the central portion, within the area shown by the dashed lines on the map, the peat varies from 10 to 20 feet and averages a little more than 15 feet in thickness. The peat is interbedded, especially in its lower portion, with thin bands of silt and silty clay. The material in the area outside the dashed line contains a much larger proportion of sand and sandy clay. West of the dashed lines there is an upper layer of 3 to 5 feet of sand over the peat, and the peat pinches out and, when traced westward, thins from 7 to 8 feet at the west spring to 1 foot at the west end of the bog (fig. 3). East of the area outlined by the dashed line there is some good peat, but most of the sections show alternations of peat, silt, sand, and clay, with a preponderance of silt. This material should be classified as peaty clay or peaty silt. The reserves of the best peat in the area enclosed by the dashed lines cover an area of about 6.7 acres and to a depth of 8 feet amounts to 86,900 cubic yards (see footnote 7). The pH of this peat varies from pH 3.5 to pH 5.5. It is lowest on the south side and highest on the north side as shown by the following table:

Ender peat bog pH determinations.
Determinations made by Dr. C. R. Johnson, Department of Chemistry, The University of Texas.

Core test No. 1		Core test No. 86	
Depth in inches	pH	Depth in inches	pH
0-8	3.35	0-10	3.43
8-20	3.33	10-20	3.08
20-34	3.88	20-38	3.19
34-44	3.88	38-49	3.38
44-55	3.95	49-63	4.94
55-68	4.00	63-74	5.39
68-88	3.82	74-88	5.51
88-93	3.03	88-101	5.02

Analyses of water in milligrams per liter from the Ender bog.
Analysed by W. W. Hastings, Chemist, Quality of Water Division, U. S. Geological Survey, Austin, Texas.

	Ender Spring*	Lone Star Peat Moss Company pit
Iron	0.95	0.6
Bicarbonate	12	0.13
Sulphate	18	32
Chloride	18	52
Nitrate	0	0
Total Hardness	30	42
pH	5.4	4.1

*Spring water coming from peat.

Atkinson bog.—The Atkinson bog is located in Milam County, 6 miles east and 3 miles north of Milano. It is oval in shape and covers an area about 1000 feet long and 300 to 400 feet wide. As indicated by the map and cross sections (fig. 4), the best peat is in the east three-quarters of the bog and covers an area of approximately 4.6 acres. Much silt and sand from the creek have washed into the western quarter of the bog. The peat is thinner than in the other two bogs described, having an average thickness of 6 feet and a sandy under layer. The peat in the Atkinson bog, however, is of better quality than the other bogs, contains a larger percentage of fiber, but has a higher pH, averaging 4.4. The bog also contains less shrubs and trees so that the peat can be more easily mined. It is estimated that the peat reserves in this bog to a depth of 6 feet amount to 44,600 cubic yards (see footnote 7) and that about 1556 cubic yards have already been taken out. The pH determinations in the Atkinson bog are shown in the following table.

Atkinson peat bog pH determinations.
Determinations made by Dr. C. R. Johnson, Department of Chemistry, The University of Texas.

Core test No. 67

Depth in inches	pH	Depth in inches	pH
0-9	3.44	45-54	4.21
9-18	4.00	54-72	4.25
18-27	4.06	72-81	4.28
27-36	4.40	81-91	4.38
36-45	3.88	91-100	4.32

Peat moss from Atkinson bog about 3' below surface — 4.39
Peat moss from Lone Star Peat Moss Company stock pile partly dried — 4.31

Analyses of water in milligrams per liter from the Atkinson bog.
Analysed by W. W. Hastings, Chemist, Quality of Water Division, U. S. Geological Survey, Austin, Texas.

	Atkinson Spring*	Lone Star Peat Moss Company pit
Iron	8.3	0.2
Bicarbonate	0	0
Sulphate	24	10
Chloride	6	53
Nitrate	3	1.0
Total hardness	20	24
pH	5.0	4.7

*Spring water coming from sand in valley bottom west of bog.

Weakley bog.—The Weakley bog is located in the valley of Marsh Creek, 3.4 miles north of Jewett in Leon County on the east side of the county road leading north out of Jewett (fig. 1). The marsh is stocking-shaped, long and narrow, occupying an area 2000 feet long and 250 feet wide (fig. 5). The peat occurs in a small area in the center of the marsh and covers an area 1400 feet long and 150 feet wide, comprising about 3.9 acres. The edges and bottom of the marsh are very sandy. The peat in the middle appears to be fibrous and of fairly good quality. The thickness of the peat varies from 5 to 10 feet, averaging perhaps about 6 feet. The total peat reserves above 5 feet amount to approximately 31,000 cubic yards (see footnote 7). The quality of the peat has not been analysed or studied in detail. The Weakley bog is owned by Mr. Weakley of Jewett.

Lanier or Long Glade bog.—The Lanier bog is located in the valley of Long Glade, a branch of Pigeon Roost Creek, on the Gus Lanier ranch, 2½ miles west of Flynn in Leon County. The bog is chiefly in the west end of a long narrow marsh which occupies Long Glade valley. The marsh is about 3800 feet long and 50 to 150 feet wide with an increase of width to 300 feet at its west end. The bog extends also up a branch stream which connects with the main glade a distance of 1200 feet (fig. 6). The peat deposits are chiefly in the widened west end of the marsh. The bog here is 800 feet long, 50 to 200 feet wide, and 10 feet deep. There is also a little peat along the middle of the long marsh but it is probably of small importance. The main bog covers approximately 2.4 acres and contains about 19,000 cubic yards (see footnote 7) of peat. The peat has not been sampled or analysed and little is known regarding its quality. Its pH is about 5. It is underlain and surrounded by Sparta sand of Eocene age.

Unexplored bogs.—Many more peat bogs occur in Texas, especially in Robertson, Leon, and Houston counties. The best place to look for peat is in marshes fed by springs especially in those occurring near the head of small spring-fed streams. Some marshes contain no peat; others have a little peat but not of good quality or in paying quantities; others contain much peat. Marshes located by the Bureau of Economic Geology but as yet unexplored for their peat resources are shown in figure 1. The marshes in Leon County were located by Dr. H. B. Stenzel, those in Lee, Milam, and Robertson counties by the author. The explored bogs and unexplored marshes are included in the following list:

List of some bogs and marshes in four counties in east Texas.

Lee County

*** Ender bog
*** Patschke bog
*** Tanglewood marsh

Milam County

*** Atkinson bog

Robertson County

** Hearne marsh
* Devils Jump bog
* Mill Creek bog

Leon County

** Alfred Penn marsh
** Bald Hill marsh
* Beaverdam marsh
** Centerville marsh
** Duckworth marsh
* Evans Chapel marsh
* Hallett marsh
* Hines marsh
* (?) Horse Shoe Lake marsh
** Johnson marsh
* Lake Bluff marsh
* Long Glade marsh and bog
* Normangee State Park lake and bog
** Oakwood marsh
** Peeler marsh
*** Sardis School marsh
* Sycamore marsh
* Simons Store marsh
*** Weakley bogs
* Wilcox marshes
* Wolfpen marsh
* Tintop marsh

* Occur in Sparta sand; ** Occur in Queen City sand; *** Occur in Carrizo sand.

All the bogs occur in water-bearing sands; six are in the Carrizo sand, eight in the Queen City sand, and fifteen in the Sparta sand.

Uses of Peat in Texas

Peat is not a fertilizer and should not be used as such. It should be considered only as a soil conditioner and then only on those types of soil for which it is adapted. If carefully and scientifically mixed with the correct proportions of nitrates and phosphates, it can be used both as a fertilizer and a soil conditioner, and if mixed with 50 percent forest loam from east Texas its humus content may be increased to a point where it contains good plant food. The chief use of the fibrous peat is to mix with hard, stiff, calcareous clay loams to render the stiff clay more porous, more permeable, and make it easier to cultivate and easier for small rootlets to penetrate. Peat also has the ability to absorb and hold water like a sponge and give it up slowly to the soil so that soils well treated with peat need less watering. This is a great advantage in dry climates. Fibrous peat, of course, is of but little help to sandy east Texas soils which are already porous and permeable and wet by frequent rains.

Acid colloidal peat, especially when mixed with humus from forest loams, has proven successful in treating gardens having alkaline soil so that acid-soil plants like azaleas and hydrangeas can be grown successfully. All the Cretaceous soils of Texas are too alkaline for these beautiful plants. They can be raised successfully only if the correct proportion of acid peat or other acid is added to the beds. Large quantities of acid peat have also been used successfully for acidifying alkaline soils in irrigated regions where fruit orchards and citrus groves are under cultivation. Pears, apples, and citrus fruits like slightly acid soils. Alkaline waters from irrigation increase alkalinity, and such soils need to be neutralized yearly.

It becomes a question of whether to use acid salts or acid peat for such purposes and which is cheaper. It requires a much larger volume of peat than of iron sulphate to acidify a given soil. The effect of peat, however, lasts much longer, and good peat also has the advantage of rendering the soil more porous and better for root growth. The acid in peat is probably derived from several sources. Some of it is humic acid, some acetic acid from organic reactions which take place in peat formations.[8] But also much of the acid, it is thought, comes from reduction by bacteria of sulphates in the peat and in the water associated with peat. Bacteria reduce sulphates, forming hydrogen sulphide and sulphur. In the bog, oxygen is practically absent and the sulphur remains in the reduced state. When, however, the sulphur and sulphides with the peat are mixed with soil and spread out in fruit groves and gardens, the humic acid and acetic acid soon wash out or are neutralized by alkalies. The sulphides and sulphur, however, slowly react with oxygen from the air and ground water to produce sulphuric acid—a strong acid which neutralizes alkalies and alkaline carbonates as fast as the acid is produced from the oxidation of the sulphides and sulphur. This reaction continues for a long time, slowly adding acid to the peaty soil until all the sulphides and sulphur are used up. The peat coutains organic matter in the form of humus, iron, and other materials which promote the growth of soil bacteria and make it possible for the formation of sulphur and sulphides to take place. The chief use of peat, therefore, is to make compact alkaline soils more porous, more permeable, and more acid.

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[8]Acetic acid in peat was mentioned by F. T. Gissing in his book "Commercial Peat" as early as 1910. Recently Dr. C. R. Johnson, Department of Chemistry, The University of Texas, has demonstrated its presence in east Texas peat.

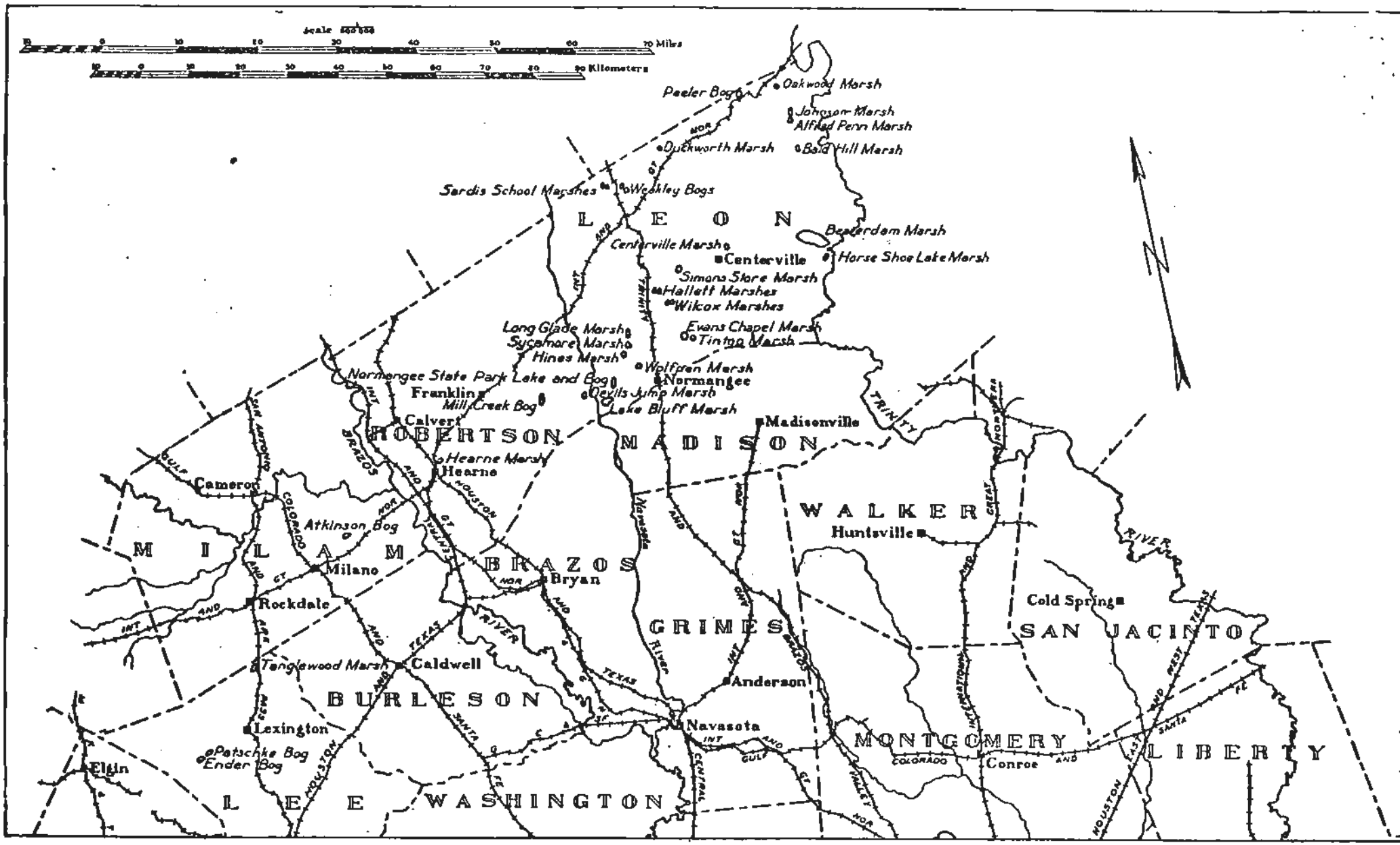

Figure 1. Index map of twelve counties west of Trinity River in east Texas showing location of bogs and marshes.

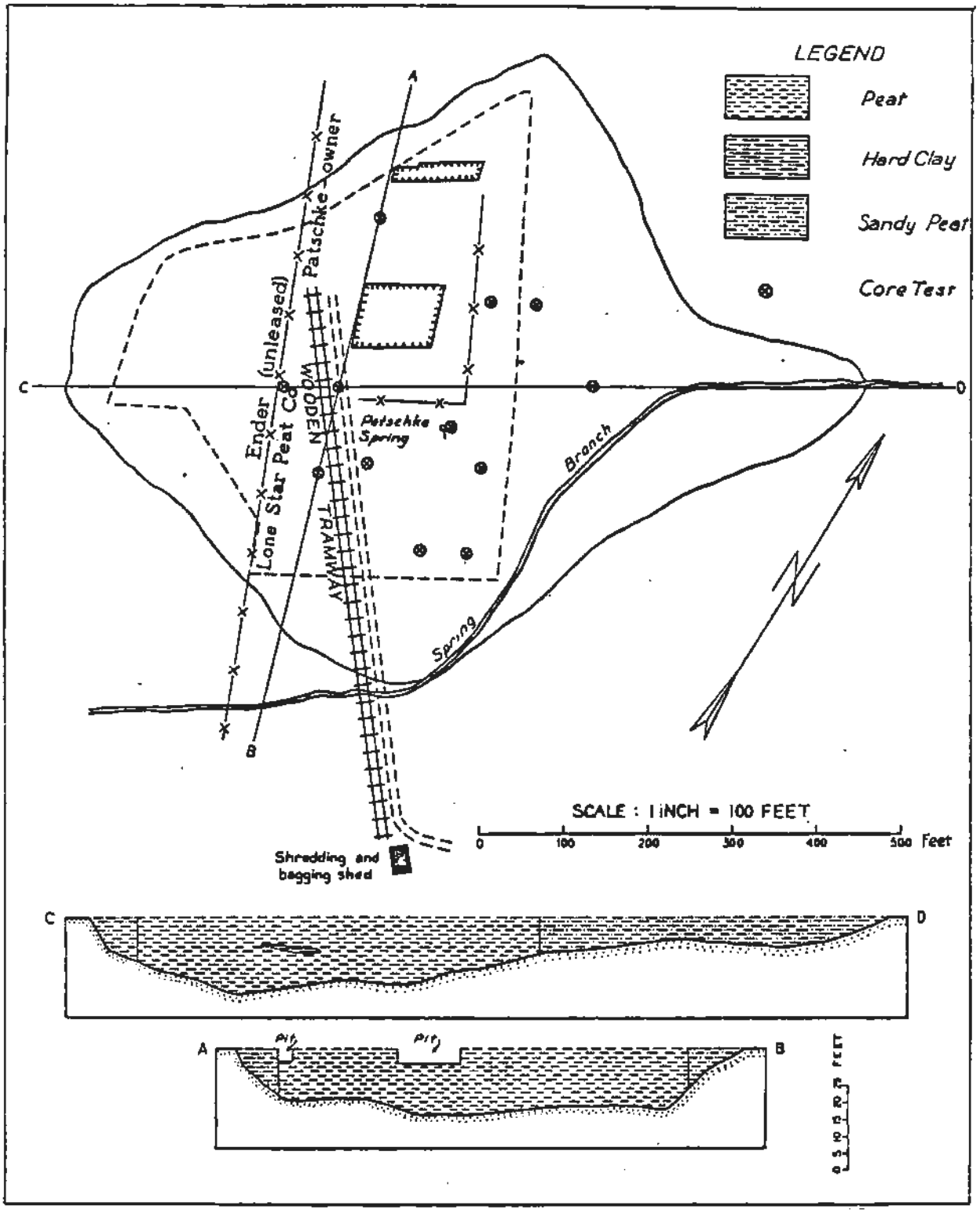

Figure 2. Patschke bog in Lee County, Texas. The solid line indicates the outline of the bog, the dashed line the extent of the best peat, the hachured lines the location of pits from which peat has been excavated. The cross sections A-B and C-D show the extent and thickness of the peat.

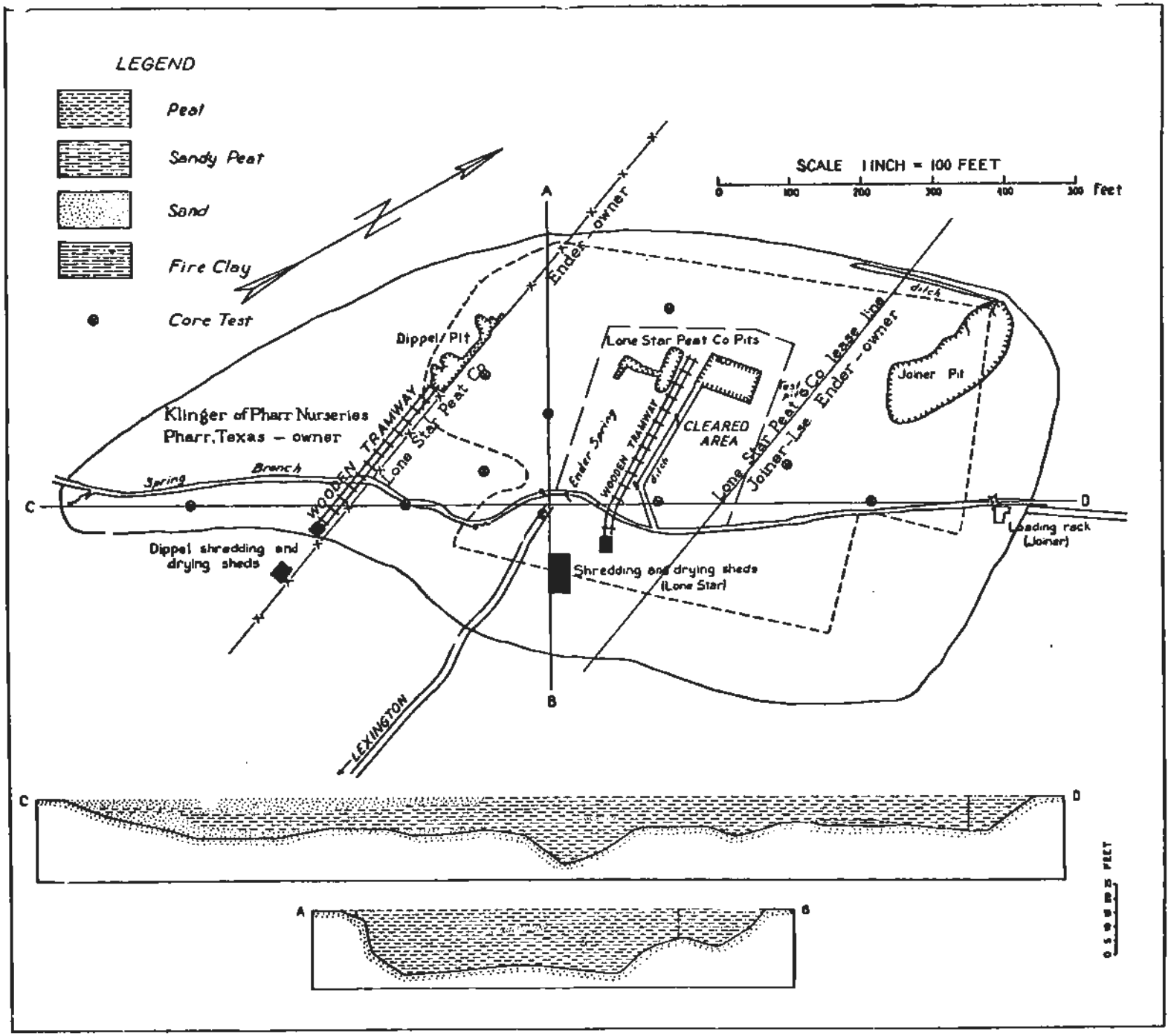

Figure 3. Ender bog in Lee County, Texas. The solid line indicates the outline of the bog, the dashed line the extent of the best peat, the hachured lines the location of pits from which peat has been excavated. The cross sections A-B and C-D show the extent and thickness of the peat.

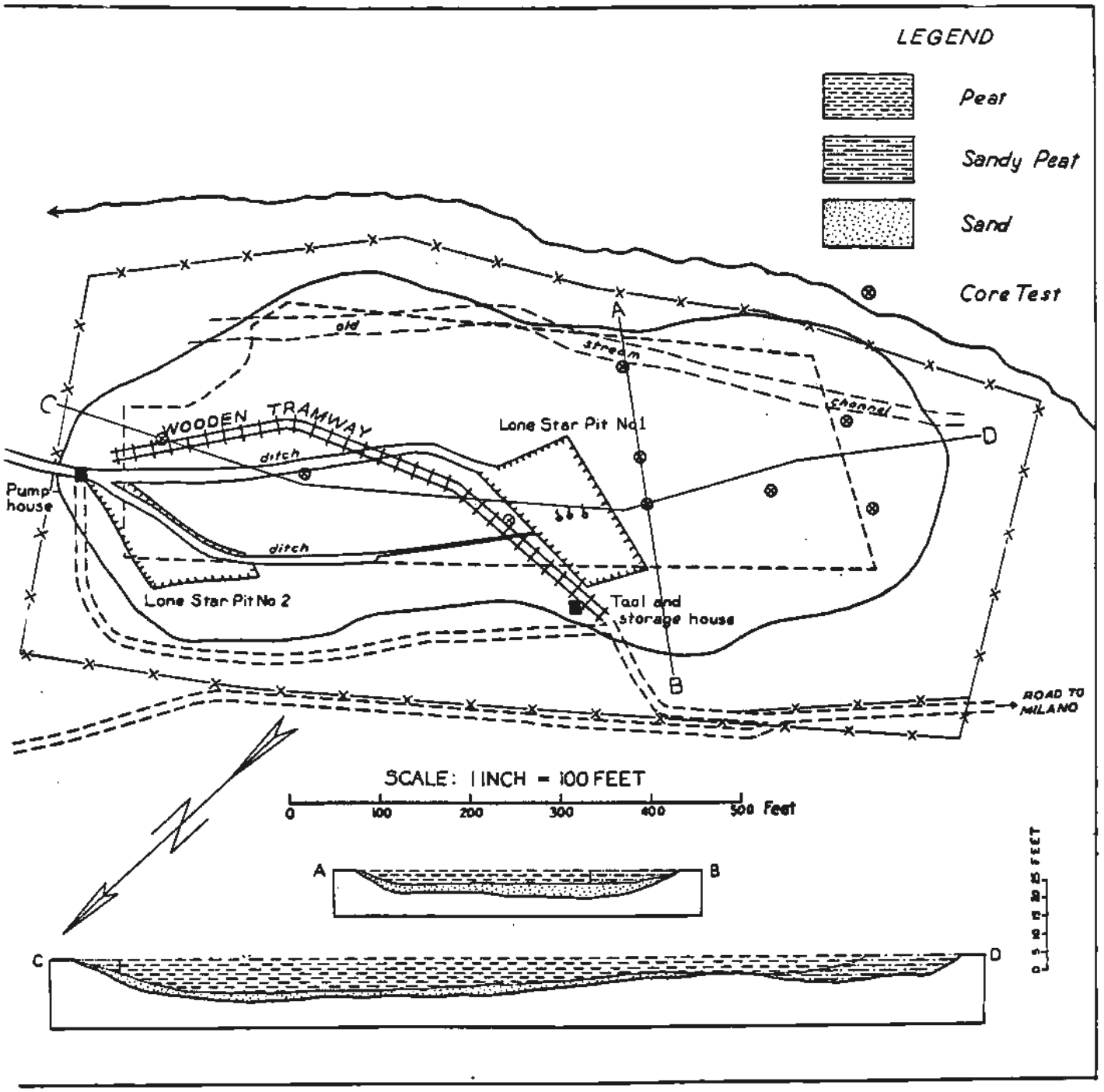

Figure 4. Atkinson bog in Milam County, Texas. The solid line indicates the outline of the bog, the dashed line the extent of the best peat, the hachured lines the location of pits from which peat has been excavated. The cross sections A-B and C-D show the extent and thickness of the peat.

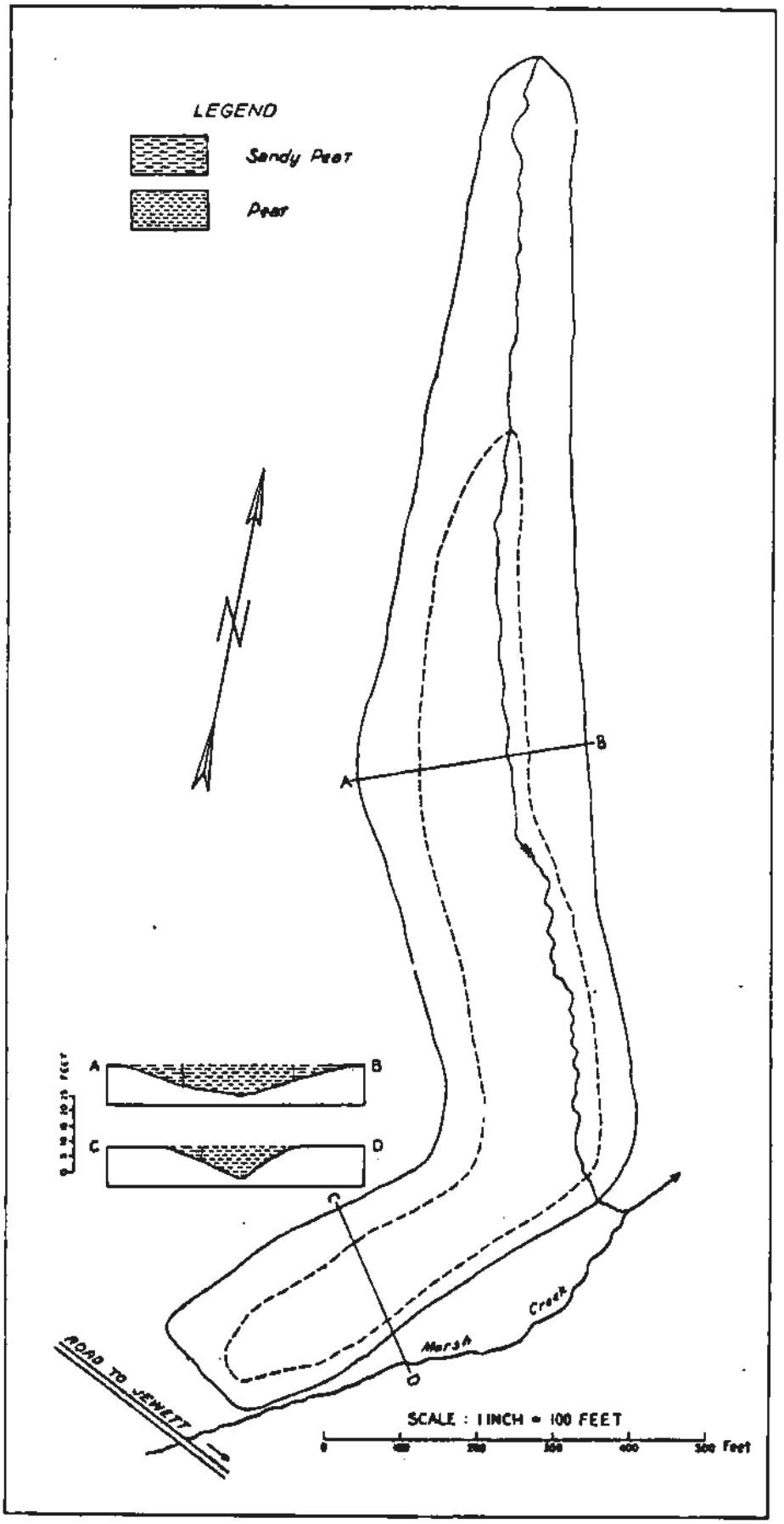

Figure 5. Weakley bog in Leon County, Texas. The solid line indicates the outline of the bog, the dashed line the extent of the best peat. No development has taken place in this bog and no core tests have been made so that the quality of the peat has not been investigated. The cross sections A-B and C-D show the approximate extent and thickness of the peat.

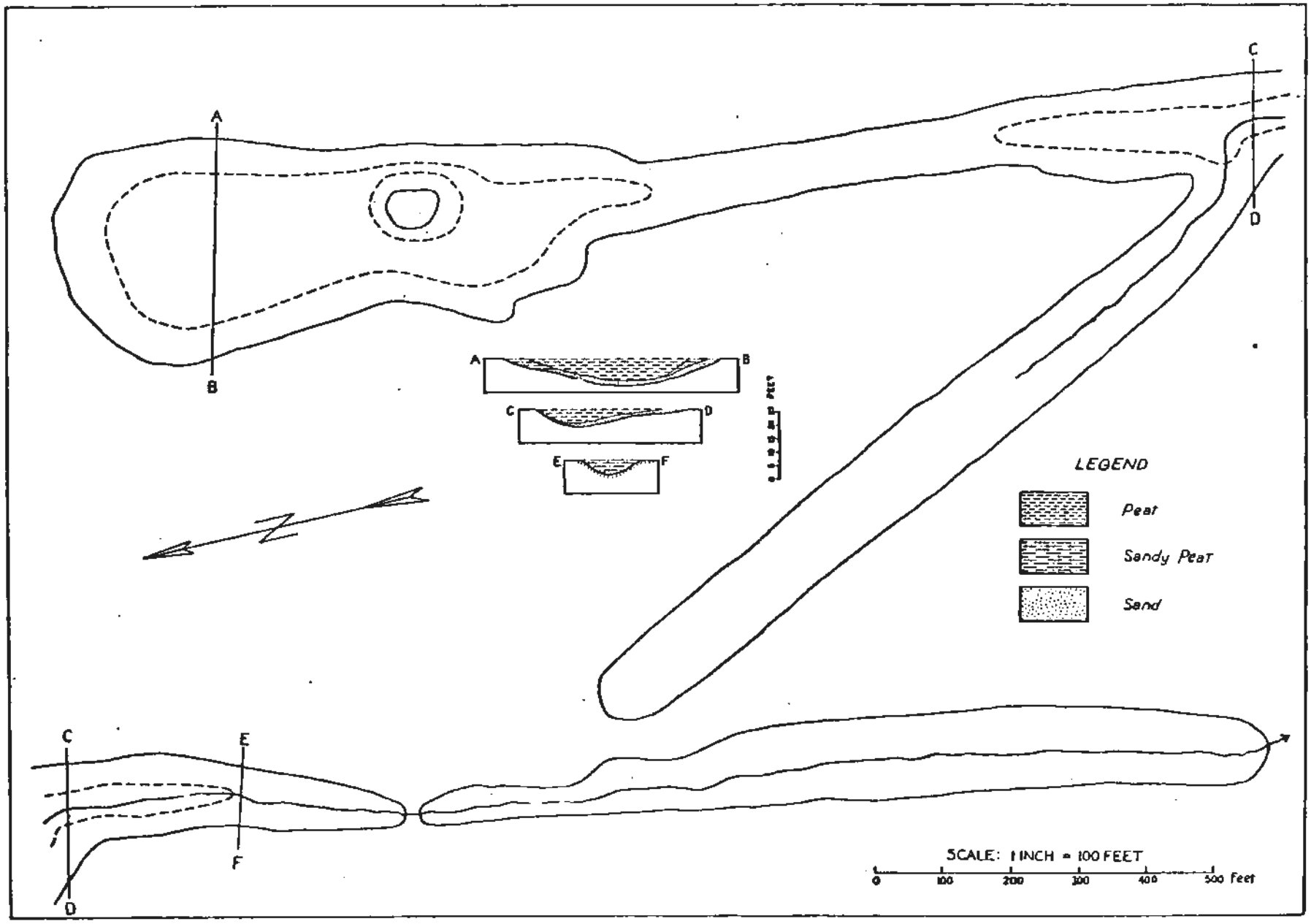

Figure 6. Lanier or Long Glade bog in Leon County, Texas. The solid line indicates the outline of the bog, the dashed line the extent of the best peat. No development has taken place in this bog and no core tests have been made so that the quality of the peat has not been investigated. The cross sections A-B and C-D show the approximate extent and thickness of the peat.