SOUTH CAROLINA

Energy Research Institute

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DOE/ET/14694--T6

DE82 006852

DOE/ET/14694--T6
PEAT RESOURCE ESTIMATION IN
SOUTH CAROLINA

FINAL REPORT

(Year 2)

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January 1982

D.O.E. Grant No. DE-FG01-79ET14694

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I. SUMMARY

South Carolina has few indigenous energy resources. Most widely known and utilized are hydropower, wood, and solar. Peat is a material composed of partially decomposed organic matter that, after burial for long periods of time, may eventually become coal. Peat is utilized as an energy resource for the production of electricity and for home heating in Europe and the Soviet Union. There are peat deposits in South Carolina, but peat has never been used as an energy resource within the state. This report presents the results of the two years of a planned four-year study of the quantity and energy potential of peat in South Carolina.

At the start of this study, the only published peat reports for the state were a one-page summary of mineral localities by Sloan (1908) which briefly mentioned peat, a Master's thesis with some data on the geometry of the peat deposits in the Snuggedy Swamp, Colleton County by Staub (1977), a U.S. Geological Survey Report by Cameron (1979) which recorded peat as present in the Wambaw Swamp, Charleston County and drill hole records from the S.C. State Geological Survey. One peat mine currently operates in South Carolina in the Snuggedy Swamp. The peat is marketed as a soil supplement for horticultural use.

In this year's survey two activities were undertaken. The first was to visit highly probable peat deposits to confirm the presence of fuel-grade peat. The second was to survey and characterize in more detail the areas judged to be of highest potential as major resources. The factors carrying the greatest weight in our determination of priority areas were: 1) a description of peat deposits in the scientific literature or from discussions with state and federal soil scientists; 2) mention of "organic soils" on soil maps or in the literature; and 3) information from farmers and other local citizens.

Because of the dense swamp - forests over most of the peat deposits in South Carolina, surveying is often quite difficult. When the suspected deposits are narrow, sample sites were reached by foot from a boat or from the road. Where the suspected or known deposits are wide, a helicopter is used to "drop in" a field crew for a sample. At each sampling site, a core is taken to deter-

mine the depth of the peat. Selected samples are given a detailed laboratory analysis. Analyses include measurements of fiber, ash, BTU (heating value) and the elements carbon, hydrogen, oxygen, nitrogen, and sulfur. Each of these factors influence the fuel quality of the peat.

Figure 1 shows the approximate locations of potential major peat deposits in South Carolina. Based on the results of the survey so far, an estimated 64 million dry tons of peat covering approximately 74, 218 acres in six counties in the coastal plain region have been identified (Table 1). Almost all of the laboratory analyses are available on the Snuggedy Swamp in Colleton County (Figure 1). It covers about 15 square miles and contains approximately 1.7×10^{11} lbs. of wet peat. Peat deposits in the swamp average about 6 feet in thickness but exceed 12 feet in some places. The average BTU content of the peat samples was 9,853 BTU's per pound (dry). This heating value is equivalent to some lignite coals. The low ash content (8.1% by weight) and high organic content (90.5% by weight) suggest that this peat could be a relatively high quality fuel.

Surveying has been completed in the Snuggedy Swamp of eastern Colleton County and in the Savannah River marshes in Jasper County. Surveying and analyses are also nearly completed for the Combahee River Swamp. Probes have been made in all identified areas of potential surficial organic deposits in Charleston, Berkeley and Horry Counties. At this time, it appears that Horry County may contain peat deposits as large or larger than those observed in the Snuggedy Swamp of Colleton County. Completion of the surveying of Horry County will be our highest priority in the coming year. The estimates of the sizes of peat deposits in all but Colleton and Jasper Counties should be regarded as "educated guesses" at this time.

Organic deposits may be present but have not yet been identified in Beaufort, Hampton or Dorchester Counties, although some smaller deposits may eventually be encountered there. Carolina Bays (small oval depressions usually less than 1 mile wide) occur in great numbers over most all of the Coastal Plain Counties of South Carolina. Some of these bays have been reported to contain peat (e.g., Woods Bay, Sumter County), although no systematic survey of these features for peat has yet been undertaken. Because they are relatively small, these bays will not be investigated until late in year 3 of this study. Buried peats (in some cases of significant thickness) have also been reported in some parts of South Carolina (e.g., behind Myrtle Beach and Cape Romain). Although these buried peats will be reported symbolically on the final maps, they will generally not be investigated as part of this survey.

Figure 1. Approximate Locations Of Major Peat Deposits In Coastal Plain Counties Of South Carolina

Table I.

CUMULATIVE TOTAL TO DATE OF PROBE SITE INFORMATION, ANALYSES, OR
OTHER DATA OBTAINED FOR ESTIMATION OF PEAT RESOURCES IN SOUTH CAROLINA

Peat Refs. Reviewed	County	Organic Soil Deposits Located	SCGS Drill Legs	Places	Probe Sites	Number of Samples	Prox. & Ult. Anal.	Ash Anal.	Fiber Anal.	Bot. Anal.	Bulk Dens.	Maps, Graphs, or X-Sects.
2,368	Colleton	9	34	Snuggedy	45	340	28	267	36	36	-	18
				Combahee	65	324	10	45	-	-	-	3
				Other	7	-	-	-	-	-	-	-
	Jasper	4	122	Savannah	66	250	10	250	58	36	58	16
				Other	7	20	-	-	-	-	-	-
	Horry	2	242	Big Swamp	58	111	3	71	-	-	-	1
				Other	-	-	-	-	-	-	-	-
	Georgetown	7	134	Black River	35	78	-	44	-	-	-	3
				Black Mingo R.	5	20	-	-	-	-	-	1
				Other	28	-	-	-	-	-	-	-
	Charleston	40	185	Wambaw	7	6	5	3	-	-	-	2
				Adam's Run	2	-	-	-	-	-	-	1
				Other	-	-	-	-	-	-	-	-
	Beaufort	4	87	Unnamed	-	-	-	-	-	-	-	-
	Berkeley	31	159	Hell Hole	12	-	-	10	-	-	-	1
				Ocean Bay	3	5	-	5	-	-	-	1
				Middle Bay	1	-	-	-	-	-	-	1
				Pigeon Bay	2	10	-	21	-	-	-	1
	Marion	1	62	Catfish	5	16	-	16	-	-	-	1
	Hampton	-	40	-	-	-	-	-	-	-	-	-
	Clarendon	4	29	Woods Millpond	-	-	-	-	-	-	-	-
				Dial Bay	-	-	-	-	-	-	-	-
				Little Bay	-	-	-	-	-	-	-	-
	Calhoun	42	105	-	-	-	-	-	-	-	-	-
	Dorchester	-	115	-	-	-	-	-	-	-	-	-
	Sumter	5	-	Woods Millpond	-	-	-	-	-	-	-	-
				Dial Bay	-	-	-	-	-	-	-	-
				Big Bay Swamp	-	-	-	-	-	-	-	-
				Other	3	-	-	-	-	-	-	-
	Florence	3	105	-	-	-	-	-	-	-	-	-
	Darlington	8	-	-	-	-	-	-	-	-	-	-
	Lee	8	19	-	-	-	-	-	-	-	-	-
	Bamberg	10	-	Edisto	-	-	-	-	-	-	-	-
				Saikahatchie	-	-	-	-	-	-	-	-
				Three Mile	-	-	-	-	-	-	-	-
				Other	-	-	-	-	-	-	-	-
	Richland	11	-	-	-	-	-	-	-	-	-	-
	Dillon	1	-	-	-	-	-	-	-	-	-	-
Total 2,358		190	2,337	36+	351	1180	57	772	94	72	58	52

Currently, one cannot make a full assessment of the impact that peat could have as an energy source in South Carolina. Deposits such as the Snuggedy Swamp are small in comparison to deposits in Alaska, Maine, or Minnesota (which may be 10 to 100 times larger). However, most of the South Carolina deposits visited so far are over 80 acres in size, have a minimum average depth of 4 feet and have an average BTU content of at least 8,000 BTU's per bone-dry pound. These are the minimum criteria the Department of Energy is currently using to include a deposit in the "National estimated fuel-peat inventory". Major peat gasification projects under development in the U.S. require peat deposits 5 to 10 times larger than the Snuggedy Swamp. In Russia and Europe, on the other hand, deposits similar in size are smaller than the Snuggedy Swamp are routinely exploited. Utilization of peat as an energy source in South Carolina may require the adaptation of European technology or the development of new technology that can make economic use of intermediate or small size (less than 20,000 acres) deposits.

II. BACKGROUND

This study is one part of D.O.E.'s program to assess the quantity and energy potential of the peat resources of the United States.

III. OBJECTIVES

A. General

1. Institute a program to assess the magnitude of the resources and areas of highest potential for peat deposits in South Carolina.
2. With a small sample of cores, through "Proximate", "Ultimate", BTU and petrographic analysis, evaluate the energy potential of the South Carolina peat resources.

B. Specific Goals

- Task 1: Assess Existing Data and Establish Priorities for Surveying
- Subtask A: Review Existing Data
  - Subtask B: Establish Priorities for Surveying
- Task 2: Identify Sampling Procedures and Strategy.
- Task 3: Procure Equipment and Supplies
- Task 4: Conduct Field Surveys and Laboratory Analyses
- Subtask A: Field Surveys
  - Subtask B: Laboratory Analyses (Ash, Moisture, Proximate and Ultimate, Fiber)
  - Subtask C: Prepare Maps, Cross Sections, Tables
Graphs
  - Subtask D: Calculate Peat Resources for Each County

IV. TECHNICAL PROGRESS

A. TASK 1. ASSESS EXISTING DATA AND ESTABLISH PRIORITIES FOR SURVEYING

1. Subtask A: Review of Existing Data

A comprehensive review of all accessible scientific, technical, and popular literature concerned with the geology, geochemistry, soils, botany and ecology of South Carolina's Coastal Plain and vicinity has been nearly completed. We have compiled a bibliography of about 2,300 references and are in the process of reviewing and obtaining copies of additional pertinent references. In this connection, we have utilized the resources or information from the libraries of the University of South Carolina, South Carolina Geological Survey, Southeastern Forest Experiment Station (Asheville, NC), Southern Forest Experiment Station (New Orleans), U.S. Forest Service (Charleston), U.S. Army Corps Engineers (Vicksburg), and an existing Georef Computer Search. We will be obtaining additional computer literature surveys as these are deemed appropriate in the future.

We have obtained copies of all existing soil surveys for the State and have also obtained advanced copies of maps from those county officials where surveys were only partially completed. In order to determine the maps and aerial photographs which we would need and also to obtain additional information regarding potential peat localities in the State, we have consulted with Donald Hallbick, State Conservationist (U.S. Soil Conser. Service), Cornelia Cameron (U.S. Geological Survey, Reston, VA), Don Colquhoun (Univ. of S. Carolina), Stan Inabinet (S.C. Land Resources Commission), John Pryor, (U.S. Forest Service, McClellanville), Dennis Law (U.S. Forest Service, Francis Marion National Forest), Ken McLeod (Savannah River Ecology Laboratory), Robert McDaniel (Congaree National Monument), Warrent Stuck (Soil Scientist, Colleton Co.), Andy Johnson (District Conservationist, Charleston Co.), Travis Dudley (Soil Sci., Georgetown Co.), David Abney (Soil Conserv., Beaufort Co.), Charles Glover (Soil Conserv., Berkeley Co.), Bethel Carey Durant (Dist. Conserv., Jasper Co.), Charles Mills (Dist. Conserv., Dorchester Co.), and personnel from the South Carolina State Highway Department.

No complete field survey of the peat resources of the State of South Carolina has ever been done. A one-page report of a study done in 1908 on horseback by Sloan describes a few peat occurrences in South Carolina, but dismisses them as insignificant. A brief, unpublished report on peat deposits in South Carolina provided from the files of the South Carolina Geological Survey mentions a few additional peat occurrences in South Carolina (some of which are buried). A Master's thesis at the University of South Carolina by Staub (1977) provides some limited data regarding the geometry of the Snuggedy Swamp of Colleton County, S.C. An "open-file" report by C. Cameron of the U.S. Geological Survey (1979) reported a small amount of peat in the Wambaw Swamp of South Carolina. Also of use to us was the extensive unpublished "drill hole" data for several counties provided to us by the South Carolina State Geological Survey.

We have found that our best source of preliminary information regarding potential areas to be surveyed has been the published (or "interim") reports of the U.S. Department of Agriculture Soil Conservation Service. It should be noted that some counties have not yet (or only partially) been surveyed and also that the term "organic soil" as used by the USDA includes not only peats but also sediments with much less than 70% organics. The following soil survey reports were utilized in this study: Beaufort-Jasper, Charleston, Colleton (Interim report), Horry, Georgetown, Berkeley, Marion, Clarendon, Calhoun, Florence-Sumter, Darlington, Lee, Bamberg, Richland and Dillon counties.

2. Subtask B: Establish Priorities for Surveying

Partially completed soils maps provided by the U.S. Soil Conservation Service, preliminary field reconnaissance (Staub 1977 and this project), and interpretation of aerial photographs indicated that Colleton County contained one of the largest, readily-accessible deposits of fuel-grade peat in our State (the Snuggedy Swamp deposit). For this reason, the completion of a detailed survey of Colleton County has been our highest priority goal for the first two contract years. Also of high priority for this second year was the surveying of another large deposit which occurs primarily in Colleton County (the Combahee Swamp). This deposit contains relatively thick and readily accessible peat.

From last year's studies we determined that we had a large deposit of peat in the southern portion of Jasper County near the Savannah River and thus we also initiated surveying in this region. All surveying and analysis of data from this deposit has now been completed. Surveying of the Big Swamp in Horry County and Black River Swamp in Georgetown County were also determined from last years study to be of high priority. However, preliminary surveying of the Black River Swamp during this year has indicated that the quality of peat there is generally too poor (i.e. high in ash) to be of much potential for energy use.

In Year III of this study we intend to complete surveying of the remaining portion of the Big Swamp in Horry County, the Wambaw Swamp in Charleston County, and to begin surveying of the numerous "Carolina Bay" swamps which occur throughout the Coastal Plain counties.

B. TASK 2. IDENTIFY SAMPLING PROCEDURES AND STRATEGY

1. Field Methods

Because of the dense swamp-forest over most of the peat deposits in South Carolina, surveying by "all-terrain" vehicle is impossible in almost all areas. Transects by boat are limited (by time and expense) to the edge of most of the swamps. In Colleton County, for instance, we determined that the best course of action where the deposit was narrow (< 1 mile wide) and bordered by either streams or roads was to survey by foot from boat or road. On the other hand, where the deposit was wide (in most cases > 1 mile wide) or far from streams or roads, the boat surveys of the edges were supplemented by use in the interior of a helicopter. Helicopter surveying was accomplished by placing a 1/2 mile grid pattern (drawn on transparent film) over an aerial photomosaic of the region. The grid intersection points were marked through the film and onto the photos with a needle. From these photos, a navigator in the helicopter guided the pilot to each grid point where a field crew was placed out into the swamp for sampling. At each site, the crew cored with a Davis Sampler or soil auger. The field characteristics (i.e., color, texture, composition) of the peat with depth were recorded on data sheets (Appendix A). Surface conditions (e.g. vegetation, cultivation activity) were also recorded. Selected samples were collected at each site for laboratory analyses (e.g., fiber, ash, proximate, ultimate).

2. Laboratory Methods

In order to better characterize our peat deposits so that those using this report will be able to determine the best use for these resources, (e.g., direct combustion, gasification) we supplemented our field descriptions with laboratory analyses including fiber content, botanical composition, ash, proximate and ultimate analyses, and BTU. Botanical composition and fiber percentages were determined on selected samples by analysis of oriented microtome sections

using the process described by Cohen and Spackman (1972) and Cohen (1980). In this procedure, percentage of fibers (i.e., plant fragments > 150 microns) were determined microscopically by point-counting. For comparison, some fiber analyses were also done by the dry weight (sieving) method (ASTM Standard #D2977; see Appendix B).

Proximate analyses (i.e. standard "coal analyses" for fixed carbon, volatile matter, moisture, and ash), ultimate analyses (i.e., analyses for the elements C, H, O, N, S) and BTU (heating value) were obtained by contract with the Coal Analysis Branch of the U.S. Department of Energy. Because of the cost of analysis, only selected samples from each major deposit were sent for analysis. These samples represented an average of several samples collected from each 24" section of peat.

Preliminary results from several regions in South Carolina have indicated that it is very difficult to distinguish with the naked eye highly decomposed peats from organic-rich clays. We have thus found it necessary to verify a large number of our field determinations of peat thickness by laboratory-determined ash analyses. Only samples with less than 30% ash were considered peats. The procedure which we used for ashing the peat is outlined in ASTM Standard #D2974 (See Appendix C).

C. TASK 3. PROCUREMENT OF EQUIPMENT AND SUPPLIES

Davis peat samplers, soil augering devices, and McCauley peat samplers were procured and utilized for completion of the field surveys. Natural deterioration of field equipment will necessitate some replacement and repair of this equipment in Year III of this project.

Supplies for laboratory analyses and map presentation were procured as the work was being conducted. We would anticipate a similar "supply procurement" schedule for the work which we will be conducting in Year III.

D. TASK 4: RESULTS OF FIELD SURVEYS AND LABORATORY ANALYSES

1. Introduction

Figure 1 shows the approximate locations of potential major peat deposits in South Carolina and also the status of our field surveying. Surveying and analysis has been completed in the Snuggedy Swamp of eastern Colleton County and the Savannah River Swamp. Surveying, but not all analysis, has been completed in the Combahee marshes of western Colleton County. Extensive probing has been undertaken in areas of potential large peat deposits in Georgetown and Horry Counties. All other major (high priority) peat deposits in South Carolina were investigated in at least a preliminary way in this past year. New, somewhat smaller deposits, were discovered this year in Berkeley, Marion, Clarendon, Sumter, Calhoun, Florence, Darlington, Lee, Bamberg, Richland, and Dillon counties.

Carolina Bays (small oval depressions usually < 1 mile wide) occur in great numbers over most all of the Coastal Plain Counties of South Carolina (Figure 2). Some of these features have been reported to contain peat (e.g., Woods Bay, Sumter County, S.C.). Because of their size, we did not investigate these deposits in Year II of this study, but plan to do so in Year III.

Buried peats (in some cases of significant thickness) have also been encountered in reports from some parts of South Carolina (e.g., behind Myrtle Beach and Cape Romain). Although these buried peats will be reported symbolically on our final maps, they will generally not be investigated as part of this survey because mining most of these would probably not be practical.

The following sections present the detailed results of this year's survey county-by-county.

Figure 2
Distribution Of Carolina Bays In Coastal Plain
Of N.C., S.C., & Georgia

2. COLLETON COUNTY

a. General

Figure 3 shows the resource data available for Colleton County, S.C. Data includes S.C. Geological Survey drill core descriptions and reconnaissance probes conducted by the S.C. Organic Sediments Research Group, University of South Carolina. Also outlined on this county map are those areas designated by the U.S.D.A. Soil Conservation Service (unpublished maps) as containing "organic soils". Note that the largest potential area of organic soil occurs in the southeastern portion of this county. We have referred to this region in the rest of this report as the Snuggedy Swamp region. Another smaller but still significant deposit occurs in the southwestern portion of this county along the Combahee River. A portion of this deposit extends across the river into Beaufort County. This will be called the Combahee region in the rest of this report.

b. Snuggedy Swamp

(1) Geometry of Deposit

Figure 4 shows the locations and depths of peat in probe sites in the Snuggedy Swamp. Peat in this region has been found to exceed 12 feet in thickness but averages about 6 feet thick. Peat is presently being mined by American Peats and Organics at Fenwick near the abandoned Seaboard Railroad line. Figure 5 shows the location of some cross sections of this swamp (Figures 6 & 7) which have been drawn from the field descriptions and ash analyses.

Since the Snuggedy Swamp in eastern Colleton County has been surveyed more extensively than any other peat deposit in South Carolina, we have chosen this deposit for initial computer mapping. All depth data from our surveys plus all depth data (that could be accurately mapped) from published reports or from files of the Organic Sediments Research Center (University of South Carolina) were digitized and plotted using the "Surface II" computer mapping program. Since the map was not yet available at the time of this printing, a hand-drawn facsimile is shown as Figure 8. The thickest peat tends to occur in 4 troughs having long axes roughly parallel to the sand islands. The deepest trough occurs toward the west-central portion of the deposit near the Ashepoo River.

Figure 4. Probe Sites In Peat Deposits In Snuggedy Swamp, S.C.

Figure 5. Location Of Cross Sections In Snuggedy Swamp, S.C.

Figure 6. Cross Sections From Cores In Snuggedy Swamp, S.C.

Figure 7. Cross Sections From Cores In Snuggedy Swamp, S.C.

FIGURE 8. ISOPACH MAP OF PEAT IN SNUGGEDY SWAMP, COLLETON CO., S.C.

The approximate total area of peat in the Snuggedy Swamp has been calculated from these maps to be 3.40×10^9 ft.³ representing about 1.7×10^{10} lbs. of wet peat.

(2) Quality

a. Ash

Figures 9 through 12 show the percentages of ash in samples taken along 4 transects (Figure 5). Note that ash tends to increase toward the rivers due to the greater influence of river-transported, inorganic sediments. Also note that, in all cores, ash increases rather abruptly at the base and in many of the cores shows a very slight increase toward the top. Table II gives actual moisture, organic, and ash contents for individual samples from the Snuggedy Swamp. In this region, the average moisture content for peat (< 30% ash) samples is 85.5%; the average organic content is 90.3% (wt. % dry); and the average ash content is 8.1% (wt. % dry).

b. Fiber Content

Fibers are intact plant fragments in peats which are greater than 150 microns in any dimension. Generally, the higher the fiber content, the greater the "water-holding-capacity" (mulching capacity) and the greater the "in situ" moisture content. In Europe, peats with low fiber content and low ash contents are generally considered to be the best "fuel peats"; however, this designation refers primarily to direct combustion. If the peat is to be converted to a gas or liquid before use, then a high fiber peat might also be a good "fuel peat". Furthermore, peats with low fiber content tend to be dense and become hard when dried which may cause problems if the mining method requires draining and drying (e.g. milled peat mining method).

Figure 13 shows a transect of the Snuggedy Swamp from which samples were taken for fiber analysis. Figure 14 gives the fiber contents with depth for each of the cores in this transect. Fiber contents tend to decrease as ash contents increase. One might expect that the older the peat is the more decomposed it would be and, thus, the lower the fiber content would be. However, there is not a consistent decrease in fiber with depth (i.e. age) and it appears that such factors as rate of sedimentation and changes in source vegetation have

Figure 9. % Ash From Transects In Snuggedy Swamp, S.C.

Figure 10. % Ash From Transects In Snuggedy Swamp, S.C.

Figure 11. % Ash From Transects In Snuggedy Swamp, S.C.

Figure 12. % Ash From Transects In Snuggedy Swamp, S.C.

Table III. Moisture, Ash, and Organic Contents of Peats from
Snuggedy Swamp, SC (wt. %)

No.	Sample Site	Depth	Moisture Content	Organic Content	Ash Content
1	SS100A	0-08"	86.8%	75.0%	25.0%
2	SS100A	8-12"	84.9	61.2	38.8*
3	SS100A	12-18"	80.9	46.4	53.6*
4	SS100A	18-24"	82.3	45.7	54.3*
5	SS100A	24-30"	81.6	52.7	47.3*
6	SS100A	30-36"	83.8	75.8	24.2
7	SS100A	54-60"	88.5	66.2	33.8*
8	SS100A	60-72"	85.6	72.8	27.2
9	SS100A	72-84"	86.0	56.1	43.9*
10	SS100A	84-96"	78.4	33.4	66.6*
11	SS100A	96-108"	67.6	18.7	81.3*
12	SS104	0-10"	90.9	88.6	11.4
13	SS104	10-20"	86.3	95.9	4.1
14	SS104	20-30"	87.4	94.7	5.3
15	SS104	30-40"	87.6	76.4	23.6
16	SS104	40-50"	87.2	76.6	23.4
17	SS104	50-60"	81.1	38.0	62.0*
18	SS132	0-12"	88.2	93.2	6.8
19	SS132	12-24"	86.1	95.1	4.9
20	SS132	24-36"	87.6	94.9	5.1
21	SS132	36-48"	86.4	90.8	9.2
22	SS132	48-60"	80.5	51.8	48.2*
23	SS134	0-10"	92.7	93.3	6.7
24	SS134	10-20"	83.8	95.5	4.5
25	SS134	20-30"	85.7	96.5	3.5

Table II. (con't)

No.	Sample Site	Depth	Moisture Content	Organic Content	Ash Content
26	SS136	0-10"	90.4%	95.6%	4.4%
27	SS136	10-20"	86.9	97.4	2.6
28	SS136	20-30"	88.8	97.3	2.7
29	SS136	30-40"	87.9	98.2	1.8
30	SS136	40-50"	86.8	98.1	1.9
31	SS136	50-60"	87.6	97.4	2.6
32	SS136	60-70"	90.0	91.2	8.8
33	SS136	70-80"	63.9	17.9	82.1*
34	SS138	0-12"	80.6	93.2	6.8
35	SS138	12-24"	82.6	95.4	4.6
36	SS138	24-36"	86.5	96.5	3.5
37	SS138	36-48"	85.4	97.3	2.7
38	SS138	48-60"	83.5	63.5	36.5*
39	SS138	60-72"	73.1	52.5	47.5*
40	SS138	72-84"	55.4	17.0	83.0*
41	SS142	0-12"	90.8	94.6	5.4
42	SS142	12-24"	88.2	93.8	6.2
43	SS142	24-36"	87.6	97.7	2.3
44	SS142	36-48"	88.5	97.7	2.3
45	SS142	43-60"	88.2	97.7	2.3
46	SS142	60-72"	88.9	92.3	7.7
47	SS142	72-84"	86.9	96.6	3.4
48	SS142	84-96"	89.5	88.6	11.4
49	SS142	96-108"	82.3	49.8	50.2*
50	SS144	0-12"	82.1	96.1	3.9

Table II. (con't)

No.	Sample Site	Depth	Moisture Content	Organic Content	Ash Content
51	SS144	12-24"	83.3%	96.2%	3.8
52	SS144	24-36"	85.3	96.8	3.2
53	SS144	48-60"	85.9	96.9	3.1
54	SS144	60-72"	84.6	96.8	3.2
55	SS144	72-84"	89.2	95.0	5.0
56	SS144	84-96"	48.9	10.4	89.4*
57	SS167	0-12"	87.3	69.7	30.3*
58	SS167	12-24"	77.2	23.9	76.1*
59	SS167	24-36"	66.4	15.9	84.1*
60	SS168	0-12"	87.1	95.6	4.4
61	SS168	12-24"	86.6	98.0	2.0
62	SS168	24-36"	86.8	98.3	1.7
63	SS168	36-48"	87.5	98.0	2.0
64	SS168	48-60"	86.7	96.8	3.2
65	SS168	60-72"	89.1	96.9	3.1
66	SS168	72-84"	87.7	93.0	7.0
67	SS168	84-96"	88.2	87.9	12.0
68	SS168	96-108"	88.7	89.0	11.0
69	SS171	0-12"	84.9	96.3	3.7
70	SS171	12-24"	84.2	98.1	1.9
71	SS171	24-36"	86.3	97.8	2.2
72	SS171	36-48"	86.3	98.4	1.6
73	SS171	48-60"	88.3	97.8	2.2
74	SS171	60-72"	87.3	96.8	3.2
75	SS171	72-84"	75.9	35.3	64.7*

Table II. (con't)

No.	Sample Site	Depth	Moisture Content	Organic Content	Ash Content
76	SS171	84-96"	67.0%	22.1%	77.9*
77	SS171	96-108"	64.1	18.6	81.4*
78	SS177	0-12"	66.4	44.4	55.6*
79	SS177	12-24"	25.7	55.3	44.7*
80	SS177	24-36"	80.9	59.5	40.5*
81	SS177	36-48"	64.8	21.9	78.1*
82	SS177	48-60"	18.3	3.8	96.2*
83	SS199	0-10"	87.2	53.0	47.0*
84	SS199	10-20"	84.9	41.8	58.2*
85	SS199	20-30"	74.1	37.3	62.7*
86	SS199	30-40"	73.0	25.7	74.3*
87	SS200	0-12"	84.8	85.6	14.4
88	SS200	12-24"	83.6	90.9	9.1
89	SS200	24-36"	84.9	91.8	8.2
90	SS200	36-48"	81.3	89.4	10.6
91	SS200	48-60"	29.8	7.9	92.1*
92	SS202	0-8"	91.6	76.8	23.3
93	SS202	8-16"	30.9	11.1	88.9*
94	SS204	0-8"	82.4	94.2	5.8
95	SS204	8-12"	89.0	96.9	3.1
96	SS204	12-24"	89.9	97.6	2.4
97	SS204	24-36"	81.2	91.4	8.6
98	SS204	36-48"	29.7	9.0	91.0*
99	SS206	0-12"	83.0	94.0	6.0
100	SS206	12-24"	85.2	97.5	2.5

Table II. (con't)

No.	Sample Site	Depth	Moisture Content	Organic Content	Ash Content
101	SS206	24-36"	84.7%	96.6%	3.4
102	SS206	36-48"	80.8	78.1	21.9
103	SS206	48-60"	43.9	20.3	79.7*
104	SS208	0-12"	72.6	97.8	2.2
105	SS208	12-24"	80.6	94.9	5.1
106	SS208	24-36"	79.5	97.3	2.7
107	SS208	36-48"	84.9	97.3	2.7
108	SS208	48-60"	71.6	98.2	1.8
109	SS208	60-72"	88.6	93.9	6.1
110	SS208	72-84"	30.1	7.4	92.6*
111	SS210	0-12"	47.4	15.9	84.1*
112	SS210	12-24"	61.8	24.0	75.0*
113	SS210	24-36"	58.4	14.8	85.2*
114	SS210	36-48"	58.4	16.1	83.9*
115	SS236	0-12"	85.2	92.5	7.5
116	SS236	12-24"	81.4	69.7	30.3*
117	SS236	24-36"	79.0	63.1	36.9*
118	SS238	0-12"	78.5	92.2	7.8
119	SS238	12-24"	88.0	91.9	8.1
120	SS238	24-36"	85.3	97.0	3.0
121	SS238	36-48"	82.8	95.3	4.7
122	SS238	48-60"	82.1	94.6	5.4
123	SS238	60-72"	81.9	92.3	7.7
124	SS238	72-84"	73.9	48.2	51.8*
125	SS240	0-10"	79.2	95.3	4.7

Table II. (con't)

No.	Sample Site	Depth.	Moisture Content	Organic Content	Ash Content
126	SS240	10-20"	80.6%	96.2%	3.8
127	SS240	20-30"	86.9	97.5	2.5
128	SS240	30-40"	85.0	94.7	5.3
129	SS240	40-50"	86.8	80.6	19.3
130	SS240	50-60"	49.8	15.7	84.3*
131	SS300	0-12"	83.9	84.4	15.6
132	SS300	12-24"	82.7	86.0	14.0
133	SS300	24-36"	84.4	91.7	8.3
134	SS300	36-48"	84.4	92.8	7.2
135	SS300	48-60"	85.8	93.4	6.6
136	SS300	60-72"	86.3	93.2	6.8
137	SS300	72-84"	85.0	92.0	7.0
138	SS300	84-96"	78.0	54.1	45.9*
139	SS300	96-108"	74.4	34.1	65.9*
140	SS301	12-24"	67.8	24.1	75.9*
141	SS301	24-36"	79.5	45.1	54.9*
142	SS301	36-48"	80.1	50.6	49.4*
143	SS301	48-60"	84.9	78.1	21.9
144	SS301	60-66"	83.3	75.7	24.3
145	SS301	66-72"	84.7	76.0	24.0
146	SS301	72-84"	85.2	65.6	34.4*
147	SS301	84-96"	79.5	37.8	62.2*
148	SS301	96-108"	72.3	24.2	75.8*
149	SS302	0-12"	85.8	73.5	26.5
150	SS302	12-24"	81.8	81.4	18.6

Table II. (con't)

No.	Sample Site	Depth	Moisture Content	Organic Content	Ash Content
151	SS302	24-36"	87.3	87.1	12.9
152	SS302	36-48"	85.2	88.0	12.0
153	SS302	48-60"	81.4	88.5	11.5
154	SS302	60-72"	84.9	87.7	12.3
155	SS302	72-84"	86.2	85.8	14.2
156	SS302	84-96"	85.6	75.2	24.8
157	SS302	96-108"	80.2	43.8	56.2*
158	SS304	0-12"	31.6	9.0	91.0*
159	SS306	0-12"	85.0	61.7	38.3*
160	SS306	12-24"	83.2	86.7	13.3
161	SS306	48-60"	50.4	22.9	77.1*
162	SS307	0-12"	86.2	91.1	8.9
163	SS307	12-24"	84.0	96.1	3.9
164	SS308	0-12"	87.5	72.4	27.6
165	SS308	12-24"	73.7	40.3	59.7*
166	SS309	0-12"	63.5	21.4	78.6*
167	SS309	12-24"	<u>65.6</u>	<u>22.1</u>	<u>77.9*</u>
Averages			85.5	90.3	8.1

*Not Peat

Figure 13. Cross Section A-A' For Fiber Analyses In Snuggedy Swamp, S.C.

Figure 14. % Fiber Of Cores In Cross Section A-A'
From Snuggedy Swamp, Colleton Co., S.C.

had as much influence on variation fiber content as has age. In Figure 15, the percentage of fibers is plotted against the percentage of total samples analyzed. Note that most of the samples (> 60%) have 20-30% fibers or less. Most of the samples from this locality would be the "sapric" type with only a small percentage being in the "hemic" range and none being of the "fibric" type. The low fiber content in conjunction with the relatively low average ash content suggests that Snuggedy Swamp peats should be good "fuel peats".

c. Botanical Composition

All of the peats in this region are woody or grass-sedge-dominated. Although precise assessments are not yet possible, a rough estimate suggests that anywhere from 40% to 70% of our peats may be of woody type. This is significant because woody peats are considerably different in texture and composition from the Sphagnum and herbaceous (bog) peats of Northern Europe and Russia which are presently being utilized for energy purposes. It is evident at this time that some modification of the existing mining and conversion technology will be required before South Carolina's peat resources can be exploited, since existing mining equipment is not designed to harvest woody peats.

The common terrestrial woody species in the swamp are Persea borbonia, (red bay), Myrica cerifera (was myrtle), Lyonia lucida, Itea virginica, Ilex spp. (hollys), Cyrilla racimiflora (titi), Pinus spp., and a few palmettos. Smilax vines and Rhus spp. (poison ivy and sumac) are also abundant. Common sedge and grass types are Carex sp., Cladium sp., Cyperus sp. and Spartina spp.. Woodwardia virginica (virginia chainfern), Osmunda spp. (royal fern and others), and Sphagnum sp. (peat moss) are all common herbaceous types. In wetter areas Lachnanthes, Xyris and Nymphaea are also present. This kind of vegetational community is typical of the pocosins and fresh-water marshes of the Atlantic Coastal Plain from North Carolina to Georgia. Evidence of recent fires in surface samples analyzed microscopically as well as evidence of recent vegetational changes in the upper portion of cores suggests that the Snuggedy Swamp drainage has been altered in the last 100 years or so. Thus, the present surface vegetation would no longer be considered to be virgin swamp vegetation.

Figure 15. Fiber Frequency Curve Of Cross Section A-A'
From Snuggedy Swamp, Colleton Co., S.C.

d. Proximate and Ultimate Analyses and BTU Content

Table III gives a summary of Proximate and Ultimate analyses for all peat samples from the Snuggedy Swamp. Note that the average BTU (9,888 per dry pound) is relatively high in comparison to peat from the northern States (e.g. Minnesota), where the peats average about 8800 BTU/lb. This is a reflection of the high degree of decomposition exhibited by peats from the warmer southeastern States. Also note that on a dry basis, these peats are equivalent in rank to lignite coals (see ASTM Classification of Coals by Rank).

As can be seen from a plot of ash versus BTU for all peat samples analyzed to date from South Carolina (Figure 16), there is a strong negative correlation between the ash content and the BTU value for all peat samples ($r = -.91$). Average BTU value had a very small coefficient of variation and a confidence interval of only 3% as compared to 55% for ash from the same 23 samples (Table IV). Based on the relative sizes of the coefficients of variation of the different factors, it appears that ash and sulfur require the most measurements in order to have strong confidence (less than a 10% confidence interval) that the mean value characterizes the peats in the Snuggedy Swamp. The difficulty in determining a precise ash content is emphasized by the higher average ash content in samples from Table II as compared to those from Table III. The average of samples from Table III was even greater than the confidence intervals of 55% calculated from the average from Table II samples. In addition, a sample size of 108 (the number of peat samples from Table II) did not reduce the confidence intervals to 10% of the mean.

Table V shows the results of an analysis of variance of the ash samples shown in Table I. In this sampling scheme, samples were taken at 10 to 12 inch intervals to varying depths (minimum of 30 inches; maximum of 108 inches) at 26 stations. We were interested in whether sampling variability between stations was greater than between depths at a station. The significant F-ratio ($p < .001$) shows that sampling variability between stations was a significant addition to the variability expected between depths at a station. The E-squared value of 0.7 estimates that two-thirds of the total variability in the ash samples taken from the bay can be attributed to the differences between stations. When this analysis was repeated for stations that had samples containing peat only (16 stations with organic content > 70% down to at least 48"), the result

Table III Summary of Proximate and Ultimate Analyses (Dry Basis)

Snuggedy Swamp, Colleton County, S.C.

Site #	Depth	BTU per lb.	Ash	Fixed C	VM	H	C	N	S	O
SS 168	0-24"	9,836	2.6	39.0	58.4	4.0	60.2	1.0	0.6	31.6
SS 168	24-48"	9,977	2.1	38.5	59.4	4.2	60.7	0.9	0.8	31.3
SS 168	48-72"	9,633	4.5	38.1	57.4	4.8	58.4	1.1	1.2	30.6
SS 171	0-24"	10,241	2.6	38.2	59.2	4.0	61.8	1.2	0.3	30.0
SS 171	24-48"	10,296	2.1	36.8	61.1	4.8	61.9	0.9	0.4	29.8
SS 171	48-72"	10,059	3.7	36.7	59.6	5.1	59.6	1.1	1.0	29.5
SS 138	0-24"	9,789	4.7	36.3	59.0	4.0	59.8	1.1	0.4	30.1
SS 138	24-48"	8,035	22.0	31.7	46.3	3.6	47.9	0.9	0.3	25.3
SS 204	0-24"	10,069	3.4	35.5	61.1	4.6	59.9	1.1	0.4	30.5
SS 204	24-48"	10,118	4.7	35.4	59.9	4.8	59.3	0.9	0.5	29.8
SS 142	0-24"	10,024	3.3	35.9	60.8	4.6	59.2	1.3	0.5	31.1
SS 142	24-48"	10,095	2.2	38.8	59.0	4.5	61.3	1.1	0.5	30.5
SS 142	48-72"	10,160	2.2	38.1	59.7	5.5	60.3	1.0	0.6	30.4
SS 136	0-24"	9,860	3.6	36.8	59.6	3.8	59.6	1.1	0.5	31.4
SS 136	24-48"	9,547	3.7	36.2	60.1	4.3	59.5	1.0	2.0	29.7
SS 136	48-72"	9,753	3.4	38.1	58.4	5.1	58.8	1.1	1.5	30.1
SS 134	0-24"	9,912	5.7	35.1	59.2	3.8	59.2	1.6	0.9	28.9
SS 134	24-48"	10,384	3.4	35.2	60.9	4.8	60.9	0.9	1.2	28.7
SS 134	48-72"	9,953	6.4	35.0	57.5	5.5	57.5	1.1	1.6	27.8
SS 144	0-24"	9,695	4.9	38.9	59.4	4.2	59.4	1.1	0.8	29.6
SS 144	24-48"	9,768	2.9	41.6	60.3	3.8	60.3	1.1	1.4	30.4
SS 144	48-72"	10,117	4.1	38.3	60.0	5.0	60.0	1.3	1.7	27.9
SS 144	72-84"	10,103	5.6	36.0	58.4	5.4	58.4	1.5	2.4	26.6
Averages		9800	4.5	37.0	58.9	4.5	59.3	1.1	0.9	29.6

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Figure 16. % Ash Versus BTU For Samples From S.C.

Table IV. The variability of measurements of proximate and ultimate analyses of peat samples taken from the Snuggedy Swamp, Colleton County, S.C. BTU measurements are expressed per pound of bone dry peat. All other factors are expressed as a percentage of a bone dry pound.

	MEAN	95% CONFIDENCE LIMITS (% OF MEAN)	SAMPLE SIZE	COEFFICIENT ¹ OF VARIATION
BTU	9888	3	23	5
Ash	4.5	55	23	103
Ash ²	8.1	6	108	86
Fixed Carbon	37.0	3	23	6
Volatile Matter	59.9	3	23	6
Hydrogen	4.5	5	23	10
Carbon	59.3	2	23	5
Nitrogen	1.1	9	23	17
Sulphur	0.9	35	23	65
Oxygen	29.6	3	23	5

1. Coefficient of variation = $\frac{\text{standard deviation} \times 100}{\text{mean}}$

2. These samples were analyzed by the Organic Sediments Research Group. All other factors were analyzed by the Department of Energy Coal Analysis Branch, Pittsburgh, Pennsylvania.

Table V. Analysis of variance of ash samples taken from 26 stations at intervals of from 10 to 12 inches to varying depths in the Snuggedy Swamp (see Table I).

ALL SAMPLES				
	<u>df</u> ¹	<u>S.S</u> ²	<u>M.S</u> ³	<u>F-ratio</u> ⁴
Among stations	25	41653.45	1666.14	10.7*
Within stations (depths)	110	17122.37	155.65	
	TSS ⁵	58775.82		
	E-squared ⁶	.709		*p < .001 ⁷
PEAT ONLY				
	<u>df</u>	<u>S.S</u>	<u>M.S</u>	<u>F-ratio</u>
Among stations	15	1501.40	100.09	5.186*
Within stations	76	1466.86	19.30	
	TSS	2968.26		*p < .001
	E-squared	.506		

1 d.f. = degrees of freedom

2 S.S. = sums of squares

3 M.S = means square = S.S./df

4 F-ratio = M.S Among stations/M.S. Within stations

5 TSS = Total Sums of Squares

6 E-squared = S.S. Among stations/TSS

7 p < .001 = probability due to chance alone that M.S among stations is a significant addition to the total sampling variability.

was similar. Again station to station variability was a significant addition to the variability between depths at a station. The E-squared value of 0.505 suggests that 50% of the total ash samples variability can be attributed to the differences between stations. This result suggest that if a uniform peat ash content is a mining objective, some strategy that mixes peat from different areas would be valuable.

Figure 17 shows the locations of the transects from which samples were taken for Proximate and Ultimate analyses. Figures 18, 19, and 20 show the changes with depth in the BTU, ash, and sulfur contents of samples along these 3 transects. Knowledge of the vertical changes in these three parameters would be critical to developing an efficient, economical and non-polluting peats from this area. As previously noted, BTU values tend to correlate inversely with the ash contents. However, in cases where the ash is relatively low (or remains constant with depth), the BTU values tend to gradually increase with depth (probably due to increasing decomposition). Also, (as previously noted), there is a tendency in most cores for the ash content to be high at the base and also at the top of the cores. This is most pronounced toward the stream channels (see especially transect A-A'). The increase toward the bottom probably represents the gradual change from salt marsh clays to fresh water peats (i.e. gradually increasing deposition of organic matter). The slight increase in ash towards the top seems to suggest increased drying or some other hydrologic change (perhaps in response to a slight rise in sea level).

Note that sulfur contents tend to correlate with the higher ash contents at the bases but not with the higher ash contents toward the tops of the cores. This suggests a marine origin for the high ash samples at the base and a fresher water origin of the higher ash surface peats.

Laterally, sulfur values tend to increase toward stream channels (reflecting the brackish nature of the surrounding streams than than just an increase in ash). Thus, stream channels and basal peats might be avoided during mining, if necessary. The average sulfur content of Snuggedy peats (.9% dry) is higher than that of Minnesota or Michigan peats (.59%) but is lower than most Appalachian bituminous coals or lignites.

Taken together the data suggest that although the Snuggedy peats would be mineable, a careful mining plan would be necessary in order to avoid undesirable areas containing higher ash or sulfur.

Figure 17.

Locations Of Transects In Snuggedy Swamp Used For Proximate, Ultimate, & BTU Analyses

A

A'

Depth

% ASH (DRY WT.)

% SULFUR (DRY WT.)

Figure 18.

Comparison Of BTU, Ash, & Sulfur From Transect A-A' In Snuggedy Swamp, S.C.

B

BTU/LB. (DRY; IN THOUSANDS)

Depth
in
Inches

% ASH (DRY WT.)

% SULFUR (DRY WT.)

Figure 19.

Comparison Of BTU, Ash, & Sulfur From Transect B-B' In Snuggedy Swamp, S.C.

B'

C

C'

BTU/LB. (DRY) IN THOUSANDS

Depth
in
Inches

% ASH (DRY WT.)

% SULFUR (DRY WT.)

Figure 20.

Comparison Of BTU, Ash, & Sulfur From Transect C-C' In Snuggedy Swamp, S.C.

c. Combahee River Swamp

(1) Geometry of Deposit

Figure 21 shows our probe sites in the western part of Colleton County along the Combahee River. Although field surveying of this area has been completed, not enough samples have yet been analyzed to produce an accurate resource evaluation. Preliminary field evidence indicates that the peats are quite variable within this region (with some sites containing as much as 12 feet of peat). Figure 22 shows a preliminary cross section represented by samples marked T1 through T10 on Figure 21. Samples from all sites within the Combahee deposit are presently being analyzed for ash and moisture content and bulk density. Samples in two-foot increments with depth from each of the sites used for the transect shown in Figure 21 have been sent out for Proximate Analysis, Ultimate Analysis, and determination of BTU content.

(2) Quality

Although analytical results have not yet been obtained for this region, field descriptions suggest that the peats will be similar to those from the Snuggedy Swamp. These peats appear to be highly decomposed (i.e. sapric) and to be derived primarily from woody vegetation. The ash content will probably be relatively high towards the river and lower away from it. Overall the average ash content could be somewhat higher than that for the Snuggedy Swamp due to the narrowness of the flood plain upon which this deposit has developed.

d. Preliminary Resource Calculations: Colleton County*

1. Approximate area of organic soil.....17,026 acres
Approximate area of peat > 4 ft. thick.....12,000 acres
2. Approximate wet (in situ) volume of peat..... 4.4×10^9 ft.³
Snuggedy..... 3.4×10^9 ft.³
Combahee..... 1.0×10^9 ft.³
3. Approximate wet (in situ) weight of peat..... 2.9×10^{11} lbs.
Snuggedy..... 2.31×10^{11} lbs.
Combahee..... 6.8×10^{11} lbs.
4. Approximate dry weight..... 4.8×10^{10} lbs.**
Snuggedy..... 3.7×10^{10} lbs.
Combahee..... 1.1×10^{10} lbs.
5. Average BTU per lb. dry.....9,885
6. Average Ash Content (wt. %).....8.1%
7. Average Fixed Carbon (wt. %).....27.0
8. Average Volatile Matter.....58.9
9. Peat Types.....Mostly Sapric &
some Hemic; woody
& grass-sedge

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* Combahee deposit extends partially into Beaufort County

** Based on an average bulk density (dry) of 11 lbs/ft.³ (ca. 240 tons per acre-foot)

Fig. 21. Probe Sites In Peat Deposits Along Combahee River, Colleton Co., S.C.

Fig. 22. Cross Section Through Combahee River Deposit, Colleton Co., S.C.

3. JASPER COUNTY

a. Geometry of Deposit

Figure 23 shows the location of potential peat deposits in Jasper County and also the locations of our probe sites and of drill log records obtained from the South Carolina Geological Survey. As previously reported, the only significant peat sediments were found along the Savannah River in the southern portion of the county. As of this date, all surveying has been completed in this county and final maps, analyses, and resource calculations are being prepared.

Figure 24 shows the locations of the probe sites in the northern portion of the Savannah River deposit and also the position of the four transects. Figure 25 is a fence diagram showing the relationships of sediment types over all of the deposit. It illustrates the interfingering of the peats with other sediments toward the north and the thickening and greater vertical continuity of the deposit toward the south. In addition to the thickening toward the south, the western portions of the deposit is split several times by "splay" deposits derived from flooding of the present and past Savannah River and its tributaries.

Figure 26 is a computer-assisted map showing the depth of the base of the deepest peat at any probe site. Because of the interfingering of peat and other sediments in part of this area, it has been necessary to use a combination of this map and the cross sections in order to properly evaluate the potential of the resource.

b. Quality

(1) Ash Content

Figure 27 shows the ash content variations with depth at all sample sites. The overall ash content of the peats of the study area was relatively high (averaging 20.8%, dry weight). This is indicative of the fluvial (riverine) nature of the area. The highest ash contents were found at the surface and at

Fig. 23. Probe Sites & Drill Locations In Jasper County, S.C.

Fig. 24. Locations Of Probe Sites & Transects In Savannah River Area, Jasper Co., S.C.

Fig. 25. Fence Diagram Showing Sediment Relationships
On The Savannah River Alluvial Plain

Fig. 26. Computer-assisted Map Showing Depth To Base Of Peat
In Savannah River Deposit, Jasper Co., S.C.

Fig. 27. Ash Content With Depth At Sample Sites From Jasper Co., S.C. (% by dry wt.)

the base at the majority of the sites. The near - surface high ash values are a function of the clastic deposition (splay formation) that results from the rivers in the area and the basal high values reflect the occurrence of the marine clay/silt unit and the Pleistocene sand unit that underlie the area. Figure 27 shows graphically the occurrence of these splay deposits (the high peaks of ash) within the sequence. The zones of high ash content are thicker in areas immediately adjacent to the rivers and are observed to thin as the distance from the rivers is increased. The remaining sample sites exhibited an ash content that was lower at the surface and steadily increased with depth. In these sites the fluctuations in ash content were absent. Instead the graphs show a fairly smooth increase in ash content. This can be explained by the location of these sites in areas that are most removed from the present river channels, which would reduce the likelihood of flood deposits reaching these sites.

Ash and moisture analyses are routinely made in our laboratory for samples from all probe sites (e.g., Figure 27), in order to establish how much of the section at each site is actually peat. Because of time and cost, considerations only a representative set of sites were selected for other kinds of analyses (i.e., bulk density, water-holding capacity, botanical composition and fiber content). Figure 28 shows the locations of these six representative sites and Tables VI-XI show the ash, moisture, water-holding capacity, bulk density and fiber content for these sites.

Fig .28. Locations Of The Six Sample Sites Chosen For Detailed Laboratory Analysis

Table VI. Economic Properties of Savannah River Peats (Core 10)

Site #	Depth (in.)	Sed. type	Ash ^{**} (%)	Moisture ^{***} (%)	Water hld. capacity	Bulk density gm/cc	Fiber content (%)
10-0	0-8	ORS*	43.9	78.6	367.1	-----	-----
10-8	8-16	POC/Sd*	56.2	81.7	445.5	-----	-----
10-16	16-24	ORS	49.9	85.3	578.7	-----	-----
10-24	24-32	PEAT	15.2	72.9	269.3	0.14	21
10-32	32-40	PEAT	12.0	77.5	344.4	0.14	26
10-40	40-48	PEAT	6.6	64.5	181.6	0.16	35
10-48	48-56	PEAT	10.9	77.6	326.9	0.10	32
10-56	56-64	PEAT	8.4	70.0	233.6	0.13	35
10-64	64-72	ORS	37.2	85.3	578.7	-----	-----
10-72	72-80	CLAY	87.5	65.4	188.9	-----	-----
10-80+	80+	SAND	92.3	26.9	36.8	-----	-----
AVERAGES			38.2	71.3	322.8	0.13	30

* ORS = organic - rich sediment (30 - 50% ash); POC/Sd = partially organic clay/sand (50 - 70% ash)

** Percent dry weight

*** Percent by weight

Table VII. Economic Properties of Savannah River Peats (Core 22)

Site #	Depth (in.)	Sed. type	Ash** (%)	Moisture*** (%)	Water hld. capacity	Bulk density gm/cc	Fiber content (%)
22-0	0-8	POC/Sd*	53.6	76.7	329.2	-----	-----
22-8	8-16	PEAT	9.8	85.5	589.3	0.09	28
22-16	16-24	PEAT	8.9	83.2	495.1	0.10	28
22-24	24-32	PEAT	14.9	86.1	621.5	0.10	26
22-32	32-40	PEAT	3.6	64.1	178.9	0.08	24
22-40	40-48	PEAT	4.7	77.8	349.9	0.06	36
22-48	48-56	PEAT	14.2	87.8	721.8	0.07	33
22-56	56-64	POC/Sd	55.1	82.5	470.3	-----	-----
22-64	64-72	PEAT	28.7	76.7	328.3	0.10	32
22-72	72-80	POC/Sd	51.5	58.6	141.5	-----	-----
22-80	80-84	CLAY	89.9	33.2	49.7	-----	-----
22-84	84+	SAND	----	----	-----	-----	-----
AVERAGES			30.5	73.8	388.7	0.09	34

* POC/Sd = partially organic clay/sand (50 - 70% ash)

** Percent dry weight

*** Percent by weight

Table VIII. Economic Properties of Savannah River Peats (Core 58)

Site #	Depth (in.)	Sed. type	Ash** (%)	Moisture*** (%)	Water hld. capacity	Bulk density gm/cc	Fiber content (%)
58-0	0-12	PEAT	15.7	91.2	1,042.3	0.06	40
58-12	12-24	PEAT	17.6	83.6	510.9	0.14	18
58-24	24-36	PEAT	19.4	84.3	537.0	0.15	24
58-36	36-48	PEAT	16.3	84.2	532.4	0.10	26
58-48	48-60	PEAT	21.3	84.3	535.3	0.08	27
58-60	60-72	PEAT	29.8	85.1	570.9	0.09	27
58-72	72-84	PEAT	18.1	87.1	676.6	0.09	30
58-84	84-96	ORS*	40.4	82.2	460.5	-----	-----
58-96	96-108	PEAT	27.5	75.8	415.6	0.09	31
58-108	108-120	ORS	46.7	85.7	500.0	-----	-----
58-120	120-132	POC/Sd*	62.8	69.7	218.2	-----	-----
58-132	132-144	CLAY	82.5	55.5	125.6	-----	-----
58-144	144+	SAND	86.3	46.9	88.5	-----	-----
AVERAGES			37.3	78.1	478.0	0.10	28

* ORS = organic - rich sediment (30 - 50% ash); POC/Sd = partially organic clay/sand (50 - 70% ash)

** Percent dry weight

*** Percent by weight

Table IX. Economic Properties of Savannah River Peats (Core 24)

Site #	Depth (in.)	Sed. type	Ash** (%)	Moisture*** (%)	Water hld. capacity	Bulk density gm/cc	Fiber content (%)
24-0	0-8	POC/Sd*	65.6	63.2	162.9	-----	-----
24-8	8-16	PEAT	19.0	81.2	432.6	0.11	19
24-16	16-24	PEAT	16.2	86.0	614.6	0.19	19
24-24	24-32	PEAT	16.1	84.5	546.9	0.12	26
24-32	32-40	PEAT	11.6	87.1	675.9	0.16	32
24-40	40-48	PEAT	11.6	86.0	615.7	0.12	30
24-48	48-56	PEAT	10.8	86.9	668.3	0.11	29
24-56	56-64	PEAT	13.2	87.9	731.6	0.14	35
24-64	64-72	PEAT	15.4	87.1	678.1	0.10	38
24-72	72-80	PEAT	10.5	82.3	460.7	0.10	37
24-80	80-88	PEAT	13.4	84.6	548.6	0.11	35
24-88	88-96	PEAT	12.5	84.1	530.2	0.11	36
24-96	96-104	PEAT	19.1	88.2	745.9	0.13	37
24-104	104-112	PEAT	10.3	81.3	433.5	0.12	36
24-112	112-120	PEAT	17.6	87.5	345.6	0.19	34
24-120	120-128	ORS*	33.7	82.3	462.7	-----	-----
24-128	128-136	PEAT	28.5	71.9	271.2	0.08	34

TABLE IX. (cont.)

Site #	Depth (in.)	Sed. type	Ash** (%)	Moisture*** (%)	Water hld. capacity	Bulk density gm/cc	Fiber content (%)
24-136	136-144	PEAT	29.3	81.0	165.6	0.07	30
24-144	144-152	ORS	36.5	80.3	437.4	-----	----
24-152	152-160	ORS	42.8	83.0	399.5	-----	----
24-160	160-168	CLAY	71.0	55.6	150.7	-----	----
24-168	168-176	CLAY	90.0	41.2	72.3	-----	----
24-176	176+	SAND	----	----	-----	-----	----
AVERAGES			27.1	79.7	461.4	0.12	32

* POC/Sd = partially organic clay/sand (50 - 70% ash); ORS = organic - rich sediment (30 - 50% ash)

** Percent dry weight

*** Percent by weight

Table X: Economic Properties of Savannah River Peats (Core 27)

Site #	Depth (in.)	Sed. type	Ash** (%)	Moisture*** (%)	Water hld. capacity	Bulk density gm/cc	Fiber content (%)
27-0	0-8	POC/Sd*	66.8	76.6	327.8	-----	-----
27-8	8-16	POC/Sd	68.0	63.2	171.5	-----	-----
27-16	16-24	PEAT	23.3	72.0	257.6	0.23	29
27-24	24-32	PEAT	18.9	80.4	409.9	0.14	30
27-32	32-40	PEAT	8.4	68.1	213.8	0.12	30
27-40	40-48	PEAT	8.3	68.4	216.6	0.12	30
27-48	48-56	PEAT	6.7	58.4	140.4	0.14	27
27-56	56-64	PEAT	9.2	70.0	233.4	0.15	28
27-64	64-72	PEAT	14.5	81.6	444.7	0.11	31
27-72	72-80	PEAT	19.6	88.0	732.8	0.12	30
27-80	80-88	PEAT	17.6	83.8	518.1	0.12	29
27-88	88-96	PEAT	19.7	85.1	570.2	0.13	35
27-96	96-104	PEAT	21.6	83.1	491.1	0.12	31
27-104	104-112	PEAT	24.3	84.4	540.4	0.14	30
27-112	112-120	PEAT	28.4	83.6	714.8	0.09	30
27-120	120-128	PEAT	28.4	85.1	831.8	0.09	32
27-128	128-136	CLAY	87.3	57.7	136.5	-----	-----

TABLE X. (cont.)

Site #	Depth (in.)	Sed. type	Ash** (%)	Moisture*** (%)	Water hld. capacity	Bulk density gm/cc	Fiber content (%)
27-136	136-144	CLAY	77.2	68.0	212.3	-----	-----
27-144	144-152	CLAY	87.1	61.0	156.5	-----	-----
27-152	152-160	CLAY	89.2	53.9	117.1	-----	-----
27-160	160-168	CLAY	87.9	62.3	164.9	-----	-----
27-168	168-176	CLAY	84.3	62.7	168.4	-----	-----
27-176	176-184	CLAY	87.6	61.8	162.1	-----	-----
27-184	184-192	CLAY	88.7	54.4	119.3	-----	-----
27-192	192+	SAND	----	----	-----	-----	-----
AVERAGES			44.7	71.4	335.5	0.13	30

* POC/Sd = partially organic clay/sand (50 - 70% ash)

** Percent dry weight

*** Percent by weight

Table XI. Economic Properties of Savannah River Peats (Core 33a)

Site #	Depth (in.)	Sed. type	Ash** (%)	Moisture*** (%)	Water hld. capacity	Bulk density gm/cc	Fiber content (%)
33a-0	0-12	POC/Sd*	52.2	84.8	559.2	-----	----
33a-12	12-24	PEAT	26.9	82.1	458.1	0.19	36
33a-24	24-36	PEAT	28.5	80.3	408.2	0.10	37
33a-36	36-48	PEAT	21.9	84.2	534.8	0.10	35
33a-48	48-60	PEAT	20.4	84.5	545.6	0.12	26
33a-60	60-72	PEAT	16.1	84.6	551.0	0.13	29
33a-72	72-84	PEAT	27.4	85.0	566.5	0.12	29
33a-84	84-96	PEAT	26.6	85.4	583.1	0.11	36
33a-96	96-108	PEAT	25.7	85.3	573.8	0.15	38
33a-108	108-120	ORS*	33.2	85.0	567.3	-----	----
33a-120	120-132	POC/Sd	64.7	76.7	329.9	-----	----
33a-132	132-144	CLAY	81.5	65.4	188.7	-----	----
33a-144	144-156	CLAY	82.9	59.9	149.9	-----	----
33a-156	156-168	CLAY	80.4	67.8	210.3	-----	----
33a-168	168-180	CLAY	77.2	70.2	235.7	-----	----
33a-180	180-192	CLAY	80.4	67.3	205.3	-----	----

TABLE XI. (cont.)

Site #	Depth (in.)	Sed. type	Ash** (%)	Moisture*** (%)	Water hld. capacity	Bulk density gm/cc	Fiber content (%)
33a-192	192+	SAND	----	-----	-----	-----	----
AVERAGES			46.6	79.0	405.5	0.13	33

* POC/S = partially organic clay/sand (50 - 70% ash); ORS = organic - rich sediment (30 - 50% ash)

** Percent dry weight

*** Percent by weight

(2) Water-Holding-Capacity

Figure 29 shows the water-holding-capacity of the sample sites with depth. Water-holding-capacity is a measure of the "mulching" quality of peats and would be of significance if these peats were ever considered for horticultural or agricultural use. It is evident from the graphic results that the water-holding-capacity tends to increase with depth, with the highest values occurring in the sediments immediately overlying the basal clay/silt and sand units. The occurrence of a higher water-holding-capacity along with a higher fiber content with depth (discussion to follow) would suggest conditions much wetter toward the base of the peats than is found on the surface today. Since this phenomenon also occurs in the Okefenokee Swamp of Georgia (D. Corvinus, personal communications) and the Everglades of Florida (Cohen, 1968), where no splays occur, it can be surmised that the occurrence of a higher water-holding-capacity and a higher fiber content at the base of the peats may represent a prevalent characteristic of peat deposits in the entire southeastern United States.

The water-holding-capacity results (Tables V-X) reveal an average of 717.7% for the peats of the study area. The water-holding-capacity ranges from a high of 1,778.5% for a surficial peat at SWR 55, to a low of 140.4% within a peat sample from SWR 27.

(3) Fiber Content

The values determined for the fiber content of the six sample sites are shown on Tables VI-XI. The fiber content generally parallels the moisture content. This is understandable in that the higher the fiber content, the more (preserved) cell structure is available to hold water. The moderately-low percentage of fiber material present in the peats (Table VI-XI) is a reflection of the environment of deposition of the peats (Bay-Gum swamps). The hardwood constituents that dominate the peat, long with the periods of water level fluctuation have resulted in the generation of predominately sapric-type peats. That is, peats with less than a 1:3 ratio of framework to matrix material. The average fiber content for the peats of Savannah River alluvial plain was approximately 30%.

The fiber content found for the peats of the six sample sites exhibited a trend that was fairly consistent throughout the deposit. As mentioned earlier, the fiber content tended to progressively increase with depth.

Fig. 29. Water-holding-capacity With Depth From Sample Sites In Jasper Co., S.C.

(4) Bulk Density

The bulk density of the peats contained in the six sample sites is shown in Tables VI-XI. The average bulk density for the entire peat deposit was found to be 0.12 gm/cc (about 8lbs/ft³), with the highest value being 0.23 gm/cc (about 14 lbs/ft³) and the lowest value being 0.06 gm/cc (about 4 lbs/ft³). The bulk density appears, for the most part, to be lowest at the base of the peat sequence. This is believed to be a function of the water level present during peat deposition at the base of the peat sequence. It has already been established that the higher water-holding-capacities and fiber contents are found to occur at the base of the peat sequence.

(5) Botanical Composition

The dominant peat type found in the Savannah River deposit is a "bay-gum"-dominated woody, sapric type. This type represents approximately 79% of the samples analyzed from the six representative cores. Bay-gum peat represents swamp vegetation occurring where water levels are not especially high. The dominant plant genera occurring in this peat are Persea, Lyonia, Myrica, and Nyssa (all tree types). Cypress peat, which represents about 18% of all samples in these cores, indicates somewhat deeper standing water. The dominant genus occurring in this peat type is the cypress tree (Taxodium). Grass-sedge peats (representing about 3% of all samples) were produced under drier conditions than were either of the previously-mentioned types. The grasses found in these peats varied by all were fresh-water types.

C. Preliminary Resource Calculations: Jasper County

(Savannah River Deposit)

1. Approximate area of organic soil.....13,000 acres
Approximate area of peat > 4 ft. thick.....10,000 acres
2. Approximate wet (in situ) volume of peat..... 2.5×10^9 ft.³
3. Approximate wet (in situ) weight of peat..... 1.6×10^{11} lbs.
4. Approximate dry weight of peat..... 2.0×10^{10} lbs.
5. Ave. Ash Content (Wt. %).....20.8
6. Approximate BTU/lb (dry).....8500 *
7. Peat Types.....mostly sapric;
woody (Bay, Gum,
Cypress) and
Grass-sedge types

* An estimate based on the average ash content

4. HORRY COUNTY (BIG SWAMP)

a. General

Figure 30 shows the resource data available for Horry County. It includes S.C. Geological Survey drill records, S.C. Organic Sediments Research Group preliminary reconnaissance sites, and the probably organic soil regions as outlined by the U.S. Soil Conservation Service. A major deposit of peat occurs in the southeastern portion of this county around the Waccamaw River. The widest part of this deposit is called the Big Swamp.

Preliminary surveys have begun in the Big Swamp in Horry County, South Carolina (Figure 31). This area presently supports a dense growth of swamp-forest vegetation and contains no roads, making it relatively difficult to survey. Consequently, most of our 58 probe sites are from the river or around the edges of the swamp. Since we have no data from the interior, any resource estimates are simply calculated guesses. However, our initial probes show a peat depth of over 10 feet in several areas.

Table XII shows several analyses for moisture, ash, and organic matter. These samples were taken near to the river so that they are undoubtedly enriched in ash and should not yet be considered typical of this region. Additional samples have been collected and are being ashed in our laboratory.

At this time, it appears that this region contains peat deposits equal to or greater than those observed in the Snuggedy Swamp of Colleton County.

b. Preliminary Resource Calculations: Horry County

1. Approx. area of organic soil.....19,500 acres
Approx. area of peat >4' thick.....15,000 acres
2. Approx. wet (in situ) volume of peat..... 2.4×10^9 ft.³
3. Approx. wet (in situ) wt. of peat..... 1.6×10^{11} lbs.
4. Approx. dry wt. of peat..... 2.6×10^{10} lbs.

Fig. 30. Probe Sites & Drill Locations In Horry County, S.C.

Fig. 31. Probe Sites In Big Swamp, Horry County, S.C.

Table XII.
Moisture, Organic & Ash Content in Big Swamp, Horry Co., S.C.

<u>Sample No.</u>	<u>Depth</u>	<u>Moisture Content</u>	<u>Organic Content</u>	<u>Ash Content</u>
BS-A	Surface	91.6	78.7	21.3
BS-B	Surface	90.9	84.5	15.5
BS-C	12-18"	89.0	85.8	14.2
BS-D	0-08"	91.3	81.2	18.8
BS-D	8-12"	92.9	64.0	36.0 *
BS-D	12-16"	91.8	75.5	24.5
BS-D	24-30"	91.4	80.7	19.3
BS-D	36"	90.5	86.6	13.4
BS-D	48"	89.3	50.0	50.0 *
BS-D	72"	69.9	20.4	79.6 *
BS-F	84"	85.9	60.9	39.0 *
BS-F	120"	88.9	68.3	31.7 *
BS-F	132"	79.7	38.5	61.5 *

Ave. Moisture 90.9

Ave. Organic Matter 81.9

Ave. Ash 18.1

*Not included in averages since not considered to be peat

5. GEORGETOWN COUNTY

a. General

Figure 32 shows the resource data available for Georgetown County. It includes S.C. Geological Survey drill records, S.C. Organic Sediment Research Group reconnaissance probes, and those regions of organic soil outlined by the U.S. Soil Conservation Service.

The major potential peat deposits occur along the Black River and along the Black Mingo River. Since the last annual report, we have probed at numerous new locations along both of these rivers. Table XIII shows ash and moisture analyses for most of these sites. Since all of our sites were in fairly close proximity to the river, ash contents might be somewhat inflated by overbank deposition from the rivers during flooding. We walked some distance back from the rivers at each site in an attempt to alleviate this problem; however, very few samples contained enough organic matter to be considered peats (Table XIII). A large number of samples had not yet been analyzed as of the date of this report. However, field descriptions suggest that the best peats occur in narrow pods along the Black Mingo River and near the junction of the Black and Black Mingo Rivers. We will be investigating these small pods of peat in more detail in the coming year. Based on this evidence, we have greatly reduced our original estimate of potential peat sediments in this region.

b. Preliminary Resource Calculations: Georgetown County

1.   Approx. area of organic soil.....15,000 acres
      Approx. area of peat > 4 ft. thick..... 2,000 acres
2.   Approx. wet (in situ) volume of peat..... 2×10^8 ft.³
3.   Approx. wet (in situ) wt. of peat..... 1.4×10^{10} lbs.
4.   Approx. dry wt. of peat..... 2.2×10^9 lbs.

Fig. 32. Probe Sites & Drill Locations In Georgetown Co., S.C.

Table XIII. Ash, Moisture, and Organic Content for Samples
From Black River Area, Georgetown Co., S. C.

Sample #	Site	% Moisture	% Organic	% Ash
SCAS 456	BR-4-4	83.62	59.66	40.34
SCAS 457	BR-4-5	81.85	53.59	46.41
SCAS 458	BR-4-6	37.42	62.90	37.10
SCAS 459	BR-4-7	82.67	65.03	34.97
SCAS 460	BR-4-8	83.88	72.04	27.95
SCAS 461	BR-4-9	10.32	82.73	17.27
SCAS 462	BR-4-10	80.42	90.76	9.24
SCAS 463	BR-5-1	86.04	60.11	39.89
SCAS 464	BR-5-2	78.71	50.96	49.04
SCAS 465	BR-5-3	84.72	55.23	44.77
SCAS 466	BR-5-4	86.71	66.67	33.33
SCAS 467	BR-5-5	90.39	78.41	21.59
SCAS 468	BR-5-6	91.91	77.35	22.65
SCAS 469	BR-5-7	85.42	46.77	53.22
SCAS 470	BR-6-1	88.97	64.02	35.98
SCAS 471	BR-6-2	73.83	44.35	55.65
SCAS 472	BR-6-3	76.06	39.12	60.88
SCAS 473	BR-6-4	78.87	53.02	46.98
SCAS 474	BR-6-5	86.37	76.04	23.96
SCAS 475	BR-6-6	8.06	67.97	32.02
SCAS 476	BR-6-7	81.28	64.38	35.67
SCAS 477	BR-6-8	9.61	68.61	31.39
SCAS 478	BR-6-9	64.94	21.70	78.30
SCAS 479	BR-6-10	81.87	36.67	63.33
SCAS 480	BR-6-11	10.05	9.74	90.26
SCAS 453	BR-4-1	74.55	46.16	53.84

Table XIII (cont.)

Sample #	Site	% Moisture	% Organic	% Ash
SCAS 454	BR-4-2	80.34	55.12	44.88
SCAS 455	BR-4-3	84.20	59.64	40.36
SCAS 481	BR-6-12	7.68	58.92	41.08
SCAS 482	BR-7-1	87.36	46.26	53.74
SCAS 483	BR-7-2	68.79	26.43	73.58
SCAS 484	BR-9-1	86.41	62.61	37.39
SCAS 485	BR-9-2	77.27	40.83	59.17
SCAS 486	BR-9-3	74.83	46.55	53.45
SCAS 487	BR-9-4	72.02	56.47	43.53
SCAS 488	BR-9-5	75.54	48.29	51.71
SCAS 489	BR-9-6	75.00	50.47	49.53
SCAS 490	BR-9-7	73.92	75.90	24.10
SCAS 491	BR-9-8	69.77	80.85	19.15
SCAS 492	BR-9-9	11.56	11.37	88.63
SCAS 493	BR-9-10	1.41	2.72	97.28
SCAS 494	BR-10-1	86.71	53.57	46.48
SCAS 495	BR-10-2	80.94	44.30	55.70
SCAS 496	BR-10-3	86.44	56.80	43.20
SCAS 497	BR-10-4	Missing		
SCAS 498	BR-10-5	88.23	66.14	33.86
SCAS 499	BR-10-6	Missing		
SCAS 500	BR-10-7	88.51	73.98	26.02
SCAS 501	BR-10-8	87.91	77.14	22.86
SCAS 502	PH-9	89.28	65.07	34.93
SCAS 503	PH-9	88.29	75.79	24.21

Table XIII. (cont.)

Sample #	Site	% Moisture	% Organic	% Ash
SCAS 504	PH-9	93.27	74.84	25.16
SCAS 505	PH-9	92.90	69.47	30.53
SCAS 506	PH-10	86.97	56.24	43.76
SCAS 507	PH-10	87.72	49.31	50.69
SCAS 508	PH-10	91.87	36.17	63.83
SCAS 509	PH-10	84.66	45.67	54.33
SCAS 510	PH-10	30.36	6.39	93.61
SCAS 511	PH-11	79.84	41.85	58.15
SCAS 512	PH-11	78.85	41.15	58.85
SCAS 513	PH-11	84.34	49.38	50.62
SCAS 514	PH-11	81.94	44.24	50.76
SCAS 515	PH-11	80.02	41.56	58.43
SCAS 516	PH-12	86.32	59.49	40.51
SCAS 517	PH-12	76.82	31.79	68.20
SCAS 518	PH-12	72.66	26.91	73.09
SCAS 519	PH-12	73.78	31.97	68.03
SCAS 520	PH-12	80.64	42.24	57.76
SCAS 521	PH-12	80.94	48.63	51.37
SCAS 522	PH-12	82.41	40.08	59.92
SCAS 523	PH-12	82.83	38.76	61.22
SCAS 524	PH-12	73.30	55.31	44.69
SCAS 525	PH-12	81.94	28.49	71.51
SCAS 526	PH-13	81.79	42.84	57.16
SCAS 527	PH-13	65.27	23.84	76.16
SCAS 528	PH-13	66.74	22.49	77.51

Table XIII. (cont.)

Sample #	Site	% Moisture	% Organic	% Ash
SCAS 529	PH-14	87.38	59.48	40.52

6. CHARLESTON COUNTY

a. General

Figures 33 and 34 show the resource data available for Charleston County. The map contains S.C. Geological Survey drill record data, S.C. Organic Sediments Research Group preliminary reconnaissance probes, U.S. Geological Survey probes, and the areas of organic soils as outlined by the U.S. Soil Conservation Service.

Preliminary surveys by roads have been initiated in the Wambaw Swamp and two small swamps west of the Wambaw Swamp (Figure 33) and in the Adams Run area near Charleston (Figure 34). Samples from several probe sites in the Wambaw Swamp have been sent for Proximate and Ultimate analyses (Table XIV). A few samples have also been ashed in our laboratory. Initial ash determinations range from 11 to 35% (Table XV).

A U.S. Geological Survey report by C. Cameron and E. Force (1979) suggests that the peat may not often exceed 4 feet in this area. Cameron has indicated that the U.S. Geological Survey is expecting to continue their reconnaissance in this region late in 1981 and we have agreed to wait until that time and to coordinate our efforts with theirs. Because of the small size of these deposits and of the other deposits in Charleston County, we decided not to continue surveying in these areas until year 3 of this project.

b. Approximate Resource Calculations: Charleston County

1. Approx. acres of organic soil.....5,102 acres
2. Approx. wet (in situ) volume organic soil..... 8.9×10^8 ft.³
3. Approx. wet (in situ) wt. organic soil..... 5.7×10^{10} lbs.
4. Approx. dry wt..... 10.5×10^9 lbs.
5. Ave. Ash.....11%

Fig. 33. Probe Sites & Drill Locations in Western Charleston County, S.C.

Fig. 34.

Probe Sites & Drill Locations In Eastern Charleston County, S.C.

Table XIV.

Summary of Proximate and Ultimate Analyses (Dry Basis)Wambaw Swamp, Charleston County, S.C.

Site #	Depth	BTU per lb.	Ash	Fixed C	VM	H	C	N	S	O
WS 1	0-24"	9568	7.1		56.2	4.7	57.3	1.6	1.3	28.0
WS 2	0-24"	8591	15.9	28.0	56.1	4.9	50.3	2.5	.5	25.8
WS 4	0-24"	-	42.5	-	-	-	-	-	.8	-

Table XV.

Moisture, Organic & Ash Content in Wambaw Swamp

<u>Sample No.</u>	<u>Depth</u>	<u>Moisture Content</u>	<u>Organic Content</u>	<u>Ash Content</u>
WB-1	0-24"	84.8	65.2	34.9
WB-2	0-24"	87.0	88.0	12.0
WB-3	0-24"	86.5	88.6	11.3

7. BERKELEY COUNTY

a. General

Figure 35 shows the locations of potential peat desposits in Berkeley County, S.C. The greatest area of potential peat occurs in the Hellhole Bay area. The large savannah areas near the center appear to have formed by burning of highly organic soils. This suggests the presence (or former presence) of some peat deposits in this area. However after preliminary probing by road and some limited helicopter reconnaissance, we have yet to find any appreciable amounts of peat.

We have also done some sampling in the organic soil regions known as Ocean Bay, Middle Bay, and Pigeon Bay. Preliminary probing indicates that Pigeon Bay may have the thickest and best quality peats in this county. Table XVI shows a sequence of samples analyzed with depth for Proximate and Ultimate composition and BTU. Note that the ash and sulfur contents are very low (averaging 4.1% and .3% respectively) and the BTU is moderately high. Additional probing will be done in this area in year III of this project.

b. Preliminary Resource Calculations: Berkeley County

1. Approx. acres of organic soil.....4,590 acres
2. Approx. wet (in situ) volume..... 8.0×10^8 ft.³
3. Approx. wet (in situ) wt..... 5.1×10^{10} lbs.
4. Approx. dry wt..... 9.4×10^9 lbs.

Fig. 35. Locations Of Potential Peat Deposits In Berkeley County, S.C.

8. MARION COUNTY

Organic soils are suspected to occur in the Catfish Swamp area of this county. Figure 36 shows the potential area of organic soil and the locations of some of our preliminary probes. Laboratory analyses of samples from this area are not yet completed but field observations (color, texture), suggest that the potential for these organic soils to be peats is not especially good.

9. SUMTER, CLARENDON, FLORENCE AND RICHLAND COUNTIES

Some preliminary field reconnaissance has begun in Sumter, Florence, and Richland Counties. To date, only relatively small deposits have been encountered, with the largest potential region being about 4-6 square miles in Sumter County. This area will be investigated further in Year III of this project.

Fig. 36. Location Of Organic Soil & Probe Sites
In Catfish Swamp, Marion Co., S.C.

V. REFERENCES CITED

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VI. APPENDICES

FIELD RECORDS SHEET

D. Field Crew

F. Site Description   ↗ none ☐   ↗ forested ☐

→farmed ☐ →grass-sedge ☐

charred trunks ☐ _____ other _____

other _____ 5. identified species

4. tree types → Broad leaf ☐

☒ Cypress-Gum ☐

H. Field Measurements

a. type of reading $\rightarrow$ wet peat ☐ b. depth _____ c. readings _____

conductivity → surface water ☐ b. depth _____ c. readings _____
a type of reading → wet seat ☐

I Sedimentary Description 1 type of probe ^{Davis}☒ Auger☒ McCawley☒

1. Sedimentary Description 1. type of probe $\rightarrow$ Auger ☐ $\rightarrow$ Piston ☒

Detailed Description

sand

A blank graph paper with a vertical axis labeled from 0 to 120 in increments of 12. The horizontal axis is labeled "Time (seconds)".

<u>Sample #</u>	<u>Purpose</u>	<u>Depth</u>

_____

Appendix B

Standard Methods of Test for MOISTURE, ASH, AND ORGANIC MATTER OF PEAT MATERIALS¹

This Standard is issued under the fixed designation D 2974; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

1. Scope

1.1 These methods cover measurement of the weight percentage of moisture, ash, and organic matter in peat materials, including moss, humus, and reed-sedge types.

2. Summary of Methods

2.1 Moisture is determined by drying a peat sample at 105 C. The loss in weight represents the total moisture content expressed as percentage by weight of the as-received sample. This is designated as Method I.

2.2 An alternative moisture method, designated as Method II, removes the total moisture in two steps: (1) evaporation of moisture by air at room temperature (air-drying) and (2) the subsequent loss in weight of the air-dried sample at 105 C. This method provides a more stable sample, the air-dried sample, when tests for nitrogen, pH, cation exchange, sand content, etc., are to be made.

2.3 Ash content of a peat sample is determined by igniting the dried sample from the total moisture determination in a muffle furnace at 550 C. The substance remaining after ignition is the ash and includes mineral impurities such as sand. The ash content is expressed as a weight percentage of the as-received sample.

2.4 Organic matter is determined by difference.

3. Apparatus

3.1 *Oven*, regulated to a constant temperature of 105 C.

3.2 *Muffle Furnace*, regulated to a constant temperature of 550 C.

3.3 *Evaporating Dishes*, high silica or por-

celain, not less than 75-ml capacity.

3.4 *Blender*, high-speed.

3.5 *Aluminum Foil*, heavy-duty.

3.6 *Porcelain pan, spoons, etc.*

4. Preparation of Sample

4.1 Place a representative field sample on a square rubber sheet, paper, or oil cloth. Reduce the sample to the quantity required by quartering and place in a moistureproof container. *Work rapidly to prevent moisture losses.*

MOISTURE

5. Procedure—Method I

5.1 Mix the sample thoroughly and place a 10 to 12-g test specimen in an ignited and weighed (with fitted heavy-duty aluminum foil cover) high silica or porcelain evaporating dish, not less than 75 ml capacity. Crush soft lumps with a spoon or spatula. Cover immediately with the aluminum foil and weigh to the nearest 1 mg. Dry uncovered for 16 h at 105 C. Remove from the oven, cover tightly, cool, and weigh.

6. Calculation

6.1 Calculate the moisture content as follows:

$$\text{Moisture, percent} = [(A - B) \times 100] / A$$

where:

A = grams of as-received test specimen, and

B = grams of oven-dried test specimen.

¹ These methods are under the jurisdiction of ASTM Committee D-29 on Peats, Mosses, Humus, and Related Products.

Effective Sept. 20, 1971.

7. Procedure—Method II

7.1 Use Method II when pH, nitrogen, sand content, cation exchange capacity, etc., are to be tested. Mix thoroughly and weigh a 100 to 300-g representative sample and spread evenly on a large flat pan. Crush soft lumps with a spoon or spatula and let the sample come to moisture equilibrium with room air, not less than 24 h. Stir occasionally to maintain maximum air exposure of the entire sample. When the weight is constant, calculate the loss in weight as percent moisture removed by air drying. Grind a representative portion of the air-dried sample 1 to 2 min in a high-speed blender. Use the ground portion for moisture, ash, nitrogen, etc., determinations.

7.2 Thoroughly mix the air-dried, ground sample and weigh to the nearest 1 mg the equivalent of 10 g of test specimen on the as-received basis. Determine the grams of air-dried sample equivalent to 10.0 g of as-received sample as follows:

$$\text{Equivalent sample weight, g} = 10.0 - [(10.0 \times \text{percent moisture removed})/100]$$

Place the weighed sample in an ignited and weighed (with fitted heavy-duty aluminum foil cover) high silica or porcelain evaporating dish and proceed as in Method I.

8. Calculation

8.1 Calculate the moisture content as follows:

$$\text{Moisture, percent} = (10.0 - B) \times 10.0$$

where:

B = grams of oven-dried sample.

ASH

9. Procedure

9.1 Place an uncovered (retain cover for weighing) high silica or porcelain dish containing the dried test specimen from the moisture determinations in a muffle furnace. Gradually bring to 550 C and hold until completely ashed. Cover with the retained aluminum foil cover, cool, and weigh.

10. Calculation

10.1 Calculate the ash content as follows:

$$\text{Ash, percent} = (C \times 100)/A$$

where:

C = grams of ash, and

A = grams of as-received test specimen taken for moisture determination. (If moisture Method II was used, grams of as-received test specimen = 10.0.)

ORGANIC MATTER

11. Procedure

11.1 Determine the amount of organic matter by difference, as follows:

$$\text{Organic matter, percent} = 100.0 - (D + E)$$

where:

D = weight percentage of moisture in the as-received sample (see Section 6), and

E = weight percentage of ash in the as-received sample (see Section 10).

REPORT

12. Report

12.1 Report all results to the nearest 0.1 percent.

By publication of this standard no position is taken with respect to the validity of any patent rights in connection therewith, and the American Society for Testing and Materials does not undertake to insure anyone utilizing the standard against liability for infringement of any Letters Patent nor assume any such liability.

Appendix C

Standard Method of Test for PARTICLE SIZE RANGE OF PEAT MATERIALS¹

This Standard is issued under the fixed designation D 2977; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

1. Scope

1.1 This method covers measurement of the weight percentage of fractions of a peat material defined in terms of selected ranges of screen sizes.

2. Summary of Method

2.1 A representative test specimen of air-dried peat is separated into four designated fractions by means of an 8-mesh and a 20-mesh sieve. The fractions are: (1) foreign matter removed manually from the 8-mesh sieve, (2) coarse fiber retained on the 8-mesh sieve, (3) medium fiber through the 8-mesh sieve but retained on the 20-mesh sieve and (4) fines through the 20-mesh sieve. The weight percentage of each fraction is reported on the as-received basis.

3. Significance

3.1 This method separates peat material into arbitrary fractions based on particle size. Physical separation of peat material according to particle size provides a useful indicator of the properties of a peat specimen such as pore space, decomposition, etc. It provides a means of determining the amount of foreign matter not in a divided state such as sticks, stones, and glass.

4. Apparatus and Material

4.1 *Oven*, regulated to a constant temperature of 105 C.

4.2 *Evaporating Dishes*, high silica or porcelain, not less than 75-ml capacity.

4.3 *Blender*, high-speed.

4.4 *Aluminum Foil*, heavy-duty.

4.5 *Porcelain pan, spoons, etc.*

4.6 *Mechanical Sieve Shaker*.

4.7 *Sieves*—U. S. standard 8-in. diameter 8

and 20-mesh sieves equipped with cover and bottom pan.

5. Preparation of Sample

5.1 Air-dry sample in accordance with Method II of ASTM Methods D 2974. Test for Moisture, Ash, and Organic Matter of Peat Materials,² and record the weight percentage of moisture removed by air-drying.

6. Procedure

6.1 Mix the air-dried sample thoroughly and place a 20-g specimen on the 8-mesh sieve. Secure the 8 and 20-mesh sieves equipped with cover and bottom pan and shake at a suitable speed for 10 min. Remove foreign matter from the 8-mesh sieve and weigh. Designate this fraction as foreign matter. Weigh the remaining fraction retained on the 8-mesh sieve and designate this fraction as coarse fiber. Weigh the fraction retained on the 20-mesh sieve and designate this fraction as medium fiber. Weigh the fraction found in the bottom pan and designate this fraction as fines.

NOTE 1—If a mechanical sieve shaker is not available, hand sieving can be used. Conduct sieving by appropriate lateral and vertical motions accompanied by a jarring action. Continue until no appreciable change is noted in the sieve fraction.

7. Calculation

7.1 Convert the specimen weight and fraction weights to the as-received basis in accordance with Method II of Methods D 2974.

¹ This method is under the jurisdiction of ASTM Committee D-29 on Peats, Mosses, Humus, and Related Products.

Effective Sept. 20, 1971.

² Annual Book of ASTM Standards, Part 19.

D 2977

NOTE 2—If foreign matter is absent, conversion to the as-received basis is not necessary.

Foreign matter = fraction removed from 8-mesh sieve

Coarse fiber = fraction retained on 8-mesh sieve

Medium fiber = fraction retained on 20-mesh sieve

Fines = fraction through 20-mesh sieve (in pan)

8. Report

8.1 Report the as-received weight of the fractions as a weight percentage of the as-received specimen as follows:

By publication of this standard no position is taken with respect to the validity of any patent rights in connection therewith, and the American Society for Testing and Materials does not undertake to insure anyone utilizing the standard against liability for infringement of any Letters Patent nor assume any such liability.

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