Some Peat Deposits in Washington and Southeastern Aroostook Counties, Maine

GEOLOGICAL SURVEY BULLETIN 1317-C

Some Peat Deposits in Washington and Southeastern Aroostook Counties, Maine

By CORNELIA C. CAMERON

STUDIES IN PEAT

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The use of physical characteristics of peat and physiographic forms of the deposits as guides to peat resources

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STUDIES IN PEAT

SOME PEAT DEPOSITS IN WASHINGTON AND SOUTHEASTERN AROOSTOOK COUNTIES, MAINE

By Cornelia C. Cameron

ABSTRACT

Peat resources of 78 undeveloped deposits investigated in Washington and southeastern Aroostook Counties, Maine, are estimated to amount to 30,785,000 short tons of air-dried moss peat of good quality, as defined by the recent ASTM (American Society for Testing Materials) peat classification. About half the deposits individually cover 100 acres or more, and 3 deposits each cover more than 1,000 acres. Thicknesses are as great as 25 feet; most average at least 5 feet thick. Representative samples from 57 of these deposits showed water-holding capacity as high as 4,920 percent. The organic content is generally greater than 90 percent (or, conversely, less than 10 percent ash), and more than half the deposits have a fiber content greater than 66 2/3 percent. Except for a few deposits in Aroostook County, the deposits have an in situ pH of less than 5.0.

The peat deposits occur in five basic physiographic forms: (1) Valleys occupied by streams; (2) closed basins with or without remnants of the initial ponds; (3) plateaulike domes on gentle clay, sand, or gravel surfaces; (4) domes and secondary ponds; and (5) coalesced domes. Moss peat, the type which has most commercial potential, occupies the upper parts of heath-covered domes of the last three physiographic forms; it lies above the regional water table and stratigraphically above the upper surface of the original water body associated with each deposit. Sediments of the original water body are derived from a variety of plants which either lived in the water or were deposited there along with varied amounts of clay; these peats have much less commercial potential.

A study of the relationship between the hydrology and the basic physiographic forms of peat deposits and a study of the reestablishment of flora in formerly exploited bogs in Washington County may afford clues useful in determining the least ecologically damaging methods of mining moss peat in individual deposits.

INTRODUCTION

GENERAL NATURE AND USE OF PEAT

Peat is a light- to dark-brown or black residuum formed by the partial decay and disintegration of plants that grew in marshes and swamps or in damp places such as heaths. It may be (1) fibrous, matted material composed of mosses, ferns, grasses, rushes, reeds, sedges, and woody material from trees and shrubs; (2) finely divided plant so decomposed that its biological identity is lost; or (3) nonfibrous, plastic, collodial, and macerated material deposited at the bottom of lakes or other bodies of water. Peat has been burned as a low-rank fuel throughout history, but only in the last two decades has it been used widely as a soil conditioner and horticultural material. In 1972, 103 operations in 22 states produced 576,712 short tons of air-dried peat for nonfuel use, an increase of 12 percent over the production reported in 1970. Commercial sales of 1972 were valued at $7,112,000; the average value per short ton was $11.72. An additional 310,491 short tons, valued at $17,173,000, was imported in 1972, chiefly from Canada, an increase of 5 percent over 1971 imports (Sheridan, 1974).

Because of the growing demand for peat along the Atlantic seaboard, an investigation of peat resources was extended from northeastern Pennsylvania and southeastern New York (Cameron, 1970 a, b) to eastern Maine between lat 44°27′ and 46°30′ N. The area investigated includes Washington County and southeastern Aroostook County (fig. 1). Physiographically, the study area is a bedrock-controlled glacial terrane stretching westward and northward from the strongly indented coast along the Bay of Fundy. Culturally, the area includes potato farms in the northeast, fishing communities along the coast, and forested uplands elsewhere which are largely suited for the pulp and lumber industry and for fishing, hunting, and other recreational activities. Peat occurs in numerous swamps, marshes, and heaths throughout the area.

SCOPE OF REPORT AND ACKNOWLEDGMENTS

The purpose of this report is to provide information for use in the exploitation of peat deposits in eastern Maine and of similar deposits elsewhere. Fifty-seven undeveloped but representative peat deposits were investigated by hand-auger holes along pace-and-compass traverses across swamps, marshes, and heaths. Holes were augered using a Davis sampler and a Macaulay peat borer; peat samples were collected to determine thickness and stratigraphy of the deposits and the configuration of the depression in which the deposits lie. The amount of peat was estimated from auger-hole data and from the surface area measured on topographic and air-photo maps. In calculating tonnage (table

1), 1 acre-foot of peat in place was considered equivalent to 200 short tons of air-dried peat. Samples from the deposits were analyzed by the U.S. Geological Survey for moisture, ash, organic content, water-holding capacity, fiber size (exceeding 0.15 mm), and acidity. An additional 21 deposits, from which samples were not analyzed, are included in the study.

The help of several people is gratefully acknowledged. Mr. Glen Jordan, U.S. Department of Agriculture, Machias, Maine, loaned aerial photographs, and Mr. Milford Savage, Island Falls, Maine, and Mr. Ted Lougee, Smyrna Mills, Maine, gave logistical support during the study of several heaths in Aroostook County.

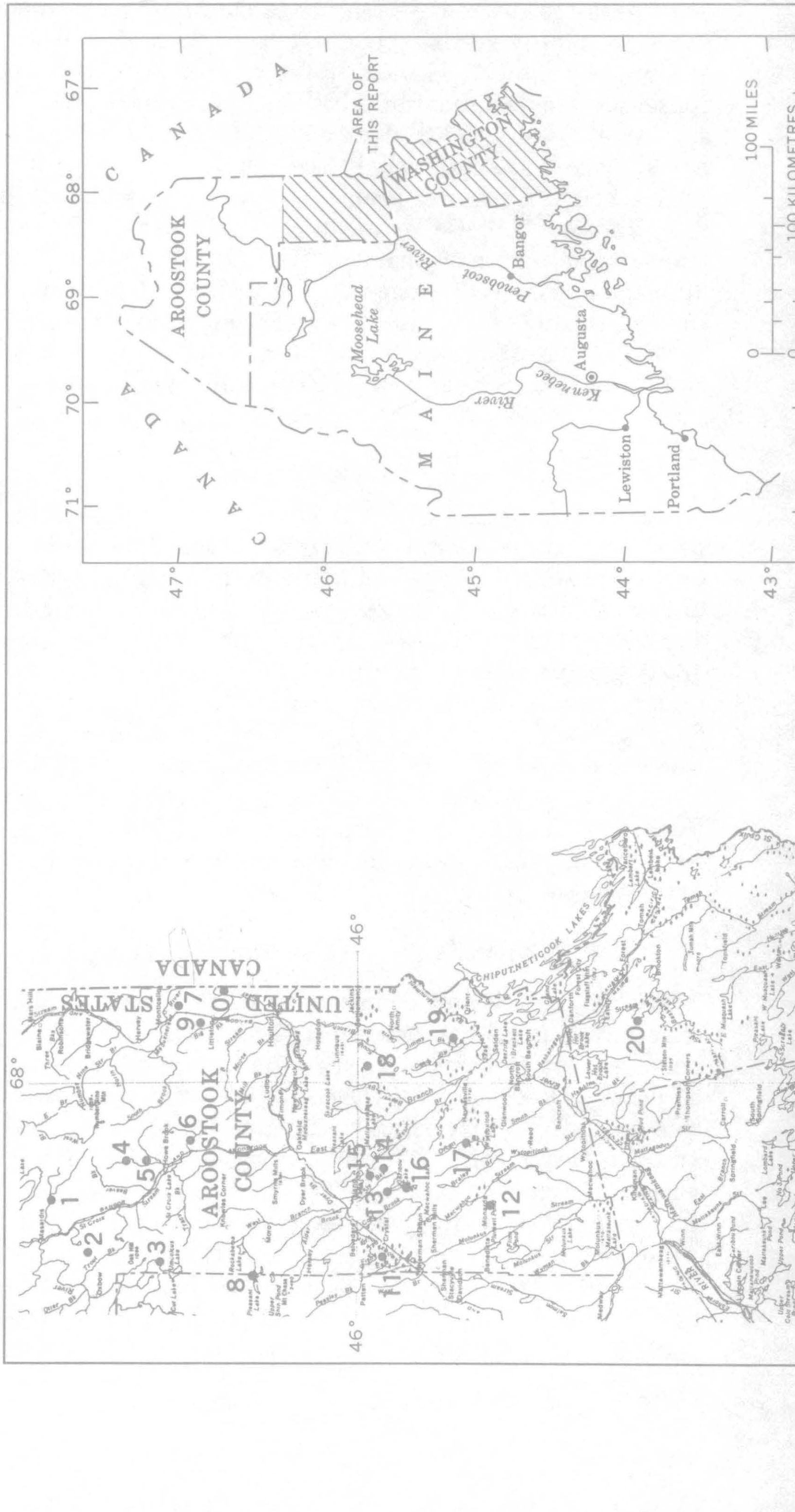
Thanks are especially due Richard S. Rhodes, James K. Watson, and Joseph C. Sarnecki who gave valuable support as field assistants.

PREVIOUS STUDIES

Attention was directed to the economic potential of Maine's peat deposits by Bastin and Davis (1909), who considered the deposits a source of fuel; they investigated 22 localities in Washington and southeastern Aroostook Counties. Soper and Osbon (1922) included this area in their study, listing an estimated 420,000 short tons of air-dried peat at 7 localities in Aroostook County and 6,519,000 short tons at 24 localities in Washington County. Finally, as late as 1944, use of peat primarily as a fuel was considered by the Maine Geological Survey (Trefethen and Bradford, 1944), although at this time large bogs in Washington County at Centerville, Jonesport, Sullivan, Franklin, and Deblois were being mined by hand labor for agricultural and horticultural purposes.

COMPOSITION AND PHYSICAL PROPERTIES OF PEAT

The properties and composition of peat vary considerably in different deposits and even in different parts of the same deposit because peat is derived from different types of vegetation and is accumulated and preserved under varying conditions. The commercial characteristics and properties of peat differ widely, and the Cooperative Extension Service at Michigan State University (Lucas and others, 1966) has published a guide for users. The principal factors that determine the commercial value are water-holding capacity, organic and ash content, fiber content, and acidity. The American Society for Testing Materials (1969) has published standard methods of testing each of these factors (ASTM Committee D–29 on peat, mosses, humus, and related


CANADA
AROOSTOOK COUNTY
MAINE
Moosehead Lake
Kennebec River
Penobscot River
Bangor
Augusta
Lewiston
Portland
WASHINGTON COUNTY
AREA OF THIS REPORT
100 MILES
100 KILOMETRES
71°
70°
69°
68°
67°
47°
46°
45°
44°
43°
UNITED STATES
CANADA
AROOSTOOK COUNTY
CHIPUTNETICOOK LAKES
1
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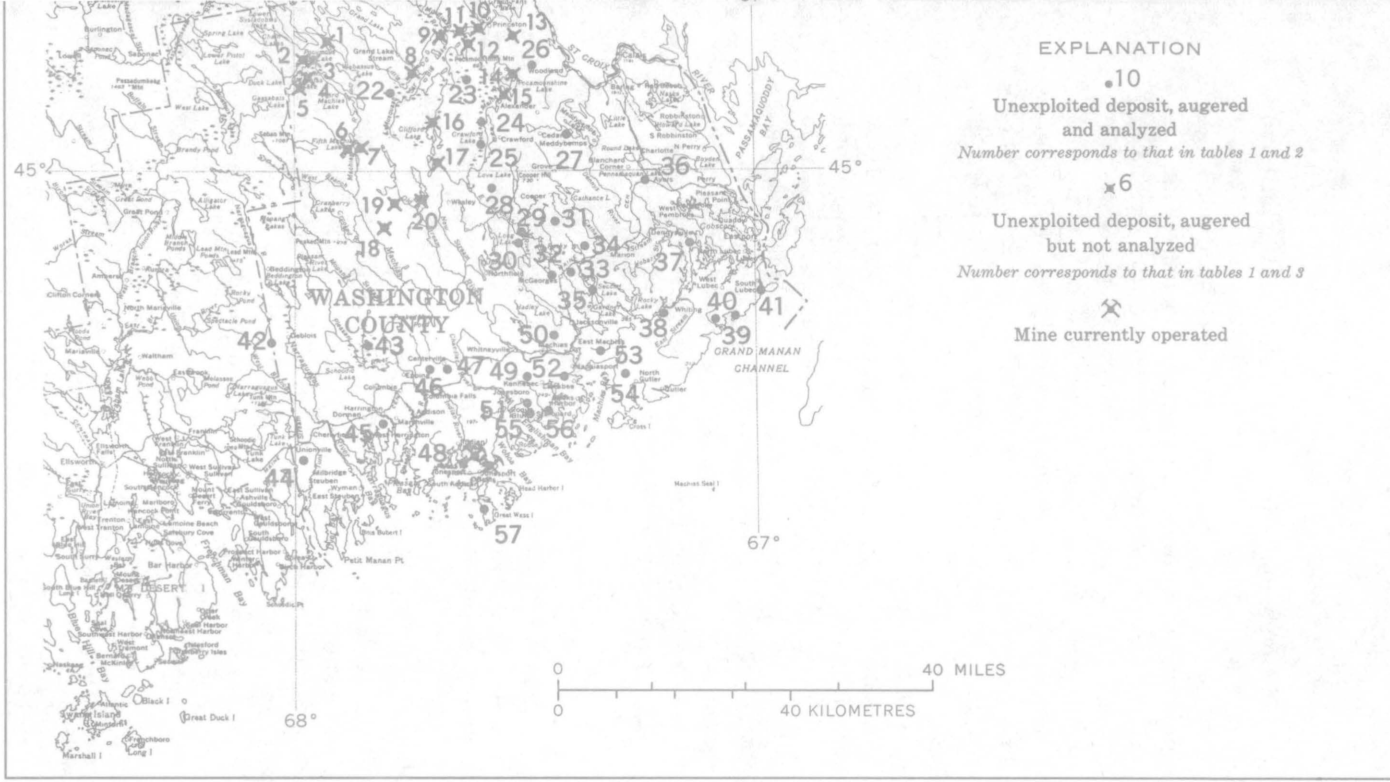

FIGURE 1.—Study area showing location of selected peat deposits, Washington and southeastern Aroostook Counties, Maine.

products, effective September 20, 1971, in the annual book of ASTM standards.[1]

WATER-HOLDING CAPACITY

Peat as a soil conditioner and horticultural material must have the ability to behave like a sponge—to reabsorb water after initial drying. Water-holding capacity, which is measured in percentage by weight, depends upon botanical character, the degree of decomposition, and the degree of drying to which the peat has been subjected. Moss peat will hold water 15 to 50 times its own dry weight. A good grade of reed-sedge peat will hold water 10 to 20 times its own dry weight. Humus, which is highly decomposed peat, will hold considerably less water. Peat generally tends to reabsorb less water when oven-dried than when it is dried in the open air.

Water-holding capacity of representative peat samples from a depth of 5 feet in each of the 57 sampled deposits ranged from 300 to 4,920 percent (table 2). Samples from only 3 deposits had water-holding capacities of less than 1,000 percent; samples from 17 deposits had capacities ranging from 1,000 to 2,000 percent; samples from 12 deposits had capacities ranging from 2,000 to 3,000 percent; samples from another 17 deposits had capacities ranging from 3,000 to 4,000 percent; and samples from 8 deposits had capacities greater than 4,000 percent.

ORGANIC AND ASH CONTENT

Regulations established by the Federal Trade Commission in 1950 make it unlawful to label a product "peat" unless 75 percent of the material by dry weight is organic. In practice, organic content is equal to the loss in weight when dry peat is heated to 550°C; the solids remaining constitute the ash.

The organic content in samples from a depth of 5 feet in the 57 Maine deposits ranged from 78 to 99 percent (table 2). In 37 of the deposits the organic content at this depth ranged from 95 to 99 percent; in 17 of the deposits it ranged from 90 to 94 percent; and in only 3 of the deposits did it fall below 90 percent.

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[1] The following reprints may be obtained from the American Society for Testing Materials, 1916 Race St., Philadelphia, PA 19103:

ASTM D2980–71, Standard method of test for volume weights, water-holding capacity, and air capacity of water saturated peat materials.

ASTM D2954–71, Standard method of test for moisture, ash, and organic matter of peat materials.

ASTM D2976–71, Standard method of test for pH of peat materials.

ASTM D2977–71, Standard method of test for size range of peat materials.

FIBER CONTENT

Fiber content refers to the proportion of stem, leaf, or other plant fragments that make up peat. Because peat with a high percentage of fibers more than 0.15 millimetres long tends to have high water-holding capacity (a desirable characteristic) and because fiber content influences weight per unit volume (a basis for determining the market value of peat), the standard classification of peats, mosses, humus, and related products which was adopted in 1969 and described in ASTM D2607–69 is based largely on fiber content.

Thirty-two of the 57 deposits contained samples having fiber content (table 2) greater than 66⅔ percent; 22 deposits contained samples having fiber content between 33⅓ and 66⅔ percent, and the remaining 3 deposits contained samples having fiber content less than 33⅓ percent.

IN SITU pH OF NATURAL PEATS

In situ pH of natural peat is normally acidic and ranges from 3.2 to 7.5. Very acid peats have a pH from 3.2 to 4.2, acid peats have a pH from 4.2 to 5.0, and peats having a pH between 5.0 and 7.0 are low in acidity. Peat having a pH of less than 5.0 is calcium deficient; that having a pH above 5.0 is calcium sufficient, which includes alkaline peats having a pH as great as 7.5. Most of the Maine deposits are calcium deficient (table 2). The calcium-sufficient peat which is present is largely restricted to the Aroostok County deposits in the limestone belt.

COMMERCIAL CLASSIFICATION OF PEAT

Because peat is formed from many kinds of plant material under a wide range of conditions, the different varieties are suitable for particular uses. Many different modes of classification have, therefore, been proposed. The most practical classifications are based on the following factors: (1) Physical or chemical characteristics such as texture, organic and mineral composition, and water content; (2) soil-like nature of peat and the vegetation that grows upon it; (3) origin, mainly by the type of vegetation represented; (4) environment of formation; and (5) marketable uses, such as fuel, as a source of chemical and other manufactured products, and as a soil conditioner.

For statistical purposes, the U.S. Bureau of Mines classifies peat into three general types: moss peat, reed-sedge peat, and peat humus.

Moss peat is formed principally from sphagnum, hypnum, and other mosses. Sphagnum moss peat is light tan to brown, light in weight, porous, high in water-holding capacity, high in acidity, and low in nitrogen content; "top moss" is the living part of the sphagnum plant and should not be confused with moss peat which has aged and partially decomposed. Hypnum moss peat is darker brown, of low acidity, and physically similar to reed-sedge peat.

Reed-sedge peat is formed principally from reeds, sedges, marsh grasses, cattails, and associated plants. Fibrous, partially decomposed reed-sedge peat is brown to reddish brown, but more decomposed peats are darker. The water-holding capacity and the nitrogen content of reed-sedge peat are of medium values.

Peat humus is derived from peat so decomposed that the original plant remains are not identifiable. It is dark brown to black, has low water-holding capacity, and has medium to high nitrogen content.

Most peat produced commercially in the United States and peat in most of the unexploited deposits in southeastern New York are either reed-sedge or humus type. Peat of any type may contain a considerable amount of woody material.

In addition to the three major types of peat defined above, other materials high in organic matter should be mentioned. Sedimentary peat is derived from such aquatic organisms as algae, plankton, pond weeds, and organic material washed into the water body. It occurs in the bottom of lakes and ponds and in the lower levels of most peat deposits. Such peat usually contains considerable mineral impurities, and in this report it is referred to as peaty clay or clayey peat, depending upon the organic content. It is too fine for most soil improvement purposes and shrinks and swells greatly with varying moisture content; some have a sheetlike structure and harden upon drying. Muck is highly weathered peat that has been modified greatly by soil micro-organisms and is usually granular in structure. It has low water-holding capacity and is poorly suited for soil-improvement purposes.

Use of peat as a soil conditioner and as a horticultural material prompted the U.S. Bureau of Mines to devise specifications governing the purchase of peat by the Federal Government. Federal Specifications Q–P–166e, dated May 10, 1961, cover four general types of peat for agricultural use and include the following specifications:

	Sphagnum moss peat	Other moss peat	Humus peat	Reed-sedge peat
Moisture content as normally marketed, percentage by weight	35–45	[1] 55	[1] 55	[1] 50
Maximum ash content, percentage by weight	10	20	20	15
Acidity [2]	3.2–4.5	3.2–7.0	4.0–7.5	4.0–7.5
Minimum water-holding capacity at 1 gravity on oven-dry basis, percentage by weight	800	400	200	400

[1] Maximum.
[2] The approximate pH shall be specified by the purchaser.

The need for a more specific classification has been recognized by the peat industry, and the ASTM Committee on Peat consequently proposed a standard classification. According to the ASTM Committee D–29 (ASTM D2607–69), the term "peat" may be used commercially only with respect to organic matter of geological origin, except lignite or other coal. Peat forms mainly from dead-plant remains through the agency of water in the absence of air; it occurs in a bog, swampland, or marsh and has an ash content not exceeding 25 percent on a dry-weight basis. The classification below is based on five major peat types determined by kind of plant material and fiber content. Fiber is defined as plant material retained on a No. 100 (ASTM) sieve (that is, 0.15 mm or larger) and includes stems, leaves, or fragments of bog plants but no wood particles larger than 0.5 inch (12.7 mm) in greatest dimensions; it excludes inorganic fragments such as shells, stones, sand, and gravel. Percentages of fiber are based on oven-dry weight at 105°C, not on volume.

Sphagnum moss peat (peat moss).—The oven-dried peat contains a minimum of 66⅔ percent sphagnum moss fiber of the total content by weight. These fibers are stems and leaves of sphagnum in which the fibrous and cellular structure is recognizable.

Hypnum moss peat.—The oven-dried peat contains a minimum of 33⅓ percent fiber content by weight, of which hypnum moss fibers compose more than 50 percent. These fibers are stems and leaves of various hypnum mosses in which the fibrous and cellular structure is recognizable.

Reed-sedge peat.—The oven-dried peat contains a minimum of 33⅓ percent fiber by weight, of which reed-sedge and other nonmoss fibers compose more than 50 percent.

Peat humus.—The oven-dried peat contains less than 33⅓ percent fiber by weight.

Other peat.—This covers all forms of peat not herein classified.

According to this ASTM classification, 32 of the 57 Maine deposits contained sphagnum moss peat, 22 deposits contained peat composed of moss and other plant fragments, and the remaining 3 deposits contained peat humus.

VEGETATION, CLIMATE, GEOLOGY, AND PHYSIOGRAPHY OF EASTERN MAINE PEAT DEPOSITS

HEATHS

Peat deposits in eastern Maine may be recognized by their covering of low shrubs and scattered trees. Heaths, as they are called locally, are generally surrounded by trees of normal height. The heath family (*Ericaceae*) includes the common leatherleaf (*Chamaedaphne calyculata*), lambkill (*Kalmia angustifolia*), pale laurel (*Kalmia polifolia*), bog rosemary (*Andromeda glaucophylla*), Labrador tea (*Ledum groenlandicum*) ; rhodora (*Rhododendron canadense*), hoary alder (*Alnus incana*), winterberry (*Ilex verticillata*), and sweetgale (*Myria gale*) are commonly associated with the heath shrubs. The most conspicuous herbaceous flowering plants include cranberries (*Vaccinium oxycocus* and *V. Macrocarpon*), pitcher plant (*Saracenia purpurea*), sundew (*Drosera rotundifolia*), cotton grasses (*Eriophorum* spp.), sedges (such as *Carex, Scirpus,* and *Rhynchospora*), and orchids (such as *Pogonia, Calopogon, Calypso,* and *Arethusa*). Several mosses, such as sphagnums (*Sphagnum* spp.) and haircaps (*Polytrichum* spp.), are abundant. Lichens are abundant, especially reindeer moss (*Cladonia rangiferina*) and red-tipped moss (*Cladonia cristatella*). Stunted forms of black spruce (*Picea mariana*) and tamarack (*Larix laricina*) occur on the heath generally, but white pine (*Pinus strobus*) and arbor-vitae or northern white cedar (*Thuja occidentalis*) may grow on the driest parts of the heath.

This rather definite and restricted group of plants is typical of the heath or raised-bog type of peat deposit; it tolerates the conditions which promote the continuous growth of sphagnum moss which is, in turn, responsible for the development of the convex surface of the heath. Lack of drainage and consequent lack of oxygen permit accumulation of organic acids. Not only does the soil become low in nutrients, but the acidic water is toxic to most plants. A ring of tall trees grows at the margin of the heath because drainage is better. The forest encroaches on the heath as surface drainage improves. Thus, some heaths have been changed to forest, which becomes the vegetative cover of the peat deposit.

Excellent botanical descriptions of Denbow Heath (deposit 42, fig. 1) and deposits 39 and 40 near South Trescott and Boot Cove, Washington County, given by Hugo Osvald (1970, p. 48–55) illustrate the vegetation of coastal and inland bogs in the area of study. Coastal bogs differ from inland bogs in that they have much greater dwarf-shrub communities with bottom-layer lichens.

CLIMATE

Peat accumulates in many climates. Temperature is not a limiting factor; just as plants grow from the Arctics to the Tropics, peat deposits also form. The peat bogs of northern latitudes have long been studied and exploited, but the great peat deposits of Florida (Davis, 1946) are not as well known. High temperature is important in stimulating plant growth, but it also increases the rate of decay. Moisture is the most critical climatic factor in promoting plant growth and inhibiting decay, and thus it largely controls the formation of peat. The anaerobic conditions in the lower parts of nearly stagnant ponds, swamps, and marshes provide maximum opportunity for preservation (Waksman, 1942, and Waksman and Stevens, 1929, 1932). In cool areas of high rainfall and humidity, and consequently low evaporation, deposits of sphagnum moss may accumulate and form peat on flat or sloping land, as along the coast of Maine; under these conditions some peat deposits have been built up more than 20 feet above the surrounding area.

The climate of Washington County and southeastern Aroostook County is characterized by summer temperature averages of less than 70°F, mean annual precipitation of 40 inches inland to 48 inches along the coast, and humidity averages of 70 to 80 percent. The most favorable period for peat development was during the cooler and more moist conditions following the melting of glacial ice; today, the most favorable climate for growth of sphagnum moss is in the coastal fog belt.

REGIONAL GEOLOGY AND PHYSIOGRAPHIC HISTORY

The bedrock of the study area consists of a folded and faulted complex of metamorphic and igneous rocks of Ordovician, Silurian, and Devonian age. Marble, largely restricted to eastern Aroostook County, has weathered to a soil that is favorable to large-scale potato culture and has furnished large quantities of lime to the glacial drift. The entire area was severely dissected by streams prior to glaciation.

The last ice sheet to cover these bedrock hills stood along the present Maine coast approximately 13,500 years ago. Ground and recessional moraines associated with kames and eskers formed at this time, and the multitude of ponds and lakes on the poorly drained deglaciated surface became potential peat-forming sites. Deglaciation of coastal Maine was followed by widespread marine invasion starting between 12,100 and 12,800 years B.P. (Borns and Calkin, 1970). During the early stage of transgression, sea level was 180 feet lower than present sea level. At maximum, the marine invasion reached a level of 400 feet above the present sea level. Radiocarbon ages of the deepest portion of bogs in small kettles on former islands within the marine limit indicate an average timelag of 800 years between deglaciation and the onset of the earliest organic growth. This means that all peat in the study area is younger than 12,700 years B.P. The deposits rest on either marine or fresh-water clay and silt.

EVOLUTION OF THE PEAT DEPOSIT

The most common type of peat deposit in the United States is the filled-basin type. The built-up or raised-bog deposit on flat or gentle slopes is more common in northern Europe than in America. The third or composite type, consisting of built-up deposits underlain by peat of the filled-basin type, is common in southern Canada and northern United States, especially in Maine.

Development of a typical Maine deposit (fig. 2) begins with deposition over the inorganic gray bottom clay of floating types of plants such as algae and pond weeds that lived in the shallow water (fig. 2, stage 1). This organic sediment is an amorphous material with high colloidal content. It fills the depression to a depth permitting growth of rooted plants such as pond lilies and bulrushes (fig. 2, stage 2). As vegetal remains accumulate and pond area decreases (fig. 2, stage 3), water of the vestigial pond is eventually replaced by grass, reeds, sedge, and moss, and the deposit grows upward and outward beyond the margin of the original water body; the water table also rises (fig. 2, stage 4). As soon as sphagnum moss dominates the vegetation, the convex surface, or dome, with perched water table begins to develop (fig. 2. stage 5).

Peat growth within a basin displaces its own volume of water until it reaches the level at which inflow and outflow are balanced. Further peat growth creates a reservoir which holds a volume of water against drainage. There are two types of peat reservoirs. The first, composed of sedimentary organic material and reed-sedge peat, acts as a physical barrier to ground water, causing the water to back up. In this process of lateral paludification, the peat moss in the original basin, acting as a dam, produces newly flooded areas, in which more peat can develop. In suitable topography this peat can grow in thickness on bedrock or soil surface beyond the margin of the original pond or lake. The second type of peat reservoir, composed of moss peat in the raised bog, acts as a second reservoir above the regional level of the groundwater, producing a perched water table which is held against gravity within the peat moss by capillarity. This process is vertical paludification and is responsible for development of the domed sphagnum peat deposits so common in Washington and southeastern Aroostook Counties.

The terrestrialization of a shallow lake having inflow and outflow streams illustrates the hydrologic regime typical of the Maine deposits (fig. 2). Five stages of evolution are recognized (Bellamy, 1968). During stage 1 water from the inflowing stream moves over and through the developing peat deposit and leaves at the outlet. Movement is chiefly over the peat if much allochthonous material is being brought into the lake; the abundant oxygen decomposes the organic material to form a heavy peat. However, if the rate of flow is low, less allochthonous material collects, less oxidation or decomposition occurs, and the water flow is directed largely below a floating mass of relatively light peat. The accrual of peat (stage 2) tends to canalize the main flow of water. Continued peat growth (stage 3) diverts the stream to the margin of the filled lake. The water supply to the deposit is restricted to rain falling directly on the surface and to seepage from the surrounding catchment. Portions of the deposit lying in the main-drainage tracts within the basin, however, may be subject to a slow continuous flow of ground and (or) surface water. Further accrual of peat (stage 4) leaves large areas of the deposit surface unaffected by moving water but subject to inundation when the water level of the basin rises during periods of rainfall. Because of continued peat growth, the deposit or bog surface rises above the effect of the vertical oscillations of the ground water. The convex surface or dome so produced possesses its own water table fed by rain falling directly on it (stage 5).

BASIC PHYSIOGRAPHIC FORMS OF THE DEPOSITS

David J. Bellamy of Durham University, England, introduced (1972) the concept of templates for interpreting mires in terms of conservation and exploitation. He defined templates for peat

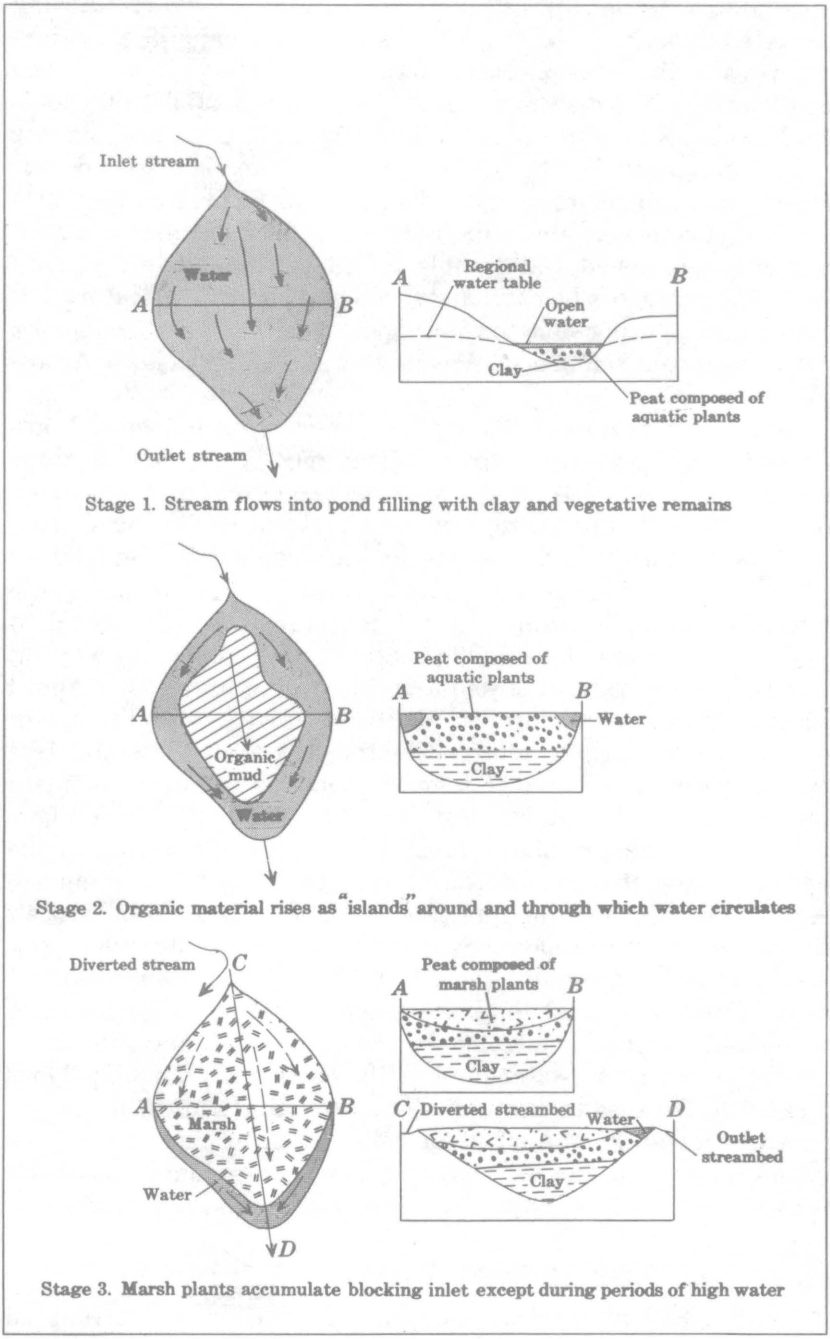
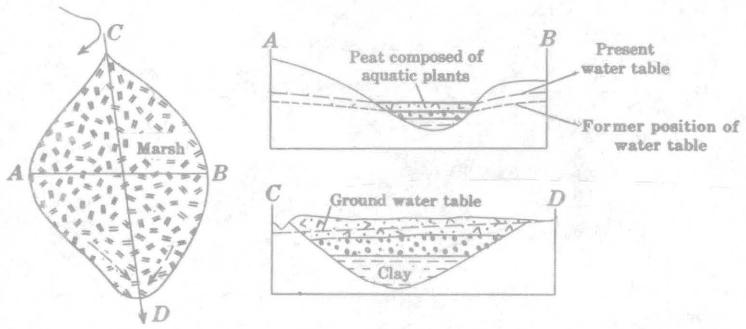
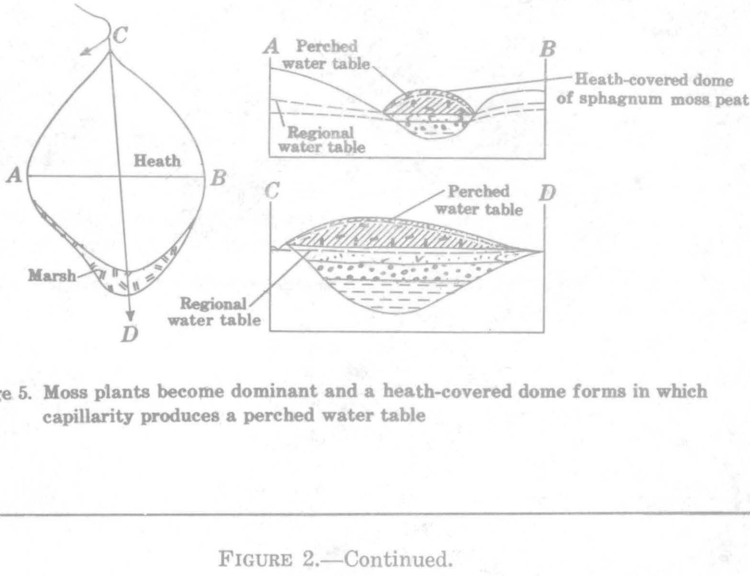


FIGURE 2.—Diagrammatic maps and cross sections of five stages in the development of the composite type of peat deposit based on a gradual change of surface and ground water regimes.



Stage 4. Further accumulation raises marsh slightly above level of original pond surface. Water table rises to surface only during periods of heavy rainfall



Stage 5. Moss plants become dominant and a heath-covered dome forms in which capillarity produces a perched water table

FIGURE 2.—Continued.

formation as places where water collects on its way down from the catchment to the sea. By this definition, templates are all forms of natural basins from valley heads to those in deltaic flood plains. Although it is difficult to apply the European system of classifying mires to the Maine peat deposits in raised and composite bogs, the idea of grouping them into basic forms with common physiographic features and origins is useful. Accordingly, five basic forms of peat deposits, which more or less resemble European mires, are recognized in the area of study. Diagrams of each form

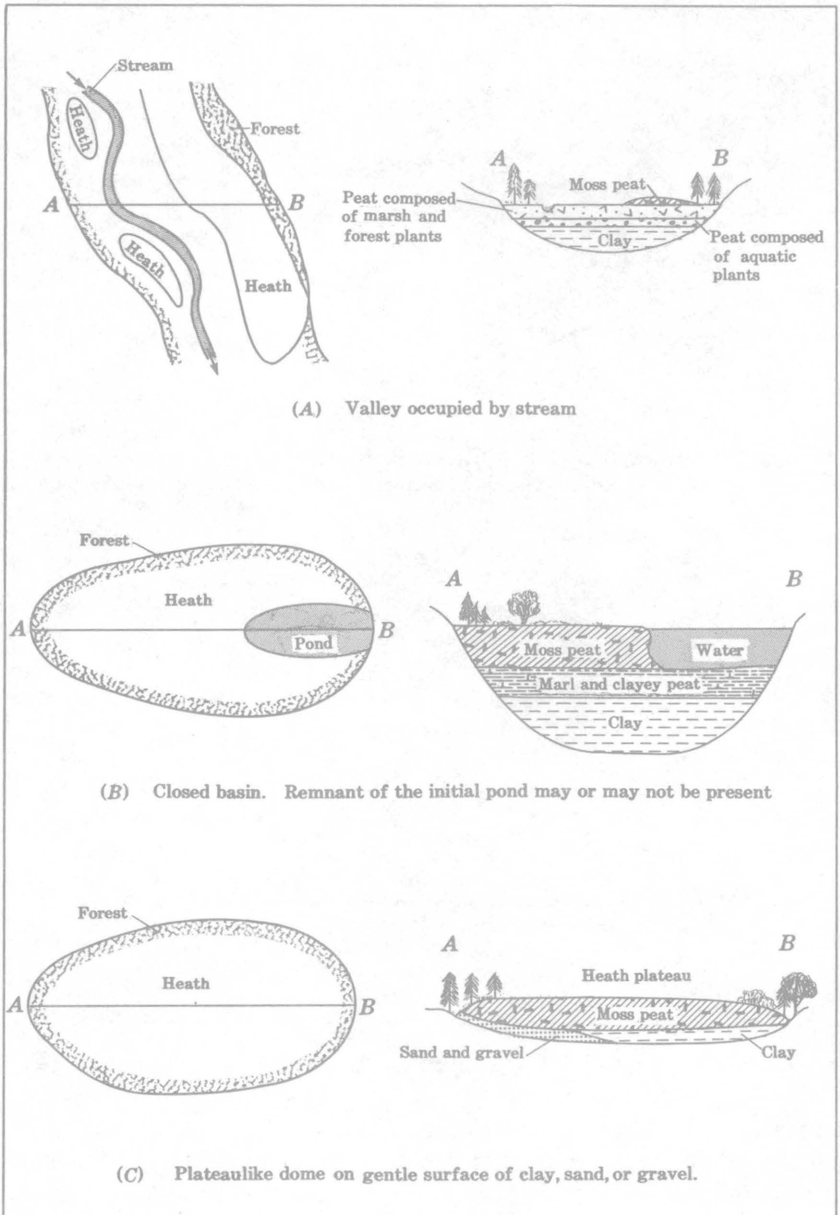
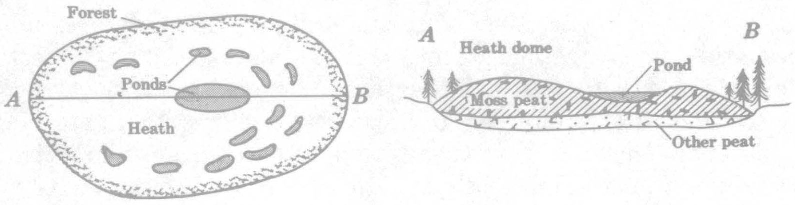
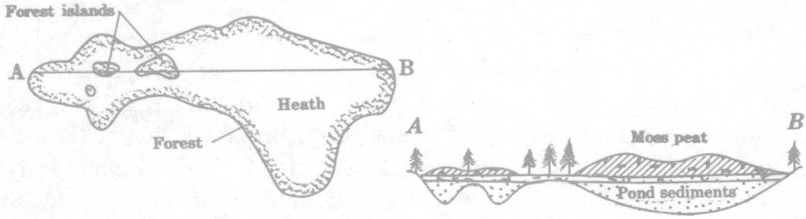


FIGURE 3.—Diagrammatic maps and cross sections of the physiographic forms of peat deposits.

are shown in figure 3. Location, physiographic form, and size of all deposits in the study area are given by quadrangle in tables 1 and 3.



(*D*) **Domes and ponds. Ponds are secondary, developing on moss peat**



(*E*) **Coalesced domes over deposit occupying several basins**

FIGURE 3.—Continued.

The deposit shown in figure 3*A* lies in a valley occupied by a stream which flows over peat composed chiefly of marsh and forest plants. The peat developed over sediments deposited in the initial pond or ponds located in dammed parts of the valley. One or more heath-covered domes of moss peat may extend along the stream. Water is brought into the deposit by the stream. Ground water also enters the deposit as seepage along the valley walls above the basal clay aquiclude, and moves toward the stream and down the valley. Eighteen of the seventy-eight deposits studied generally have this physiographic form. They range in size from 30 to 320 acres, have maximum thickness of 7 to 21 feet, and contain an estimated 20,000 to 640,000 short tons of commercial-quality air-dried peat, chiefly sphagnum moss and other peat (ASTM classification).

The deposit shown in figure 3*B* lies in a closed basin. Floating mats of moss peat extend over open water of the vestigial lake or pond. The vegetation cover is heath surrounded by tall forest grading inward to stunted trees and bushes. Water enters the deposit as rainfall and as seepage along the basin walls above the basal clay aquiclude. Most of the deposits in the study area which have this physiographic form occur in sink holes in the limestone belt of the potato region in eastern Aroostook County, and they are composed of thin layers of moss peat over marl and associated sediments. They are very small—only 10 to 15 acres in extent—and have a maximum depth of 7 to 12 feet and contain 10,000 to 15,000 short tons of commercial-quality sphagnum moss peat.

The deposit shown in figure 3*C* lies on a gentle surface of sand, gravel, or clay in the form of a broad moss peat dome or plateau. Surface drainage has been diverted around the deposit, and growth of the deposit is sustained by rainfall and ground water entering from below, chiefly through the sand and gravel. The heath-covered dome or plateau is invaded by trees from the sloping edge. Half of all the deposits studied have this physiographic form. Although the range in size and thickness is great, all the deposits of this form contain less than 500,000 short tons of commercial-quality air-dried peat classified as sphagnum moss and other peat (ASTM classification). This common broad-dome or plateau form is typified by Runaway Pond Heath in Washington County (deposit 50 on fig. 1; fig. 4).

When developed on any of the foundations described above, large moss-peat plateaus form undulating surfaces due to subsurface water and rainwater moving down the slope or toward depressions made by compaction under snow drifts. Water gathers in these depressions, which are made larger by oxidation and which frequently are arranged in concentric bands (fig. 3*D*). Ponds such as these characterize thick deposits of moss peat. Deposit 11 in Aroostook County and deposits 27, 42, and 43 in Washington County all exhibit this form (fig. 3*D*) and are among the largest deposits in the area of study. Three of the above deposits range in area from 1,125 to 4,000 acres, are as much as 20 feet thick, and contain 2,250,000 to 8,000,000 short tons of air-dried peat, most of which is sphagnum-moss peat. The fourth deposit covers 32 acres, is as much as 25 feet thick, and contains 640,000 short tons of peat.

The most complex peat deposits in the area are those in which the domes of moss peat coalesce over divides which separate basins that contain peat developed above and below the original pond surfaces (fig. 3*E*). The divides covered by the moss peat are most likely areas of ground-water exchange between the deposit and the country rock. Fourteen of the studied deposits have this physiographic form, some of which are combined with other forms, as in deposits 14 (table 3), 11, 27, 42, and 43 (table 1). Thousand Acre Bog (deposit 11 of table 1) in Aroostook County (figs. 5, 6) is typical of the dome-and-pond and coalesced-dome forms shown in figures 3*D* and 3*E* respectively.

STRATIGRAPHY

Physiographic forms reflect the stratigraphy of a peat deposit and quality factors, especially ash content (see table 2), reflect the deposit. For purposes of discussion, the deposit may be divided into two parts, (1) that part below the level of the original pond surface and (2) that part above the level. In the ideal section, the basal zone of part 1 is clay and peaty clay containing more than 50 percent ash. Ash content in the overlying clayey peat ranges from greater than 25 percent to less than 25 percent, depending on the pond environment. Algae and pond weeds living in clear water produce peat with low ash content; a clayey peat layer low in ash may be produced in a pond obliterated by floating mats of marsh and moss vegetation which continually sink and mix with pond sediments until the level of the original pond is reached.

The basal zone of part 2 usually contains less than 25 percent ash, unless a period of oxidation and decay has interrupted plant growth, and consists of a variety of plants such as marsh, perhaps forest growth, moss, and heath plants. Because moss becomes the dominant plant type as the dome increases in height, ash content decreases to less than 2 percent, the percent of fibers that are 0.15 mm long increases to greater than 66⅔, and water-holding capacity increases to several thousand percent. However, as soon as oxidation begins to destroy peat, a layer of humus develops at the surface, especially near the margin of the dome where oxygenated water moves most freely. As humus develops, ash content increases, fibers become shorter, water-holding capacity decreases, and forest invades the heath from the margin and migrates toward the center of the dome.

RESOURCES

The resources of peat in the 19 deposits that were augered and analyzed in southeastern Aroostook County are estimated to be about 5,100,000 short tons; in the 38 deposits augered and analyzed in Washington County, resources are estimated to be about 20,041,000 short tons (table 1). The location, size, and quality of each of these deposits are given in table 1. Twenty-one

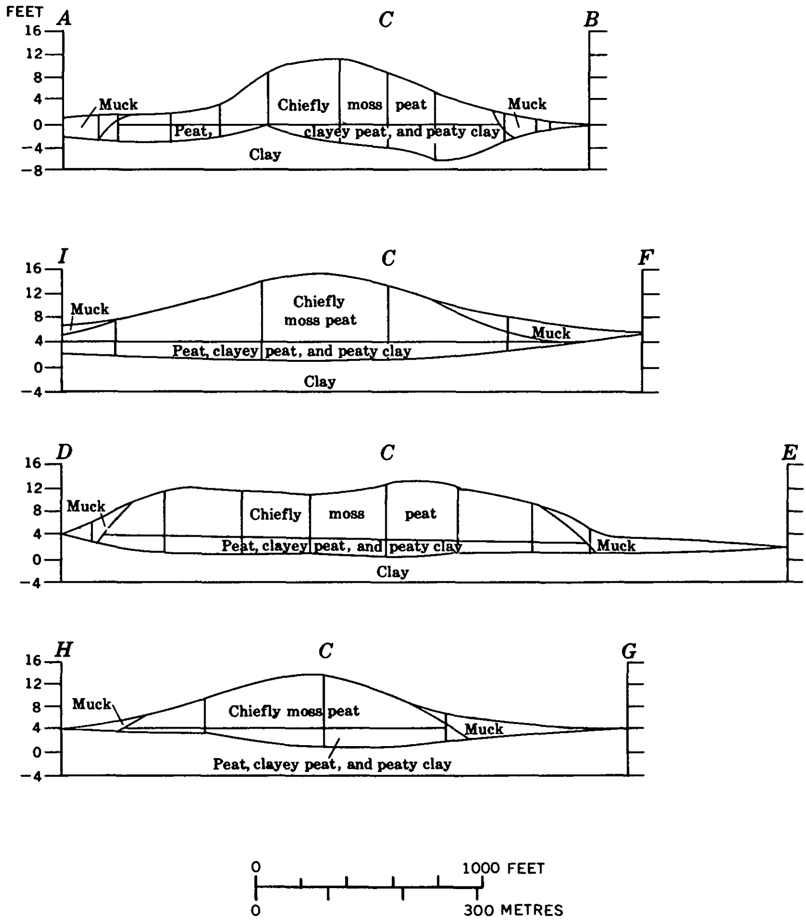


FIGURE 4.—Contour map and diagrammatic profile sections of Runaway Pond Heath (deposit 50 in fig. 1). Map shows location of lines of traverse and sections, as well as auger hole sites (solid dots). Contour lines (in feet above sea level) within the Heath boundary indicate shape of the dome. Zero elevation on the sections is approximate base of sphagnum peat.

additional deposits, augered but not analyzed, contain an estimated 5,257,000 short tons and are described in table 3. Estimates are for air-dried peat on a basis of 200 short tons of peat per acre-

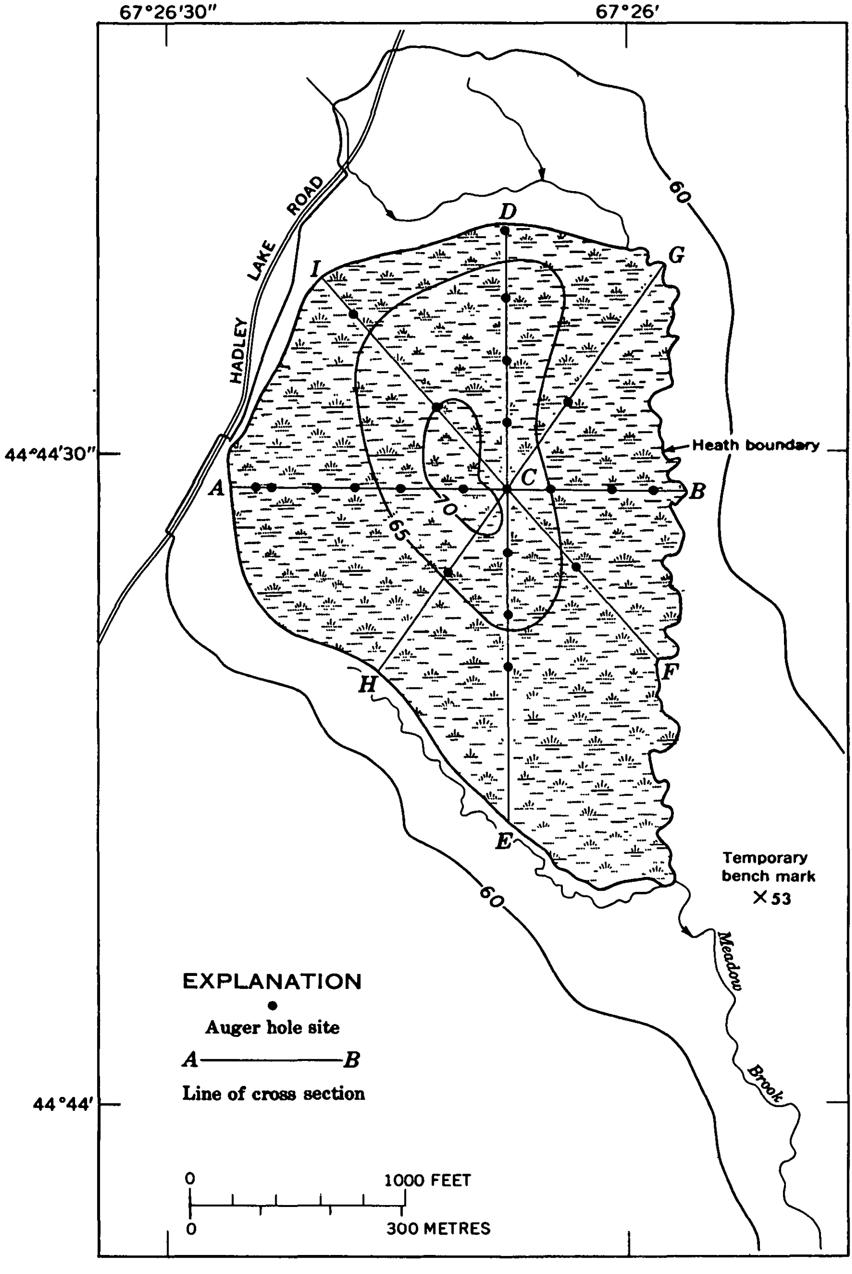


FIGURE 4.—Continued.

foot in place. In addition to the number of deposits examined, it is estimated that there are at least as many more deposits of similar size and quality elsewhere in the study area and in other parts

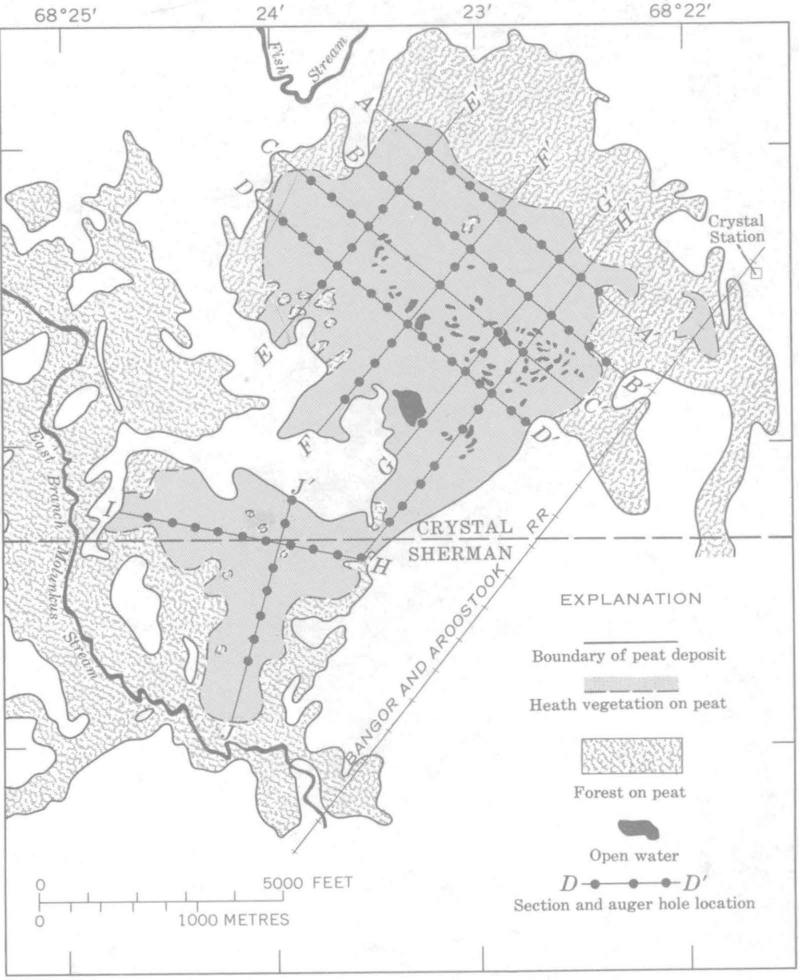


FIGURE 5.—Map of Thousand Acre Bog (deposit 11 in fig. 1) showing location of lines of traverse and auger hole sites. Profile sections are shown in figure 6.

of eastern Maine; in effect, the resources calculated above can be doubled.

Size of the peat deposits in the study area ranges from less than 100 to 4,000 acres; almost half cover 100 acres or more. Thickness of commercial-quality peat in these deposits reach a maximum of 25 feet, and most average at least 5 feet. Much is moss peat, with sphagnum predominating in the upper parts of the deposit. Moss peat rests on peat that is classified as "other peat" in the ASTM classification. Peat classed as "reed-sedge" is practically absent in the area of study.

PEAT MINING

Maine produced 2,903 short tons of air-dried peat in 1972 at four plants, two of which are near Jonesport in Washington County, and sold 2,083 packaged short tons at an average price of $47.60 per short ton (Sheridan, 1974). Both production and sales doubled those of 1970, when 1,223 short tons of air-dried peat was produced and 1,000 short tons was sold at an average price of $39.00 per short ton (Sheridan, 1972).

Moss peat is cut into blocks which are stacked and dried in the field or in a kiln. Until very recently mining was by hand. Today modern machinery clears the surface of the deposit; cuts and stacks the peat blocks; and hauls, shreds, and bags the product, which is then distributed by truck.

IMPACT ON ENVIRONMENT

Exploitation during the past 75 years has made little impact on the vegetation of Denbow Heath (deposit 42) and other heaths in Washington County described by Osvald (1970). This is because sphagnum moss peat was removed from the domes, which are above the regional water tables, and the remaining heath plants regenerated new peat. Deposits most suitable for exploitation today are the plateaulike-dome, dome-and-pond, and coalesced-dome physiographic forms (see figs. 3*C*, *D*, and *E*, 4–6) in which the peat of best quality lies above the regional water table. Streams have been diverted around these deposits in the manner diagrammed in figure 2.

As long as regional ground-water tables are little changed, which can be accomplished by keeping drainage ditches at minimum depth, and as long as some patches of heath are left undisturbed, peat mining might not cause permanent change. However, since the advent of modern machinery for rapid clearing of the heath surface and for ditching, preliminary studies of drainage, of the physiographic form of the deposit, and of its biology are imperative in order to prevent unnecessary damage.

OUTLOOK FOR THE AREA

Transportation and marketing are the chief factors which will influence the long-range outlook for the area. Interstate 95, constructed as far north as Houlton, links southeastern Aroostook County to the excellent road network of the eastern United States. In addition, the large pulp companies have changed from the use of streams to the use of trucks for log transport; thus roads are

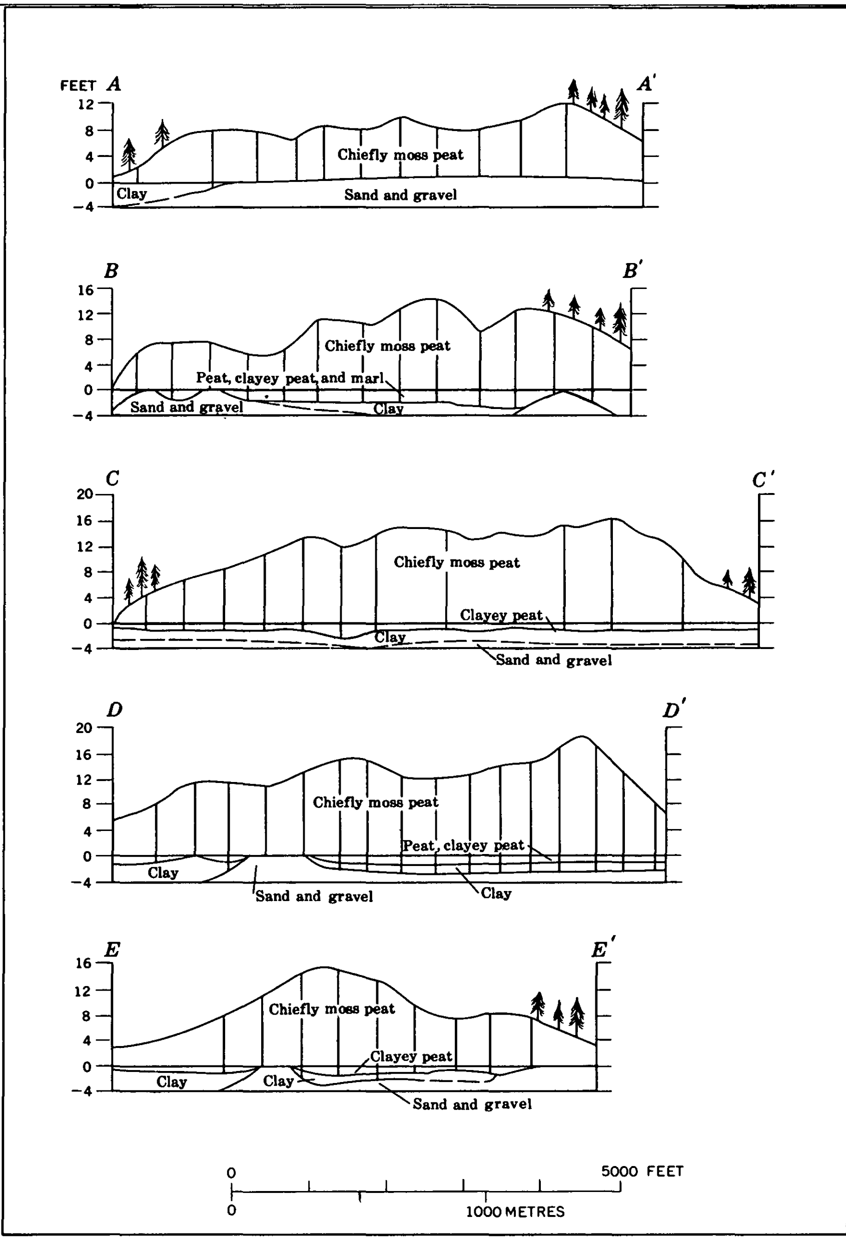


FIGURE 6.—Profile sections of Thousand Acre Bog. See figure 5 for location of sections. Zero elevation is approximate base of sphagnum peat.

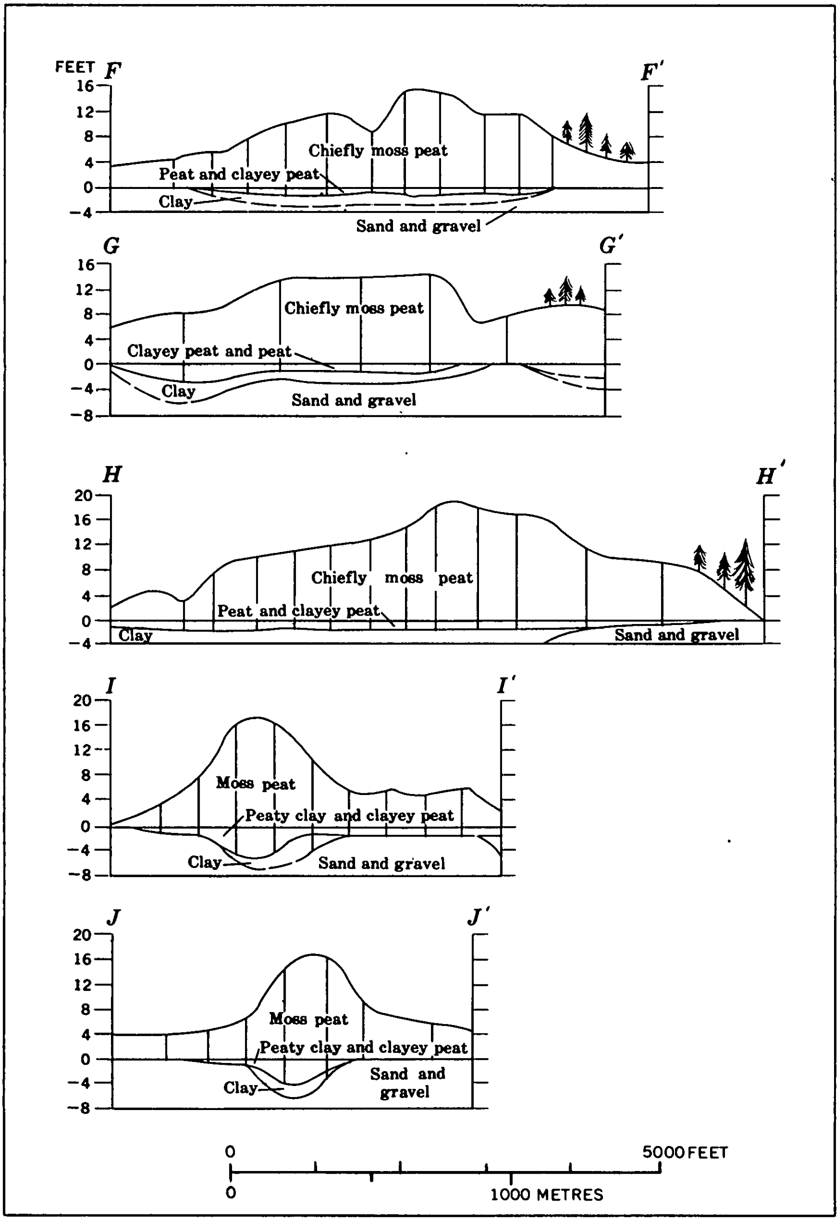


FIGURE 6.—Continued.

provided which make new areas accessible for peat exploration and possible exploitation.

Decarlo (1971) forecasts that the national demand for peat in the year 2000 will reach 1,200,000 to 2,400,000 short tons, compared to 917,169 short tons used in 1972. Although most peat is presently used for agricultural and horticultural purposes, technology is introducing new uses as environmental control. For example, D'Hennezel and Coupal (1972) showed that moss peat, because of its very high water-holding capacity, can be used on a large scale in combating pollution caused by oil spills from offshore drilling, freighters, and barges. Sheridan (1974) stated that Finland has begun production of oil-absorbent compressed peat in 170-litre packs for sale to oil companies and port authorities. He also reported research in Switzerland on the use of peat as a filter for decontamination of radioactively contaminated water. Research conducted at Sherbrooke in Quebec, Canada, revealed the high efficiency of moss peat in the filtration of pigments and dyes in wastes from textile plants and in the filtration of mercury and other metals in wastes from industrial plants.

The future for a peat industry in eastern Maine is bright in that good-quality moss-peat deposits are available and are increasingly accessible by a developing road network which includes the eastern United States market with its growing demand for peat and peat products.

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TABLES 1–3

TABLE 1.—*Size, physiographic form, and location of peat deposits of Maine*

[Deposits 1–19 are in southeastern Aroostook County; deposits 20–57 are in Washington County]

Deposit No. (fig. 1)	Quadrangle (15′ unless otherwise noted)	Location within quadrangle	Physiographic form of deposit (fig. 3)	Surface area of deposit (acres)	Thickness of peat (feet)		Estimated short tons (air-dried)[1]
					Maximum	Average	
Deposits containing more than 2,000,000 tons of peat							
43	Cherryfield	Bog crossed by Pleasant River, T. 18 MD and Columbia Tp.	*D* and *E*	4,000	20	10	8,000,000
27	Calais	Meddybemps Heath, Alexander and Cooper Tps.	*D* and *E*	2,080	20	15	6,240,000
11	Sherman	Thousand Acre Bog, Crystal and Sherman Tps.	*D* and *E*	1,125	20	10	2,250,000
Deposits containing 500,000 to 2,000,000 tons of peat							
21	Vanceboro	Bog north of Sussie Hill, Vanceboro Tp.	*E*	700	13	7	980,000
42	Tunk Lake	Denbow Heath on Washington-Hancock County Line.	*D* and *E*	320	23	10	640,000
17	Mattawamkeag Lake	Bog adjacent to Orcutt Brook, Glenwood Tp.	*A*	320	21	10	640,000
Deposits containing 100,000 to 500,000 tons of peat							
25	Big Lake	Bog at west side of Crawford Lake, Crawford Tp.	*C*	245	21	10	490,000
16	Mattawamkeag Lake	Bog at south edge of Caribou Lake, Island Falls Tp.	*A*	240	25	10	480,000
2	Oxbow	Bog at Houlton Brook deadwater, T.9, R. 5.	*C*	215	13	10	430,000
24	Big Lake	Bog at north end of Crawford Lake, Plantation No. 21 Tp.	*A*	340	6	5	340,000
46	Columbia Falls, 7½′	Marst Heath, Columbia Falls Tp	*C*	180	10	9	324,000
44	Cherryfield, 7½′	Heath 1.0 mile south of Unionville, Steuben Tp.	*C*	100	15	9	270,000
26	Calais	Bog 1.0 mile east of South Princeton, Princeton Tp.	*C*	260	13	5	260,000

[1] Estimated according to 1 acre-foot of peat in place being equivalent to 200 short tons of air-dried peat.

TABLE 1.—*Size, physiographic form, and location of peat deposits of Maine*—Continued

Deposit No. (fig. 1)	Quadrangle (15′ unless otherwise noted)	Location within quadrangle	Physiographic form of deposit (fig. 3)	Surface area of deposit (acres)	Thickness of peat (feet)		Estimated short tons (air-dried)[1]
					Maximum	Average	
Deposits containing 100,000 to 500,000 tons of peat—Continued							
28	Wesley	Joe Hanscom Heath, T. 19 ED	*C*	120	23	10	240,000
31	Gardiner Lake	Bog at The Commons adjacent to Rte. 191, west of Lake Cathance.	*E*	160	12	7	224,000
23	Big Lake	Elighah Brown Heath, Plantation No. 21 Tp.	*C*	100	21	10	200,000
20	Danforth	Webber Bog, Brookton Tp	*C*	200	7	5	200,000
4	Howe Brook	Bog at Upper Deadwater on Howe Brook, St. Croix Tp.	*E*	135	12	7	189,000
8	Island Falls	Bog at Mud Lake, Moro Tp. on county border.	*A*	90	17	10	180,000
45	Harrington, 7½′	Heath south of Harrington and west of Rte. 1A.	*C*	120	8	7	168,000
13	Mattawamkeag Lake	Bog at north edge of Caribou Lake, Island Falls Tp.	*C*	80	15	10	160,000
1	Oxbow	Bog along Blackwater River north of Cranberry Pond.	*C*	150	9	5	150,000
18	Amity	Coffin Bog, Linneus Tp	*C*	65	15	10	130,000
35	Gardiner Lake	Bog adjacent to Hammond Pond at north end of Gardiner Lake, Marion Tp.	*E*	70	18	7	126,000
29	Wesley	Bog adjacent to East Machias River north of Oak Point Meadow, T. 18 ED.	*A*	120	13	5	120,000
52	Machias, 7½′	Heath 0.5 mile west of Larrabee Cove, Machiasport Tp.	*C*	100	15	6	120,000
32	Gardiner Lake	Bog west of Rte. 191 at south end of Rocky Lake Ridge, East Machias Tp.	*C*	60	13	10	120,000
30	Wesley	Bog at Oak Point Meadow, T. 18 ED	*A*	100	8	5	100,000
54	Machias Bay, 7½′	Heath 1.5 mile south of Huntley Creek, Cutler Tp.	*C*	100	9	5	100,000
15	Mattawamkeag Lake	Saucier Bog, Island Falls Tp	*C*	50	15	10	100,000

Deposits containing 50,000 to 100,000 tons of peat						
3----Oxbow	Bog at Smith Pond, T. 8, R. 5 WELS	*E*	70	10	7	98,000
6----Howe Brook	Bog at Smith Brook Pond, Dudley Tp.	*A*	90	7	5	90,000
19----Amity	Bog in northwest corner of Orient Tp.	*C*	90	9	5	90,000
50----Machias, 7½′	Runaway Pond Heath, East Machias and Marshfield Tps.	*C*	90	10	5	90,000
48----Addison, 7½′	Heath on east quadrangle boundary south of Rte. 187.	*C*	40	18	9	72,000
39----West Lubec, 7½′	Heath west of Balch Head and south of South Trescott.	*C*	70	15	5	70,000
47----Columbia Falls, 7½′	Heath south of Pecky Brook, Centerville Tp.	*C*	65	6	5	65,000
49----Whitneyville, 7½′	Heath north of Rte. 1, Whitneyville Tp.	*C*	40	9	7	56,000
51----Machias, 7½′	Heath 0.3 mile north of Great Cove, Rogue Bluffs Tp.	*C*	55	8	5	55,000
Deposits containing 10,000 to 50,000 tons of peat						
37----Pembroke, 7½′	Bog at southeast end of Leighton Neck between Youngs Cove and Long Cove.	*C*	30	9	7	42,000
41----Lubec, 7½′	Bog north of Carrying Place Cove between mainland and west Quoddy Head.	*C*	30	15	7	42,000
36----Pembroke, 7½′	Bog 0.4 mile east of Ayers junction, Pembroke Tp.	*C*	50	5	4	40,000
38----Whiting, 7½′	Bog west of Rte. 1 at junction of Orange River and Reynolds Brook.	*C*	40	9	5	40,000
5----Howe Brook	Bog at Lower Deadwater on Howe Brook, St. Croix Tp.	*E*	38	9	5	38,000
53----Machias Bay, 7½′	Heath northeast of Enoch Hill, Whiting Tp.	*A*	60	9	3	36,000
57----Great Wass Island, 7½′.	Heath east of Norton point, Beals Tp.	*C*	25	11	7	35,000
22----Wabassus Lake	Bog 0.5 mile south of junction of Little River and South Brook, T. 27 ED.	*C*	20	17	7	28,000

[1] Estimated according to 1 acre-foot of peat in place being equivalent to 200 short tons of air-dried peat.

TABLE 1.—*Size, physiographic form, and location of peat deposits of Maine*—Continued

Deposit No. (fig. 1)	Quadrangle (15′ unless otherwise noted)	Location within quadrangle	Physiographic form of deposit (fig. 3)	Surface area of deposit (acres)	Thickness of peat (feet)		Estimated short tons (air-drid)[1]
					Maximum	Average	
Deposits containing 10,000 to 50,000 tons of peat—Continued							
34	Gardiner Lake	Bog along Rocky Brook at southeast end of Patrick Lake, Marion Tp.	*A*	20	12	7	28,000
33	Gardiner Lake	Bog along Maine Central Railroad on east side of Southern Inlet, T. 18 ED.	*C*	35	12	5	25,000
55	Rouge Bluffs, 7½′	Heath west of Rogue Bluffs Road, Rogue Bluffs Tp.	*C*	25	9	5	25,000
12	Sherman	Bog along Gulliver Brook, T. 2, R. 4 W.	*A*	20	7	5	20,000
14	Mattawamkeag Lake	Bog between Sly Brook and Mud Pond, Island Falls Tp.	*A*	30	7	5	20,000
7	Bridgewater	Bog at Gentle Lake, Monticello Tp	*B*	15	12	5	15,000
56	Rouge Bluffs, 7½′	Heath between Black Head and John Mountain, Rogue Bluffs Tp.	*C*	15	9	5	15,000
40	Great Wass Island, 7½′.	Heath between Boot Cove and Baileys Mistake.	*C*	15	12	5	15,000
9	Houlton	Edge of pond 0.4 mile south-southwest of Littleton Station, Littleton Tp.	*B*	10	7	5	10,000
10	Houlton	Edge of pond 1.2 miles southwest of Starkey Corner, Littleton Tp.	*B*	10	7	5	10,000

[1] Estimated according to 1 acre-foot of peat in place being equivalent to 200 short tons of air-dried peat.

TABLE 2.—*Typical section and analytical data (physical properties) for peat deposits of Maine*

Deposit No. (fig. 1)	Typical section, cumulative thickness in feet	Ash (percent dry weight)	Water-holding capacity (percent)	Fiber> 0.15 mm (percent)	pH
	Aroostook County				
1.	Peat, 0–9	12.2	1,890	---	5.4
	Clayey peat, 9–12	---	----	---	--
	Gray clay, 12+	---	----	---	--
2.	Peat, 0–13	5.9	2,930	57.8	6.0
	Clayey peat, 13-17	---	----	---	--
	Gray clay, 17+	---	----	---	--
3.	Peat, 0–10	2.3	2,428	56.0	4.1
	Clayey peat, 10–16	---	----	---	--
	Gray clay and gravel, 16+	---	----	---	--
4.	Sphagnum moss peat, 0–7	2.6	2,162	92.6	4.8
	Peat, 7–12	4.3	1,708	47.4	5.4
	Clayey peat, 13–27	37.3	----	---	--
	Peaty clay, 27–30	---	----	---	--
	Gray clay, 30+	---	----	---	--
5.	Peat, 0–7	8.0	1,479	57.4	4.6
	Clayey peat, 7–10	39.2	----	---	--
	Gray clay, 10–14	---	----	---	--
	Gravel, 14+	---	----	---	--
6.	Peat, 0–7	7.4	1,253	64.7	5.6
	Clayey peat, 7–12	---	----	---	--
	Gray clay, 12+	---	----	---	--
7.	Sphagnum moss peat, 0–5	8.5	1,318	73.6	6.0
	Peat, 5–12	---	----	---	--
	Clayey peat, 12–16	---	----	---	--
	Clay, sand, gravel, 16+	---	----	---	--
8.	Peat, 0–10	8.2	2,987	63.4	4.8
	Clayey peat, 10–15	---	----	---	--
	Gray clay, 15+	---	----	---	--
9.	Peat, 0–7	21.9	1,026	66.9	5.7
	Gravel, 7+	---	----	---	--
10.	Sphagnum moss peat, 0–9	7.3	1,286	67.0	6.1
	Marl, 9–21	---	----	---	--
	Gray clay, 21+	---	----	---	--
11.	Sphagnum moss peat, 0–17	3.8	3,435	70.0	5.0
	Peat, 17–18	---	----	---	--
	Clayey peat, 18–20	---	----	---	--
	Gray clay, 20+	---	----	---	--
12.	Peat, 0–7	5.8	1,956	56.5	5.6
	Clayey peat, 7–9	---	----	---	--
	Gray clay, 9+	---	----	---	--
13.	Sphagnum moss peat, 0–7	5.6	2,638	72.8	5.0
	Peat, 7–12	---	----	---	--
	Clayey peat, 12–15	---	----	---	--
	Gray clay, 15+	---	----	---	--
14.	Peat, 0–7	6.9	1,065	45.2	5.8
	Clayey peat, 7–8	---	----	---	--
	Gray clay, 8+	---	----	---	--
15.	Peat, 0–17	2.5	2,181	55.0	4.6
	Clayey peat, 17–21	---	----	---	--
	Gray clay, 21+	---	----	---	--
16.	Sphagnum moss peat, 0–7	5.3	2,178	69.2	5.0
	Peat, 7–25	---	----	---	--
	Clayey peat, 25–30	---	----	---	--
	Peaty clay, 30–33	---	----	---	--

TABLE 2.—*Typical section and analytical data (physical properties) for peat deposits of Maine*—Continued

Deposit No. (fig. 1)	Typical section, cumulative thickness in feet	Ash (percent dry weight)	Water-holding capacity (percent)	Fiber> 0.15 mm (percent)	pH
	Aroostook County—Continued				
17.	Sphagnum moss peat, 0–9	3.2	1,631	91.7	5.4
	Peat, 9–21	---	----	---	--
	Clayey peat, 21–24	---	----	---	--
	Gray clay, 24+	---	----	---	--
18.	Peat, 0–15	3.4	1,654	48.1	4.1
	Clayey peat, 15–17	---	----	---	--
	Sand, 17+	---	----	---	--
19.	Sphagnum moss peat, 0–5	3.0	3,699	66.8	4.3
	Peat, 5–9	---	----	---	--
	Gray clay, 9+	---	----	---	--
	Washington County				
20.	Sphagnum moss peat, 0–4	---	----	---	--
	Peat, 4–7	16.0	880	36.3	4.7
	Gray clay, 7+	---	----	---	--
21.	Peat, 0–13	4.0	1,540	49.2	5.0
	Sand and gravel, 13+	---	----	---	--
22.	Sphagnum moss peat, 0–11	3.0	4,700	72.4	4.0
	Peat, 11–17	1.0	2,310	53.3	4.1
	Peaty clay, 17–21	---	----	---	--
23.	Sphagnum moss peat, 0–7	0.6	3,460	66.8	3.8
	Peat, 7–11	1.0	1,980	52.3	3.8
	Clayey peat, 11–13	---	----	---	--
	Sand, 13+	---	----	---	--
24.	Peat, 0–6	<10.0	>1,000	>33.4	--
	Sand, 6+	---	----	---	--
25.	Sphagnum moss peat, 0–16	1.0	3,620	67.2	4.0
	Peat, 16–20	---	----	---	--
	Peaty clay, 20–21	---	----	---	--
	Gray clay, 21+	---	----	---	--
26.	Sphagnum moss peat, 0–7	1.0	4,000	75.0	3.7
	Peat, 7–13	3.7	1,120	46.3	4.9
	Gray clay and sand 13+	---	----	---	--
27.	Sphagnum moss peat, 0–11	0.9	3,000	73.5	3.9
	Peat, 11–20	3.0	1,130	---	4.3
	Clayey peat, 20–25	---	----	---	--
	Silty clay, 23+	---	----	---	--
28.	Sphagnum moss peat, 0–17	0.7	4,220	72.6	4.2
	Clayey peat, 17–23	---	----	---	--
	Gray clay, 23+	---	----	---	--
29.	Peat, 0–9	1.0	2,770	56.6	3.8
	Clayey peat, 9–13	---	----	---	--
	Gray silt, 13+	---	----	---	--
30.	Peat, 0–8	<10.0	>1,000	>33.4	--
	Peaty clay, 8–9	---	----	---	--
	Gray clay 9+	---	----	---	--
31.	Peat, 0–9	1.0	2,670	64.2	3.8
	Clayey peat, 9–12	---	----	---	--
	Sand, 12+	---	----	---	--
32.	Sphagnum moss peat, 0–8	4.0	3,920	79.8	4.0
	Peat, 8–10	3.0	640	34.2	4.0
	Silt, 10+	---	----	---	--

TABLE 2.—*Typical section and analytical data (physical properties) for peat deposits of Maine*—Continued

Deposit No. (fig. 1)	Typical section, cumulative thickness in feet	Ash (percent dry weight)	Water-holding capacity (percent)	Fiber> 0.15 mm (percent)	pH
	Washington County—Continued				
33.	Sphagnum moss peat, 0–10	2.0	3,300	66.2	3.9
	Peat, 10–12	---	----	---	--
	Peaty clay, 12–17	---	----	---	--
	Gray clay, 17+	---	----	---	--
34.	Peat, 0–12	5.5	1,790	51.4	4.5
	Peaty clay, 12–16	---	----	---	--
	Gray clay, 16+	---	----	---	--
35.	Sphagnum moss peat, 0–12	1.0	3,780	66.5	3.7
	Peat, 12–16	---	----	---	--
	Clayey peat, 16–18	---	----	---	--
	Gray clay, 18+	---	----	---	--
36.	Peat, 0–5	7.0	840	44.5	4.5
	Gray clay, 5+	---	----	---	--
37.	Sphagnum moss peat, 0–9	2.0	3,290	83.9	4.0
	Peaty clay, 9–10	---	----	---	--
	Gray clay, 10+	---	----	---	--
38.	Sphagnum moss peat, 0–4	---	----	---	--
	Peat, 4–9 ft	1.0	2,680	62.4	4.6
	Clayey peat	63.0	300	11.9	5.3
39.	Sphagnum moss peat, 0–7	2.0	4,500	70.9	4.1
	Peat. 7–15	6.0	2,270	48.2	4.9
	Gray clay, 15+	---	----	---	--
40.	Sphagnum moss peat, 0–11	3.5	2,620	74.0	4.8
	Peat, 11–12	---	----	---	--
	Gray silty clay, 12+	---	----	---	--
41.	Peat, 0–15	0.6	3,000	42.0	4.3
	Peaty clay, 17–19+	---	----	---	--
42.	Sphagnum moss peat, 0–13	1.0	3,360	71.6	--
	Peat, 13–23	2.0	2,820	---	--
	Clayey sand, 23+	---	----	---	--
43.	Sphagnum moss peat, 0–8	0.5	4,120	99.2	4.2
	Peat, 8–15	1.5	1,855	54.9	4.1
	Peat, slightly clay, 15–18	4.0	1,010	36.7	4.4
	Peaty clay, 18–19	74.0	----	---	4.6
	Silt, 19+	---	----	---	--
44.	Sphagnum moss peat, 0–11	1.0	4,830	76.3	3.7
	Peat, 11–15	1.0	3,010	49.3	5.0
	Peaty clay, 15–16	---	----	---	--
	Gray clay, 16+	---	----	---	--
45.	Sphagnum moss peat, 0–8	2.0	3,650	72.7	3.8
	Peaty clay, 8–9	---	----	---	--
	Tan clay, 9+	---	----	---	--
46.	Sphagnum moss peat, 0–7	2.0	3,750	68.8	4.6
	Peat humus, 7–10	10.0	800	30.8	5.3
	Silty clay	---	----	---	--
47.	Peat, 0–6	6.0	930	42.6	4.6
	Gray clay, 6+	---	----	---	--
48.	Sphagnum moss peat, 0–18	3.0	3,110	68.8	4.8
	Gray clay, 18+	---	----	---	--
49.	Peat, 0–9	1.0	1,660	52.6	3.9
	Gray clay, 9+	---	----	---	--
50.	Peat, 0–7	2.8	1,670	54.1	4.5
	Clayey peat, 7–8	---	----	---	--
	Peaty clay and gray clay 8+	---	----	---	--

TABLE 2.—*Typical section and analytical data (physical properties) for peat deposits of Maine*—Continued

Deposit No. (fig. 1)	Typical section cumulative thickness in feet	Ash (percent dry weight)	Water-holding capacity (percent)	Fiber> 0.15 mm) (percent)	pH
	Washington County—Continued				
51.	Sphagnum moss peat, 0–8	2.0	3,130	68.1	4.2
	Peaty clay, 8–8	---	----	---	--
	Gray clay 9+	---	----	---	--
52.	Sphagnum moss peat, 0–8	1.0	2,570	75.8	4.0
	Peat, 8–15	3.0	1,420	47.4	4.4
	Gray clay, 15+	---	----	---	--
	Humus, 0–3	---	----	---	--
53.	Sphagnum moss peat, 3–7	3.0	4,920	70.1	9.8
	Peat humus, 7–9	19.0	650	20.6	5.5
	Silt, 9+	---	----	---	--
54.	Sphagnum moss peat, 0–7	3.0	4,920	70.1	9.8
	Peat humus, 7–9	19.0	650	20.6	5.5
	Silt, 9+	---	----	---	--
55.	Sphagnum moss peat, 0–9	1.0	3,760	71.7	4.2
	Peaty clay, 9–16	---	----	---	--
	Fine sand, 10+	---	----	---	--
56.	Peat, 0–9	2.0	1,820	55.9	3.6
	Peaty clay, 9–10	28.0	480	33.0	4.0
	Sand, 10+	---	----	---	--
57.	Peat, 0–5	2.0	3,510	60.3	4.1
	Peat, 5–11	3.0	1,900	47.8	4.1
	Clayey peat, 11–14	36.0	920	21.7	4.1
	Gray clay and sand, 14+	---	----	---	--

TABLE 3.—*Size, physiographic form, location, and drainage of nonanalyzed Maine peat deposits of commercial quality*

[Deposits 1–20 are in Washington County; deposit 21 is in Aroostook County]

Deposit No. (fig. 1)	Quadrangle (15')	Location within quadrangle	Surface area of deposit (acres)	Thickness of peat (feet)		Estimated short tons (air-dried)[1]	Drainage	Physiographic form (fig. 3)
				Maximum	Average			
5	Wabassus Lake	Bog south of Dead Stream east of Fourth Machias Lake.	900	20	8	1,536,000	Controlled by lake dam.	*E*
21	Wytopitlock	Bog along deadwater on Macwahoc Stream, T. 1, R. 4.	755	15	10	1,455,000	Good on domes	*E*
4	Wabassus Lake	Bog north of Dead Stream east of Fourth Machias Lake.	280	20	8	448,000	Controlled by lake dam.	*E*
7	do	Bog at southeast end of Second Machias Lake, T. 37 MD.	200	15	7	80,000	Good on domed heath.	*A*
14	Big Lake	Bog along lower reaches of Dog Brook and west side of Brown Cove, Princeton Tp.	160	15	7	224,000	Fair on partly drowned dome.	*A* and *E*
16	do	Bog along Clifford Stream north of East Arm of Clifford Lake.	260	15	4	208,000	Controlled by stream dam.	*A*
13	do	Sawtelle Heath, north of Rte. 1.	100	15	10	200,000	Fair to good near center.	*C*
19	Tug Mountain	Bog on west side of Old Stream north of Canaan dam, T. 31 MD.	100	15	10	200,000	Good on domed heath.	*C*
1	Wabassus Lake	Bog north of Dark Cove Mountain, T. 5 ND.	90	22	10	180,000	Good on domed heath.	*C*
18	Tug Mountain	Bog along Pembroke Stream deadwater north of Rte. 9, T. 31 MD.	140	10	6	168,000	Fair on low dome.	*A*

[1] Estimated according to 1 acre-foot of peat in place being equivalent to 200 tons of air-dried peat.

TABLE 3.—*Size, physiographic form, location, and drainage of nonanalyzed Maine peat deposits of commercial quality*—Continued

Deposit No. (fig. 1)	Quadrangle (15′)	Location within quadrangle	Surface area of deposit (acres)	Thickness of peat (feet)		Estimated short tons (air-dried)[1]	Drainage	Physiographic form (fig. 3)
				Maximum	Average			
9	Big Lake	Bog between Musquash Stream and Cass Cove, Grand Lake Plantation Tp.	120	6	5	120,000	Good on domed heath.	*E*
12	do	Bog between Greenland Cove and Jimmy Libby Cove, Princeton Tp.	100	6	5	100,000	Good on domed heath.	*E*
6	Wabassus Lake	Bog south of Second Machias Lake along Machias River, T. 37 MD.	45	22	10	90,000	Good on dome at south end.	*A*
17	Big Lake	Bog along Beaverdam Stream near quadrangle boundary, T. 26 ED.	60	15	7	84,000	Good on domed heath.	*A*
8	do	Bog between mouth of Grand Lake Stream and Little River Bluff, T. 27 ED.	40	10	8	64,000	Fair on domed heath.	*E*
10	do	Bog on west side of Lewy Lake, Indian Tp.	40	10	8	64,000	Largely drowned heath.	*C*
15	do	Bog south of Morrison Point on Pocomoonshine Lake.	40	10	8	64,000	Fair on partly drowned dome.	*E*
2	Wabassus Lake	Bog north of Fourth Machias Lake, T. 5 ND.	30	22	10	60,000	Good on domed heath.	*E*
11	Big Lake	Bog west of Long Lake campground, Indian Tp.	50	6	5	50,000	Dome is too low to permit good drainage.	*C*
3	Wabassus Lake	Bog adjacent to Fourth Lake Stream 0.5 mile east of outlet, T. 5 ND.	30	7	5	30,000	Controlled by lake dam.	*A*
20	Wesley	Bog on southwest side of First Chain Lake, northwest corner of Wesley Tp.	5	13	10	3,000	Dome partly drowned by high lake level.	*C*

[1] Estimated according to 1 acre-foot of peat in place being equivalent to 200 tons of air-dried peat.

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