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Contents

Tables

Figures

SUMMARY

In Maine, non-tidal peatlands comprise the last major terrestrial ecosystem group remaining largely undisturbed by humans, and for which there still exists a full range of options for protection in near-pristine condition. To make the best choices of areas to protect, ecologically based prioritization of candidate natural areas is needed. This technical bulletin presents a quantitative method of evaluation of the natural features of peatlands—providing the fundamental tool for establishing peatland protection priorities. We apply the method to the evaluation of 76 Maine peatlands representing all the morphologic/hydrologic peatland types in the biophysical regions of the state.

Primary Criteria, Characteristics, and Primary Criterion/ Characteristic Pairs Evaluated

The primary criteria we use for evaluation, and their percentage emphases are (1) rarity (39%), (2) exemplariness (24%), and (3) diversity (28%). We apply these criteria to four peatland characteristics (with percentage emphases): peatland morphologic/hydrologic types (44%), other geologic/geomorphic features (5%), vegetation types (14%), and flora (28%). Each set of percentages totals 91. A matrix (c/c matrix) of these three criteria (axis 1) and four characteristics (axis 2) contains percentage emphases for each criterion/characteristic pair (e.g., rarity of other geologic/geomorphic features: 1%; diversity of vegetation types: 6%), except that exemplariness/flora is not evaluated (therefore, total of 11 pairs in c/c matrix). Two additional characteristics, peatland area (5%) and pristine (or disturbed) condition (4%), are evaluated without application of the primary criteria, for a total of 100% Rationale underlying these evaluation components is presented. The percentage emphases may be modified, as appropriate, for application in other geopolitical regions. In Maine, data on the six peatland characteristics are readily obtainable. Data on vertebrate, invertebrate, and microbial populations are not as easy to obtain, and therefore do not figure into the evaluations at this time.

Need for Reference Database

This and other formal methods of "conservation evaluation" require a resource inventory or representative sample as a frame of reference for determining what constitutes a high or low value or condition for each criterion/characteristic pair (e.g., rarity of vegeta-

tion type, exemplariness of peatland type, diversity of flora). Most of the work in developing this method has been to amass a large (102 peatlands) reference database on the six peatland characteristics, and much of this bulletin consists of a presentation of the database.

Rarity Values, Numeric Standards, and Levels

Using the database, we developed numeric rarity values for peatland types, other geologic/geomorphic features, and vegetation types, and did the same for flora using official rare plant listings. More than one rare peatland or vegetation type, other geologic/geomorphic feature, or species may occur at the same peatland, thus for each peatland we totaled the rarity values for them. By examining statewide frequencies of these totals, we developed numeric (percentage) standards on five levels (highest to lowest) for rarity of each of the characteristics. The highest level percentage for each rarity/characteristic pair equals its emphasis in the aforementioned c/c matrix; highest level percentages for rarity of the four characteristics total 39%.

For diversity, we used the database to plot frequency distributions of the numbers of different peatland types, vegetation types, other geologic/geomorphic features, and plant species (flora) per peatland to determine standards of diversity on five levels for each of these characteristics. As for rarity, highest level percentages equal the percentage emphases in the c/c matrix; for diversity these total 28%. We also used the database to develop numeric (percentage) standards on five levels for peatland area. The five levels of pristine character were defined qualitatively, and percentages assigned to each.The five levels of exemplariness for peatland types, other geologic/geomorphic features, and vegetation types (flora not scored for exemplariness) were also defined qualitatively, and percentages assigned to them. Rating the exemplariness of these characteristics of a particular peatland into one of five exemplariness levels is based on experience of the evaluator in study of peatlands in Maine and elsewhere.

Geographic Scales

We score some criterion/characteristic pairs (e.g., rarity of flora, exemplariness of peatland type) on multiple geographic scales: international, national, state, and in-state biophysical region. A particular peatland type (e.g., eccentric bog) or a certain peatland feature (e.g., a flark/string series, *Betula pumila* or some other species) that is rare and/or exemplary statewide, or in one biophysi-

cal region of the state, may or may not be rare or exemplary elsewhere. A peatland with rare and exemplary features on an international and/or national level is likely to receive a higher total score (evaluation grade) than one of only local significance.

Scoring a Peatland

The following steps are followed in evaluating a peatland. First, the necessary data are gathered. This involves study of existent maps and air photos (and an optional overflight for additional photography), and requires one to three days of field data collection, depending on the size (area) of the peatland. These data cover (1) peatland type (large peatlands typically consist of multiple units of more than one type, e.g., unpatterned fen in open basin, domed concentric bog), (2) other geological features, and how many of each, e.g., stream, esker, beach ridge, (3) vegetation types, e.g., shrub heath, mixed wooded fen, streamside meadow, (4) plant species, (5) total peatland area, and (6) evidence of disturbance, e.g., transmission lines and roads, altered hydrology, logging. Next, results are entered on a scoring form, levels assigned and percentage scores entered for each criterion/characteristic pair and for area and pristine condition, based on the aforementioned standards. These scores are totaled to obtain a peatland evaluation grade (maximum possible grade 100%).

Evaluation Grades and Priority Recommendation Classes for 76 Peatlands

The evaluation grades of the 76 peatlands range from 5.4% to 85.0%. The frequency distribution is unimodal, with a mean and standard deviation of 28.3 ± 15.8% and a median of 25.8%. We lump numeric grades into protection recommendation (PR) classes: (A) >45% (highly recommended; 9 peatlands), (B) 31–45% (recommended; 18 peatlands), (C) 16–30% (not now recommended; 34 peatlands), and (D) <16% (unlikely to be recommended; 15 peatlands). In some cases, a peatland may be raised or lowered in PR class based on special considerations. Ranking peatlands by grade within separate geomorphic/hydrologic types, and by score within separate criterion/characteristic couples (e.g., rarity of flora) provide additional perspectives for decision-making regarding protection priority.

INTRODUCTION

This presentation rests on the premise that there is substantial social and scientific value in maintaining areas of landscape in a natural state. Natural areas are important not only as reservoirs of biological diversity, but also for the information they provide for understanding human impacts on the world and the conditions under which species have evolved. Given the continuing expansion of the human population and its ongoing destruction of the natural world, the protection of natural areas becomes increasingly urgent. In this context, it is important that the most exemplary, diverse, and undisturbed of the remaining areas be chosen for protection.

Need and Opportunity for Peatland Conservation

Although this presentation applies only to Maine's organic wetlands (peatlands), the need for conservation of wetlands is worldwide, as has been officially recognized by the numerous nations that are parties to the Ramsar Convention of 1971 (Ramsar Convention 1999a). More recently, it has been pointed out that peatlands have been greatly underrepresented in wetland conservation programs (Lindsay 1996), and parties to the Convention acted favorably in 1996 on a recommendation to increase emphasis on the conservation of peatlands (Ramsar Convention 1999b). This act was followed six months later, at Kushiro, Japan, by a resolution of the International Mire Conservation Group recommending to the Ramsar Convention that further emphasis be placed on peatland conservation (Ramsar Convention 1999c).

Maine's peatlands, constituting a major class of Maine's wetlands, provide a unique opportunity for accomplishing peatland conservation. Within Maine's limited geographic area, steep climatic (Boone 1997) and topographic (Krohn et al. 1999) gradients support a wide range of temperate and boreal peatland types (Davis and Anderson in press), and, unlike all other major ecosystem groups in the state, the vast majority of Maine's peatlands still remains virtually unmodified by human activity. This favorable situation contrasts greatly with most of Europe where a large proportion of the peatland resource has been destroyed, and most remaining peatlands are in highly modified condition (Kivinen and Pakarinen 1980). Although in much of Europe conservation efforts must concentrate largely on damaged peatland vestiges, until recently the recognition of the value of peatland conservation has been more widespread and stronger there (e.g., Nature Conservancy Council 1989; Scottish Wildlife Trust 1995; Brooks and Stoneman 1997) than in North America.

Conservation Evaluation of Peatlands Outside Maine

Methods of evaluation of peatlands for identification of outstanding and undisturbed sites for protection have their origins in northern Europe (e.g., Ruuhijärvi 1978; Moen 1979a,b; Goodwillie 1980). In the conterminous United States, Minnesota has a peatland resource most similar to Maine's in its transitional character from temperate to boreal. The Minnesota Department of Natural Resources (MDNR) evaluated the ecological significance of the state's peatlands to prioritize them for protection (Minnesota Department of Natural Resources 1984a-c). Aaseng and Djupstrom (1992) summarized the then current approaches of MDNR for peatland evaluation in Minnesota. These and other approaches to "conservation evaluation" (Joint Nature Conservation Committee 1994; Lindsay 1995; Nature Conservancy Council 1989; Spellerberg 1981; Usher 1986) of peatlands and other wetland ecosystems cover many of the same aspects, most consistently "representivity" of ecosystems and their features within and across biogeographic regions, quality or exemplariness, rarity, and diversity, but emphases on these and other criteria differ by biogeographic region and by state, provincial, and national circumstances (de Groot 1992). Ramsar Convention criteria for identifying wetlands of international importance emphasize the wetland's exemplariness in one or more biogeographic regions, its natural (undisturbed) condition, its importance to hydrological, biological, or ecological functions (especially in providing migratory bird habitat) of the area, and its rare or unusual character (Ramsar Convention 1999d).

Precursor Peatland Evaluation in Maine

The evaluation method in this technical bulletin is an outgrowth of the approach of Davis et al. (1983) for the "Evaluation of Maine Peatlands for their Unique and Exemplary Qualities." That approach covered both natural (80% emphasis) and cultural (20% emphasis) factors. Natural criteria included, in order of emphasis, rarity (40%), exemplariness (12%), diversity (12%), hydrological and other environmental values (10%), size (area) (4%), and pristine character (2%). Rarity and exemplariness were applied to "developmental-morphological peatland types" (DMP types), "other geological features," and vegetation types or biotic communities (VT/BC). Rarity also was applied to flora. Diversity was applied to DMP types, VT/BC, and wildlife habitats. Cultural values included historical/archeological features, research and educational values, recreational uses, and aesthetic aspects. Based on the limited peatland evaluation database at the time, Widoff (1988) applied the Davis et

al. (1983) approach, together with "protection strategies" from European authors, for a preliminary selection of 32 Maine peatlands worthy of protection.

Our Present Approach and Some of its Problematic Aspects

A summary of the method in this bulletin has been published by Davis (1997). Unlike that summary, this publication lays out the method in detail, describes the extensive database used to develop it, and appends brief descriptions and vegetation cover maps of those peatlands in the database that lack such information in prior publications.

Our method is quantitative and involves the totaling of scores covering various important aspects of a peatland to obtain a final evaluation grade. De Groot (1992:3) summarized criticisms of this approach, pointing out that "one cannot simply add figures which represent values of a completely different nature." We argue that proper weighting of each value toward computation of a final grade adds validity to the grade, and that a peatland with high scores for several values (viz., rarity, exemplariness, and diversity, each applied to several peatland features), and therefore a higher final evaluation grade is more worthy of consideration for protection than a peatland excelling only in one value, such as rarity. However, as de Groot (1992) points out, one site with an equally high grade as another may have that grade for very different reasons. We agree, and believe that it is essential that multifaceted methods, such as ours, display the rating for each separate facet so that site comparisons can be made on the basis of single or any combination of facets.

A second problematic aspect of multifaceted quantitative evaluation methods arises when attempts are made to compare results of the same method to different ecosystem types (de Groot 1992). To the extent that the ecosystems differ, comparison of the evaluation grades becomes less valid. Just how similar the ecosystems must be to retain validity of comparison of grades is a matter of ecological judgement. With what we believe to be appropriate qualification, we apply our method to a set of peatlands that includes diverse peatland types. But we further focus comparisons by applying the method to separate subsets of peatlands, each subset containing only one type. This approach was used by Davis and Anderson (1991) for Maine's eccentric bogs by applying an earlier version of the method.[1]

[1]This bulletin reevaluates the eccentric bogs of Davis and Anderson (1991) using a larger comparative database and resultant grades that differ from the 1991 publication. In addition, two of the eccentric bogs are now evaluated as parts of larger, multiple-unit peatlands.

Given the complicated nature of ecosystems and landscapes, it is probably impossible to develop a perfect method of quantitative (or even qualitative) evaluation that retains some level of practical application. We believe that it is wise to retain flexibility so that after evaluations are completed as objectively as possible, some sites may be shifted in rank or level of protection priority based on specialized considerations inadequately dealt with by the method.

Our method (unlike Davis et al. [1983]) is based on natural features only, with the exception of peatland pristine character (or departures from it), and conforms to the concept of "conservation evaluation" of de Groot (1992:3):

> evaluation of ecosystem qualities per se, regardless of their socio-economic interests. Usually, the purpose of these evaluations is to determine the 'conservation value' of certain species or ecosystems in order to be able to set priorities for their protection.

Other, Broader Approaches to Wetland Evaluation

Wetland evaluation methods covering a wider range of considerations including environmental, economic, and social/cultural factors, and relating to decision-making regarding various wetland uses (removal, modification, reconstruction/restoration, preservation) were reviewed by World Wildlife Fund (1992), including a method for nearby New Hampshire (Ammann and Stone 1991). A wide range of criteria for identification of peatlands of "global conservation significance" was given by Joosten (1996) and for the small country of Switzerland by Hintermann (1994). Bond et al. (1992) presented a broad-based method for evaluating Canadian wetlands. Evaluation of wetlands for the functional services they provide to humans (flood control, carbon storage, sediment control, uptake of pollutants, game habitat), while based largely on natural wetland functions, is not the type of evaluation described in this technical bulletin.

We defer cultural considerations including demographic, educational, economic, and political aspects of selection of a peatland for protection as a natural area to a separate phase of evaluation. Natural aspects of ecosystems are fundamental to all decisions to protect natural areas. Once a peatland has become a strong candidate for protection as a natural area or ecological reserve, cultural factors must be added to the evaluation matrix.

Practical Considerations

Although our method is intended for use by government and private conservation agencies for screening peatlands for designa-

tion as ecological reserves, it may also be used to avoid damage to outstanding peatlands when permit applications for peat extraction or other destructive activities are considered. Furthermore, the method may be modified for application to ecosystem types other than peatlands.

To evaluate a peatland, information is derived from aerial photographs, an optional overflight in small aircraft, and a field visit. Routine data collection and compilation can be assigned to trained technical staff, but professional judgement and geographical breadth of knowledge is needed for final evaluation. Using this method, two persons can gather the information on a peatland and complete an evaluation of it in a week or less (one to two weeks for a very large multiple-unit peatland).

Recently, Gawler (1998) has developed qualitative peatland evaluation methods that differ by peatland type, and which incorporate several of the elements of our method. Near the end of this bulletin, we will compare our results to hers for the same sets of Maine peatlands.

PRIMARY CRITERIA FOR EVALUATION

A peatland is valuable as, or as part of, a natural area or ecological reserve when (1) it contains rare biological and/or physical features and/or the entire peatland is of a rare type, (2) its features and/or the entire peatland are outstanding examples of their type, and (3) it contains a high diversity of biota and/or physical features, and/or, for "multiple-unit peatlands" (Davis and Anderson in press), a diversity of peatland types. These attributes, viz. **rarity**, **exemplariness**, and **diversity**, constitute our three primary criteria of evaluation. For a discussion of the values of these and other attributes of natural systems, see Rolston (1994). Of the three criteria, the evaluation of exemplariness is most difficult, and requires the most expertise.

The terms rare, exemplary, and diverse are relative. The contexts in which they are used require description—preferably of a quantitative nature. Data on the abundance, geographic distribution, and manifold characteristics of peatlands, peatland types and features are necessary for determining whether the type or a feature of a peatland is truly rare or exemplary, or whether the diversity of features of the peatland is high or low. Put more broadly, "effective targeting of resources can only be achieved if there is a clear nature conservation inventory of the resource" (Scottish Wildlife Trust 1995:9). For these reasons, we present extensive support-

ing data in this publication on a representative set of 102 Maine peatlands (Figure 1). A full inventory of relevant aspects of Maine's extensive peatland resource is beyond practical reach at this time.

Appraisal of a Maine peatland, or of one or more of its components, depends on geographic considerations. For example, a Maine peatland may be a fine example of its geomorphic-hydrologic type in Maine, but the type may be represented by many more-outstanding examples in another state, Canada, and/or Eurasia, thus detracting to some degree from the value of the Maine peatland. Parallel distinctions apply on a smaller scale, as between one biophysical region of Maine versus the entire state. We use four geographic scales in the scoring: international (G1), national (G2)[2], Maine (G3), in-Maine biophysical region (McMahon 1990) (G4).

SIX PEATLAND CHARACTERISTICS TO BE EVALUATED

We evaluate the following peatland characteristics in terms of rarity, exemplariness, and diversity: (1) geomorphic-hydrologic type of peatland (Table 1) (Davis and Anderson in press), (2) geologic/geomorphic features other than peatland type (Table 2), and (3) vegetation types (Table 3) (Anderson and Davis 1997). A fourth characteristic, flora (vascular plants, bryophytes, and lichens: Anderson and Davis [1998][3]) is evaluated in terms of rarity and diversity only. Two additional characteristics, (5) peatland size (area) and (6) pristine character are scored apart from the three primary criteria. The degree of emphasis (percentage) we place on each of the six characteristics (Table 4) is based on our judgement regarding its ecological importance and independence from other characteristics. Some other ecologists, conservationists, or natural area planners and administrators may prefer different emphases.

It is clear that the criteria and characteristics are not completely independent of each other. Diversity, for example, is likely to be roughly correlated with the size (area) of a peatland. Nevertheless, size is included as a separate small part (5%) of the evaluation because large habitat size is crucial to the long-term survival of many biological populations. Size is also related to rarity. Large size increases the probability that rare but so far undetected species are present. Undetected species are most likely for peatland invertebrates, algae, fungi and microbes, about which there is less

[2]Alaska is included in G1.

[3] Corticolous and year-round submergent aquatic species are not considered

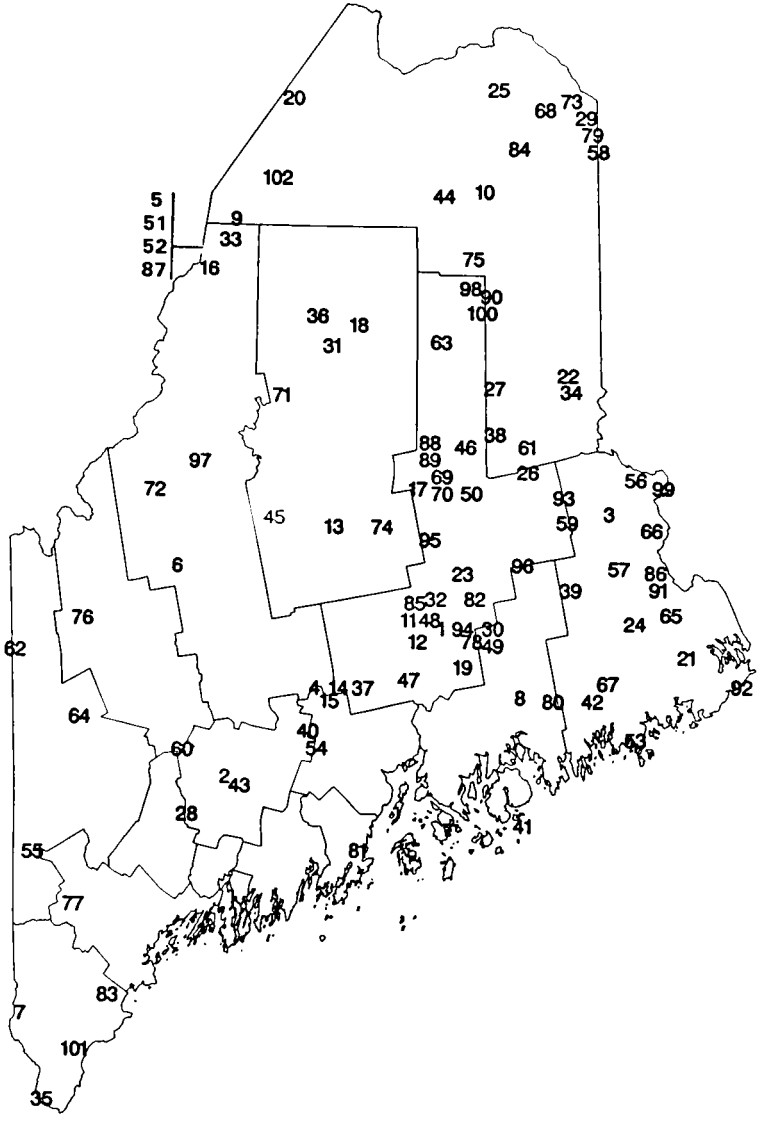

Figure 1. Map of Maine showing the locations of the 102 sites from the University of Maine peatland database used for this publication. All sites were subjected to air photo, low altitude overflight, and on-ground studies (Davis and Anderson in press). Information on the sites is summarized in Table 7 and several appendices. Appendix G lists the 76 of these sites that were evaluated.

Table 1. Maine peatland types (complexes), number of observed sites and estimate of the total number of sites for each type in the state, and Biophysical Regions (McMahon 1990) where the type has been observed. See Figure 2 for a map and the names of these regions. From Davis and Anderson (in press).

Type No.	Name	Abundance[2] Observed (est.)	Biophysical Region
A. Geogenous[1] peatland (fen) complexes			
1	Unpatterned fen in stream valley	>200 (≥1000)	all
2	Unpatterned fen in open basin	>200 (≥1000)	all
3	Unpatterned fen in closed basin	>100 (≥500)[3]	all
4	Ribbed or string (patterned) fen	50 (~60)	1-8[4]
B. Ombrogenous peatland (bog) complexes			
5	Gently convex bog (without concentric or eccentric pattern)		
	a. without pools	154 (~200)	all but 13&14[5]
	b. with pools	24 (~50)	all but 13&14[5]
6	Eccentric bog	23 (≤35)	3,4,6–8[6]
7	Domed bog with concentric pattern		
	a. without pools	34 (~50)	3–8,10,11,15[7]
	b. with pools	28 (~30)	3–8,10,11,15[7]
8	Plateau (coastal) bog	~100	15

[1]Many multiple-unit peatlands have more than one complex of the same type. Such multiple occurrences are considered as a single occurrence for the purpose of this table.

[2]Includes transitional type of Davis et al. (1983).

[3]Estimates are based on sites of at least 1 ha each.

[4]Only the northern parts of Biophysical Regions 5, 7, and 8.

[5]Rare in Biophysical Regions 9 and 12, only northern part of region 5.

[6]A southwestern outlier eccentric bog has recently (1999) been confirmed at Caribou Bog multiple-unit peatland at the northeastern part of Biophysical Region 10.

[7]Most numerous in Biophysical Region 8; only southern half of Regions 3 and 4, northern half of Region 7, and northeastern corner of Region 10; rare in Regions 5 and 6; one known occurrence in Region 15 on border of Region 11.

ecological knowledge than for vertebrates and "higher" plants. Large size is also of major practical importance for protection of natural areas, and it thereby increases the potential value of a peatland as a natural area. Pristine character is included (4%) because undisturbed, natural ecosystems are becoming increasingly rare and are important benchmarks for ecological research.

Peatland type is heavily weighted (44%) because it is a fundamental concomitant of hydrologic and chemical characteristics that

Table 2. Geologic/geomorphic features other than peatland type, the numbers of Maine peatlands (out of a total of 76 evaluated peatlands) in which they occur, and their rarity values (r).

	Occurrence (n)	Rarity Value
1. River or mapped stream	66	0.25
2. Lake (primary water body)	25	0.25
3. Mountain at peatland edge	7	0.50
4. Deep trough occupied by peatland	1	1.00
5. Esker	20	0.50[1]
6. Drumlin	1	1.00[2]
7. Kettle	8	0.50
8. Moraine ridge	5	0.75
9. Ancient or modern beach deposit	3	1.00
10. Mineral (upland) island[3]	>51	0.25
11. Water track (Worley 1981) on peatland	17	0.50
12. Soak (Worley 1981) on peatland	5	0.75
13. Carbonate rock substrate	4	1.00[2]

[1]On international (G1) and national (G2) scales, eskers have r = 1.00. Eskers are relatively common in Maine, but much less so in most glaciated areas outside of Maine.

[2]Drumlins and carbonate substrates occur only in a few restricted areas of Maine, but are more common in many glaciated regions with abundant peatlands outside of Maine (r = 0.50 for G1 and G2).

[3]These are numerous at some peatlands. A maximum of six is scored for a single peatland (0.25 x 6).

control the plant life of the peatland (Davis and Anderson in press). Plant species (flora) and vegetation are heavily weighted (42% together) because they are fundamental ecological components (Anderson and Davis 1997, 1998) and provide the habitat for vertebrates (Stockwell 1985, 1994; Stockwell and Hunter 1989) and other animal as well as microbial populations of the peatland. Direct consideration of animals and microbes is omitted because useful information on them is rarely available and difficult to obtain. However, animals should be inventoried prior to approval of applications for peat extraction or other destructive uses and, preferably, prior to protection.

Geologic/geomorphic characteristics other than peatland morphology (type) include some features on the peatland, for example, water tracks and soaks, as well as aquatic and "upland" (mineral soil) features surrounded by, or contiguous with, the

Table 3. Vegetation types and their rarity (r) values in Maine. Some of these categories are coarser than, or are combinations of, the specific vegetation types in Anderson and Davis (1997).

	Occurrence (n)	Rarity Value
1. Forested bog	28	0.25
2. Wooded shrub heath	43	0.00
3. Shrub heath (bog)	44	0.00
4. Lichen lawn	1	1.00
5. *Trichophorum*-shrub heath (bog)	6	1.00
6. *Trichophorum* fen	3	1.00
7. *Chamaedaphne*/moss lawn	45	0.00
8. Moss lawn	39	0.25
9. Sedge (*Carex*)/moss lawn	26	0.50
10. Mud bottom community	39	0.25
11. Gymnosperm wooded fen	66	0.00
12. Mixed wooded fen	52	0.00
13. Angiosperm wooded fen	12	0.25[1]
14. Open wooded fen	46	0.00
15. Wooded tall shrub thicket	51	0.00
16. Tall shrub thicket	54	0.00
17. Low shrub thicket	66	0.00
18. Shrub-sedge (*Carex*) fen	43	0.00
19. Streamside meadow	45	0.00
20. Secondary pool community	40	0.25

[1]Only 12 cases were recorded due to undersampling of the commonly occurring angiosperm wooded fen communities in central and southern Maine. Despite the number of occurrences, this type merits an r value of only 0.25.

Table 4. Percentage emphases on six characteristics and three primary criteria.

	Primary Criteria			
	Rarity	Exemplariness	Diversity	Totals
1. Peatland types[1]	18	18	8	44
2. Other geologic/geomorphic features[2]	1	2	2	5
3. Vegetation types[3]	4	4	6	14
4. Plant species (flora)	16		12	28
5. Peatland size (area)				5
6. Pristine character				4
TOTALS	39	24	28	100

[1] Table 1.
[2] Table 2.
[3] Table 3.

peatland, for example, lakes and streams, mineral soil islands, eskers and moraines (Table 2). They are considered (5%) because they add to the landscape and habitat diversity of a peatland, thereby increasing the diversity of biological components, some of which could not be included in field surveys.[4] They may also be of interest in their own right, for example, undisturbed eskers are becoming increasingly rare due primarily to gravel extraction, and are worthy of protection. Upland features (items 3, 5, 6, 8–10 in Table 2) should be protected within the peatland natural area because disturbance or removal of them can drastically alter peatland hydrology and chemistry and threaten the peatland ecosystem. We also consider the type of mineral substrate, namely, carbonate-rich rock (Table 2; viz. limestone, marble, dolomite)—which is uncommon in Maine. This geologic factor can profoundly affect peatland water chemistry, flora and vegetation.

Although some upland features are considered in our method, we do not include the more general "landscape context" (Gawler 1998) of the peatland. The range of features and conditions, both natural and anthropogenic (e.g., logging and roads) on the broader landscape (much of which is not directly contiguous with the peatland itself) is very important at a later stage of evaluation of a peatland, both when the focus of protection is on the peatland itself and when it is being considered as part of a larger landscape. Furthermore, as a part of a larger catchment (watershed), a peatland is affected by activities and conditions in that catchment. In no way is our focus on the peatland itself intended to minimize the significance of "landscape context" in final decisions regarding peatland protection.

Although hydrology is of fundamental importance in wetlands including peatlands (Brinson 1993; Mitsch and Gosselink 1993), hydrological data are usually lacking and difficult to obtain. Therefore, we omit direct consideration of hydrology from this evaluation method. However, major hydrological patterns are implicit in peatland typology (Davis and Anderson in press)—which receives major emphasis in this method. Direct data on hydrology are needed for assessment of environmental impacts of consumptive uses of peatlands and can be very useful for managing and protecting peatland natural areas.

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[4]Biota on upland islands in a peatland, on upland features directly at the edge of a peatland (e.g., an esker), or in primary water bodies within or bordering a peatland were not surveyed.

SCORING SYSTEM

Geographic Scale

Four geographic scales are used in the scoring: international (G1), national (G2)[5], Maine (G3), in-Maine biophysical region (McMahon 1990) (G4). Scoring of rarity and exemplariness is done on separate geographic scales for each of the first four characteristics (Table 4). Abundances and types of peatlands differ greatly from one biophysical region of Maine to another (Table 1; Figures 2 and 3). For example, in the Western Mountain Region peatlands are sparsely distributed and individually small in size, and the few raised bogs that are present are of only one type and are limited to the northern third of the region. On the other hand, in the Eastern Lowlands Region, peatlands, including raised bogs of more than one type, are abundant and many of them are large (Figures 2 and 3).

To make distinctions at national and international geographic scales, geographically wide field experience and/or reference to the peatland literature is necessary. Literature on geographic distributions of peatland types and features in the temperate and boreal regions of the northern hemisphere is referenced and reviewed in many publications, including Botch and Masing (1983), Davis and Anderson (in press), Glaser and Janssens (1986), Gore (1983), Kivinen and Pakarinen (1981), Moore (1984), Moore and Bellamy (1974), National Wetlands Working Group (1988), Parkyn et al. (1997), Zhulidov et al. (1997), and Zoltai and Vitt (1995).

Levels of Rarity, Exemplariness, and Diversity, and Standards and Scoring of Levels

We define five levels (highest, lowest, and three intermediate levels) of rarity (R1-5), exemplariness (E1-5), and diversity (D1-5) for each of the first four peatland characteristics (Table 5). For the final two characteristics, size and pristine character, we define five levels without reference to the primary criteria.

The term "standard," as used in this method, is a numerical definition of level. For rarity of the first three characteristics (peatland type, other geologic/geomorphic characteristics, and vegetation types), a preliminary step is needed for setting standards because each of these characteristics may be represented by multiple types or features at the same peatland. This step assigns a rarity value (r value) to each type/feature. Standards for each of the five levels of rarity of these characteristics are sums of r values.

[5]Alaska is included in G1.

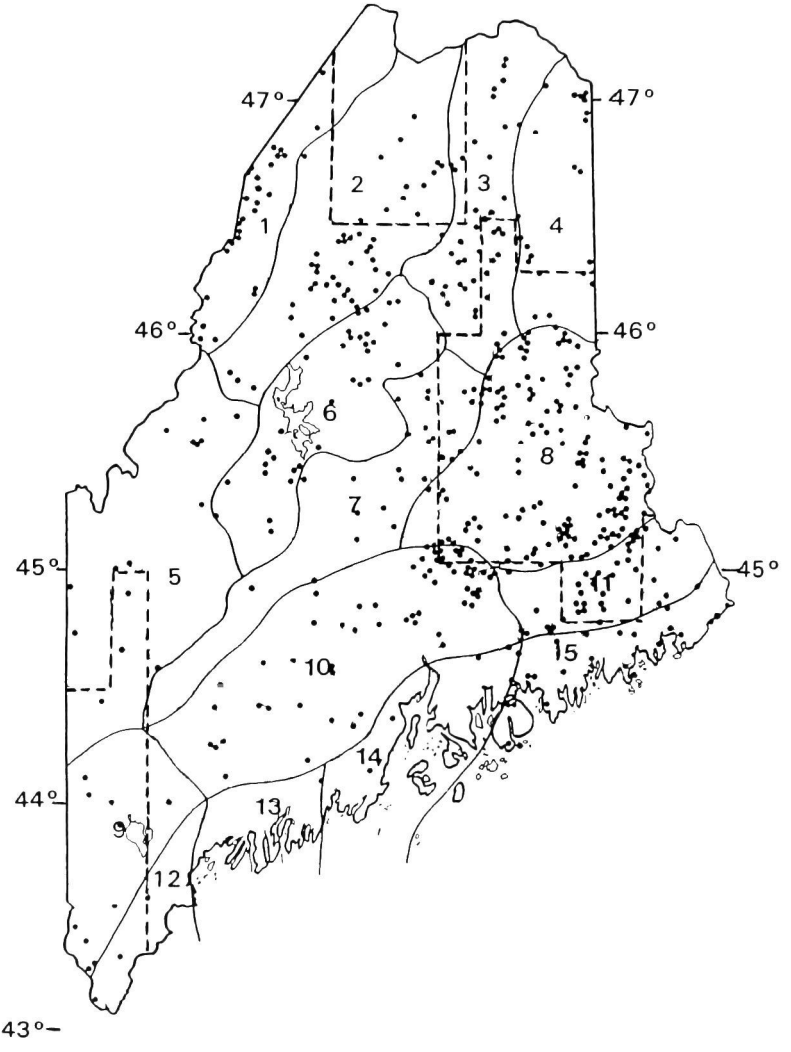

Figure 2. Map of Maine showing biophysical regions of McMahon (1990) and the locations of all peatlands in the University of Maine peatland database. Peatlands are least abundant in regions of high topographic relief and, generally, in the warmer/drier (summer) southwestern corner of the state. The biophysical regions are 1. Boundary Plateau, 2. Saint John Uplands, 3. Aroostook Hills, 4. Aroostook Lowlands, 5. Western Mountains, 6. Central Mountains, 7. Western Foothills, 8. Eastern Lowlands, 9. Southwest Interior, 10. Central Interior, 11. Eastern Interior, 12. South Coastal Region, 13. Midcoast Region, 14. Penobscot Bay Region, 15. East Coastal Region. Areas enclosed by dashed lines were subjected to complete air photo survey (Davis and Anderson in press).

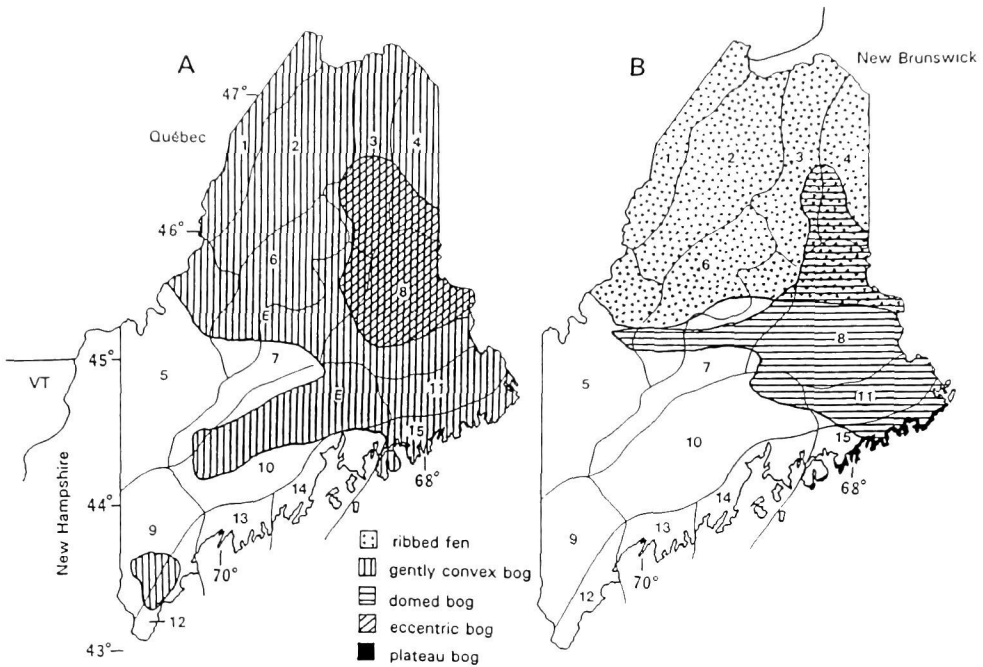

Figure 3. Maps of Maine showing distribution of peatland types (from Davis and Anderson in press) and biophysical regions (McMahon 1980). See Figure 2 caption for definitions of numbered biophysical regions. Unpatterned fens (Types 1 to 3 in Table 1) occur throughout Maine, but in lesser abundance (and aggregate area) in regions with high topographic relief. E = outlier eccentric bogs (northwestern: Greenville Junction Peatland; southeastern: Caribou Bog).

Table 5. Standards for levels of rarity, exemplariness, and diversity for the first four characteristics (Table 4). Standards for exemplariness cover only the first three characteristics.

RARITY			
Levels	**Standards (Total r value for a peatland)**		
Peatland types[1]			
R1	≥3.5		
R2	2.0–3.25		
R3	0.75–1.75		
R4	0.25–0.50		
R5	0		
Other geologic/geomorphic features[2]			
R1	≥3.75		
R2	2.25–3.50		
R3	1.50–2.00		
R4	0.75–1.25		
R5	<0.75		
Vegetation types[3]			
R1	≥2.25		
R2	1.75–2.00		
R3	1.25–1.50		
R4	0.50–1.00		
R5	<0.50		
	No. S1/S2 spp.		**No. S3 spp.**[4]
Plant species (flora)			
R1	≥1	&/or	≥6
R2	0		4–5
R3	0		2–3
R4	0		1
R5	0		0

EXEMPLARINESS[5]	
Levels	**Standards**
E1	truly exceptional example
E2	very fine example
E3	good example
E4	fair example
E5	poor example

Table 5. Continued.

DIVERSITY	
Levels	**Standards (No. different types)**
Peatland types	
D1	≥5
D2	4
D3	3
D4	2
D5	1
Other geologic/geomorphic features	
D1	≥7
D2	5
D3	4
D4	2–3
D5	<2
Vegetation types	
D1	≥16
D2	13–15
D3	10–12
D4	7–9
D5	<7
Plant species (flora)	
	(No. species)
D1	>140
D2	111–140
D3	81–110
D4	51–80
D5	<51
	OR
	(Index of species richness [D_c])
D1	>60
D2	51–60
D3	41–50
D4	26–40
D5	<26

[1]See Table 6 for rarity values.
[2]See Table 2 for rarity values.
[3]See Table 3 for rarity values.
[4]Maine Natural Areas Program (1998), except that *Arethusa bulbosa*, *Calypso bulbosa*, *Rubus chamaemorus*, *Symphyotrichum boreale*, and *Triantha glutinosa* are included in S3 for this publication.
[5]Exemplariness of peatland types, other geologic/geomorphic features, and vegetation types.

Rarity of peatland types

The extensive data compiled by Davis and Anderson (in press) on peatland types in Maine facilitate estimation of total numbers of each type statewide and in each of the state's biophysical regions (Table 1, Figures 2 and 3). Aforementioned literature sources provide information on which to base gross estimates of abundances of peatland types outside of Maine. For rarity of peatland type only, r-values are defined differently for G4 versus G1 to G3 (Table 6) to take account of the relatively small areas and small numbers of peatlands of each of Maine's biophysical regions (G4).

Rarity of other geologic/geomorphic characteristics

Published and unpublished descriptions and data on 102 Maine peatlands (Figure 1, Table 7, Appendices A and B) contain information on geologic/geomorphic features other than peatland type (Table 2). This information, along with indications of geologic/geomorphic features at the numerous other Maine peatlands studied by Cameron (1975), Cameron and Massey (1978), and Cameron et al. (1984), and less detailed studies at numerous additional Maine peatlands (Davis and Anderson in press) indicate that a majority of the peatlands have streams or rivers directly associated with them. This feature is assigned a low r value (0.25). The direct association

Table 6. Rarity values for peatland types, based on the total number of occurrences of a type on differing geographic scales. See Table 1 for numbers of occurrences of each type in Maine (G3).

Rarity (r) Value	Total No. Occurrences of Type In G1, G2, or G3	In G4
1	≤30	≤5
3/4	31–60	6–20
1/2	61–200	21–40
1/4	201–500	41–100
0	>500	>100

Table 7. Summary data for the 102 Maine peatlands used for this publication. Numbers (n) of different peatland types, geologic/geomorphic features, and vegetation types are from among those listed in Tables 1, 2, and 3, respectively. Data sources: 1 = Davis and Anderson 1991, 2 = this publication (Appendix B) and Davis and Anderson unpubl., 3 = Davis et al. 1983, 4 = Sorenson 1986, 5 = Widoff and Ruffing 1984. See Figure 1 for site locations.

No.	Name	Source	Latitude N	Longitude W	Field hours	Peatland Area (ha)	Peatland Types (n)	Geologic/ Geomorphic Features (n)	Vegetation Types (n)	Flora # spp.
1	Alton Bog	2	45 00	68 42	8.5	1030	2	3	6	73
2	Belgrade Kettles	2	44 26	69 50	8	20	1	2	5	79
3	Big Bog	1	45 27	67 45	7	314	3	3	14	58
4	Big Meadow Bog	5	44 46	69 22	7	326	3	4		58
5	Big Ten Peatland Complex	4	46 31	70 01		92				50
6	Black Brook Pond Fen	3	45 14	70 09	7	320	2	3	7	61
7	Black Pond Fen	2	43 28	70 56	8.5	113	2	4	5	115
8	Bog and Union River Peatland	3	44 44	68 15	8	200	2	2	7	35
9	Burntland Brook Fen	3,4	46 37	69 51	7.5	35	2	3	11	84
10	Burpee Brook Peatland	3	46 44	68 26	7	300	2	1	9	38
11	Call Bog	5	45 02	68 52	7	190	3	3		47
12	Caribou Bog	3	44 56	68 46	54	2519	7	4	17	126
13	Caribou Bog near Indian Pond	3	45 24	69 17	2.5	130	2	4	14	28
14	Bog North of Carlton Pond, East	5	44 45	69 16	7	192	2	2		50
15	Bog North of Carlton Pond, West	5	44 45	69 17	7	76	2	2		65
16	Carter Brook Fen	4	46 27	70 01		36				66
17	Peatland North of Cedar Mountain	3	45 33	68 49	6	65	2	2	11	57
18	Chamberlain Fen	4	46 12	69 09		11				66
19	Chemo Bog	3	44 51	68 34	8	781	4	2	12	53
20	Chimenticook Fen	2,4	47 06	69 32	7	20	2	1	7	73

Table 7. Continued.

No.	Name	Source	Latitude N	Longitude W	Field hours	Peatland Area (ha)	Peatland Types (n)	Geologic/ Geomorphic Features (n)	Vegetation Types (n)	Flora # spp.
21	Clifford Stream Fen	2	44 53	67 20	8	130	1	2	7	89
22	Coffin Bog	1	45 59	67 58	6.5	225	3	2	13	69
23	Cold Stream Peatland	1	45 12	68 34	30.5	1673	2	4	16	188
24	Bog Southwest of Crawford Lake	5	45 01	67 36	6.5	91	3	2		56
25	Cross Lake Fen	3,4	47 07	68 21	8.5	463	2	2	10	63
26	Crossuntic Stream Peatland	1	45 37	68 12	7	383	3	2	11	69
27	Crystal Bog	2,3	45 57	68 23	56.5	1472	4	5	17	171
28	Curtis Corner Fen	2	44 16	70 04	7.5	410	1	3	6	101
29	Deer Lake Fen	3,4	47 01	67 51	8	125	3	4	10	87
30	Dollar Pond Fen	2	44 58	68 26	2	30	1	4	4	40
31	Dottle Brook Fen	2	46 09	69 18	9.5	270	1	3	7	98
32	Bog East of Birch Stream	3	45 07	68 45	7	842	3	4	15	60
33	Eastman Brook Fen	4	46 33	69 55		19				45
34	Elevenmile Lake Peatland	1	45 58	67 57	6.5	160	4	3	14	86
35	Eliot Heath	2	43 08	70 48	6	65	1	2	4	66
36	Ellis Bog	3,4	46 14	69 23	10.5	640	4	2	12	55
37	Etna Bog	5	44 46	69 07	6	168	2	2		65
38	Flinn Pond Peatlands	1	45 46	68 23	6.5	196	3	3	12	75
39	Peatland East of Fourth Machias	3	45 09	67 58	3.5	113	2	3		53
40	Fowler Bog	2	44 35	69 25	10	338	1	2	7	107
41	Great Cranberry Island Heath	2	44 14	68 16	11	95	1	3	8	107
42	Great Heath	3	44 43	67 51	60	2536	6	7	16	112
43	Great Sidney Bog	2	44 23	69 47	6	400	2	2	9	84
44	Greenlaw Stream Fen	2	46 43	68 40	6.5	279	2	2	6	102

Table 7. Continued.

No	Name	Source	Latitude N	Longitude W	Field hours	Peatland Area (ha)	Peatland Types (n)	Geologic/ Geomorphic Features (n)	Vegetation Types (n)	Flora # spp.
45	Greenville Junction Peatland	1,3	45 26	69 37	7	173	2	3	12	49
46	Hatham Bog	1	45 43	68 33	5	148	2	5	13	58
47	Hermon Bog	5	44 48	68 52	7	649	4	2	14	49
48	Holland Pond Peatland	5	45 02	68 45	4	81	3	4		38
49	Horseback Bog	3	44 57	68 26	7	276	3	4	10	89
50	Inman Bog	1	45 32	68 31	6.5	101	1	2	9	54
51	International Peatland	4	46 31	70 02		94				48
52	Island Fen	4	46 31	70 00		17				55
53	Jonesport Heath	2	44 34	67 37	9	350	2	3	7	76
54	Kanokolus Bog	3	44 33	69 22	6	169	2	2	13	71
55	Fen West of Kezar Pond	2	44 06	70 54	10	503	1	2	8	100
56	Peatland Northwest of Lambert	1	45 35	67 36	6	209	2	3	12	69
57	Bog South of Lamb's Deadwater	5	45 14	67 42	6	190	5	4		48
58	Bog Northeast of Limestone	5	46 56	67 48	4	18	1	1		39
59	Lindsey Brook Peatland	1	45 25	67 59	7	221	2	2	13	68
60	Little Norridgewock Stream Ptld.	2	44 31	70 06	8	526	3	5	9	104
61	Macwahoc Stream Peatland	1,3	45 43	68 12	8	675	4	3	13	116
62	Magalloway River Fen	2	44 53	71 02	9	296	2	3	7	70
63	Marble Fen	3,4	46 08	68 41	12	71	2	2	12	96
64	Meadow Brook Fen	2	44 37	70 40	7.5	100	1	3	6	76
65	Meddybemps Heath	3	45 03	67 25	8	1400	4	5	14	60
66	Millberry Stream West Branch Fen	2	45 23	67 31	8.5	53	1	1	8	133
67	Montegail Pond Peatland	2	44 46	67 47	9	134	4	5	10	101
68	Moose Fen	4	47 03	68 05		17				52

Table 7. Continued.

No.	Name	Source	Latitude N	Longitude W	Field hours	Peatland Area (ha)	Peatland Types (n)	Geologic/ Geomorphic Features (n)	Vegetation Types (n)	Flora # spp.
69	Nollesemic Kettle	1,2	45 35	68 41	1.5	10	2	4	5	37
70	Nollesemic Stream Peatland	1	45 35	68 41	5.5	266	3	4	9	37
71	Northeast Carry Fen	2	45 54	69 37	8.5	497	3	2	8	129
72	Number 5 Bog	2,4	45 32	70 17	11.3	544	3	5	12	128
73	Orchard Bog	4,5	47 02	67 55	4	106	3	4		51
74	Orson Bog	2	45 24	69 01	8.5	290	2	1	8	78
75	Otter Brook Bog	4	46 28	68 30		74				51
76	Perk Pond Flowage Fen	3	45 01	70 40	6	150	1	2	8	29
77	Perley Pond Fen	2	43 54	70 40	8	161	2	3	10	119
78	Kettle near Pickerel Pond	2	44 58	68 27	4	2	1	3	3	62
79	Bog Northwest of Pierce Lake	5	46 59	67 49	5	18	1	2		53
80	Rock Dam Heath	3	44 43	68 04	8	263	3	0	13	57
81	Rockland Bog	2	44 08	69 09	10.2	155	2	3	8	119
82	Rocky Rips Bog	2	45 07	68 30	18	485	3	4	14	102
83	Saco Heath	2	43 33	70 28	16	305	3	1	14	82
84	Salmon Brook Lake Fen	2	46 54	68 14	8.7	99	2	3	8	134
85	Sargent Bog	5	45 05	68 47	7	162	2	3		62
86	Sawtelle Heath	5	45 13	67 30	7	121	4	5		95
87	Slight Depression Fen	4	46 28	70 01		36				43
88	Smith Brook Deadwater Bog	1,5	45 42	68 45	8	211	3	2	13	68
89	Smith Brook Fen	4	45 41	68 45		16				64
90	Smith Pond Peatland	2	46 19	68 25	5	240	3	2	8	38
91	Bog Northeast of South Princeton	5	45 10	67 29	5	105	3	2		44
92	South Trescott Heath	3	44 46	67 05	6.5	40	2	1	6	51

Table 7. Continued.

No.	Name	Source	Latitude N	Longitude W	Field hours	Peatland Area (ha)	Peatland Types (n)	Geologic/ Geomorphic Features (n)	Vegetation Types (n)	Flora # spp.
93	Stetson Mountain Peatland	1	45 31	68 00	8.5	247	2	3	10	102
94	Sunkaze Stream Peatland	3	44 59	68 34	6	2738	3	1		
95	Sweat Bog	3	45 21	68 45	6	504	4	5	13	60
96	Thousand Acre Heath	2	45 15	68 14	17	980	4	4	16	117
97	Twelvemile Bog	3	45 39	70 02	7	112	3	1	11	57
98	Umcolcus Deadwater Fen	3	46 21	68 30	5	170	1	3	9	58
99	Vanceboro Railroad Peatland	1,3	45 33	67 29	13.5	760	6	3	15	77
100	Wadleigh Bog	1	46 15	68 27	7.5	184	2	1	13	65
101	Wells Heath	3	43 20	70 38	4	180	2	1	8	30
102	White Pond Fen	2	46 47	69 37	9	211	1	2	10	206

of peatlands with lakes (primary bodies of standing water[6]) is less common, but occurs in a substantial minority of peatlands (r = 0.25). Upland islands occur in a majority of Maine peatlands, and are also assigned a low value (r = 0.25). In Maine, eskers are commonly associated with Type 4 peatlands (Table 1), but less commonly with other types (r = 0.50 for G3 and G4). Eskers are generally less common in glaciated regions outside of Maine (r = 1.00 for G1 and G2). A geologic/geomorphic feature rarely found in association with Maine peatlands is a modern beach deposit (r = 1.00); the feature has been found at only a few of Maine's coastal raised bogs. The vast majority of Maine peatlands occur on non-calcareous, granitic/siliceous substrates. Peatlands on calcareous substrates are very uncommon in Maine (r = 1.00 for G3 and G4), except for some parts of Aroostook County, but are more common outside of Maine (r = 0.50 for G1 and G2). Table 2 contains additional geologic/geomorphogic features with their r values.

Rarity of vegetation types

Information from vegetation surveys (Anderson and Davis 1997, 1998), vegetation maps (e.g.: Davis et al. 1983; Davis and Anderson 1991; Appendix B), and less formal observations at numerous additional Maine peatlands provide the basis for assignment of r values to vegetation types (Table 3) and total r value standards for scoring (Table 5). Because of the variable definitions of peatland vegetation types in regions outside Maine, and other difficulties in comparability of peatland vegetation databases, we determine rarity of vegetation types only for Maine (G3) and in-Maine biophysical regions (G4).

Rarity of flora

The rare vascular plant species of Maine are listed by Maine Natural Areas Program (1998:12) as: S1, "critically imperilled in Maine because of extreme rarity (five or fewer occurrences or very few remaining individuals or acres) or because some aspect of its biology makes it especially vulnerable to extirpation from the State of Maine"; S2, "imperilled in Maine because of rarity (6–20 occurrences or few remaining individuals or acres) or because of other factors making it vulnerable to further decline"; and S3, "rare in

[6]A primary water body (pond or lake) associated with a peatland is one that formed on/in a mineral substrate/basin before or at the time of initial development of the peatland. It may now be partly bordered, or entirely surrounded, by the peatland, and may have been reduced in area by encroachment by the peatland. A secondary water body (pool) on a peatland is one that formed on peat after initial development of the peatland, and is typically shallow (≤1 m) and much smaller than a primary water body.

Maine (on the order of 20–100 occurrences)." For our purposes, we include an additional five species with S3 that are uncommon on Maine's peatlands, namely *Arethusa bulbosa*, *Calypso bulbosa*, *Rubus chamaemorus*, *Symphyotrichum boreale*, and *Triantha glutinosa*. The standards (Table 5), which are based on occurrences of S1/S2 and S3 plants at 101 Maine peatlands (Appendix C), are summarized in Table 8. Information on non-vascular plants is insufficient to judge levels of rarity; therefore these plants are omitted from this aspect of scoring.

Searches for rare plant species are often hampered by the limited period of time that certain rare plants are noticeable. Single occurrences of rare plants with inconspicuous foliage and lacking flowers or fruits may be overlooked in rapid field surveys. Peatlands under consideration as final candidates for preserve status or for consumptive use should be subjected to thorough floristic study, preferably with visits throughout the growing season.

Levels of exemplariness

The five levels of exemplariness are truly exceptional example (E1), very fine example (E2), good example (E3), fair example (E4), and poor example (E5). The assignment of level of exemplariness is a judgement based on expertise and geographically wide familiarity with peatland types and associated geologic/geomorphic features, including on international (G1) and national (G2) scales. This

Table 8. Frequency of S1/S2 and S3 species[1] at 101 of the Maine peatlands listed in Table 7.

Number of Species	Number of Peatlands[2] S1/S2	S3
1	8	17
2	1	5
3	1	1
4	0	2
5	0	1
6	1[3]	0
7	0	2
12	0	1[3]

[1]Maine Natural Areas Program (1998), except that *Arethusa bulbosa*, *Calypso bulbosa*, *Rubus chamaemorus*, *Symphyotrichum boreale*, and *Triantha glutinosa* are included in S3 for this publication.

[2]Sixty-seven peatlands had no S1/S2 or S3 species.

[3]Crystal Bog (most occurrences of S1/S2 and S3 species are in a peripheral fen area).

judgement is made with reference to archetypes as, for example, the descriptions and diagrams of peatland types in Moore and Bellamy (1974) and Eurola et al. (1984) for all of Europe and for Finland, respectively, and by Davis and Anderson (in press) for Maine. For Maine peatland vegetation types, Anderson and Davis's (1997) descriptions are used as archetypes. In addition, extensiveness of the stand or patch of a vegetation type figures into the judgement of exemplariness. For peatland type, other geologic/geomorphic features, and vegetation type, the highest E level attained for any one type or feature in a peatland is the level used for scoring. For vegetation type, only G3 and G4 are scored for exemplariness for the same reasons given for rarity of vegetation type. Flora is not scored for exemplariness.

Diversity of peatland types

Geographic scale is not used in the scoring of diversity because published data sufficient for setting standards are available only for Maine. The five levels of diversity are exceptional (D1), very high (D2), high (D3), medium and medium low (D4), and very low (D5). We base standards of diversity of peatland type (Table 5) on a histogram of the number of different types per peatland (Figure 4) at the 92 peatlands with relevant data (Table 5; Appendix D). Only 18 of the 92 peatlands are single-unit peatlands; the other 74 are multiple-unit peatlands. Four peatlands contain five or more different types of units, namely (with number of types), Caribou Bog (Bangor-Old Town area) (7), Great Heath (6), Vanceboro Railroad Peatland (6), and Bog South of Lamb's Deadwater (5).[7]

Diversity of other geologic/geomorphic characteristics

We base diversity standards for these features (Tables 2 and 7) on a histogram of the number of different features per peatland at 92 peatlands with relevant data (Figure 5; Table 5; Appendix A). The maximum number of different features at a single peatland is seven, at Great Heath. Eight large peatlands have five types each.

Diversity of vegetation types

A histogram of numbers of different vegetation types per peatland, out of the 20 types in Table 3, is given as Figure 6 for the 76 peatlands with relevant data (Table 7; Appendix E). The histogram provides a basis for standards of vegetational diversity (Table 5).

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[7]Descriptions of these, except Lamb's Deadwater (described by Widoff and Ruffing [1984]), and many other peatlands studied by us are given in Appendix B.

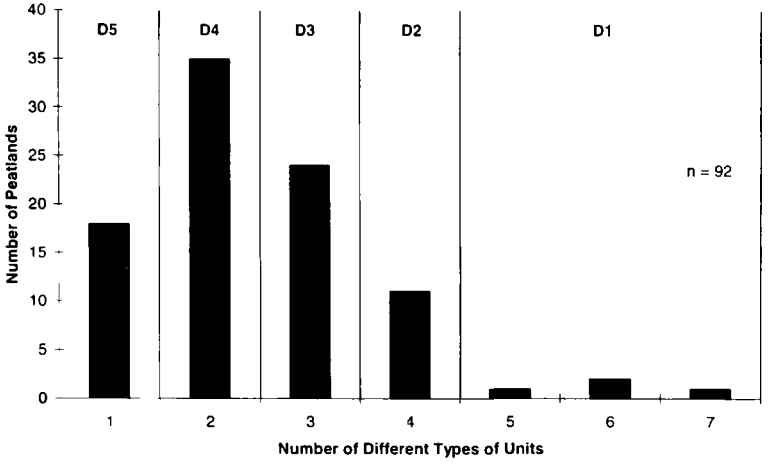


Figure 4. Histogram of the number of different peatland types (Table 1; Appendix D) per peatland, and levels of diversity (D1-5) of peatland types (Table 5). Of the 92 sampled peatlands, all but 18 were multiple-unit peatlands with complexes of more than one type. Data sources in Table 7.

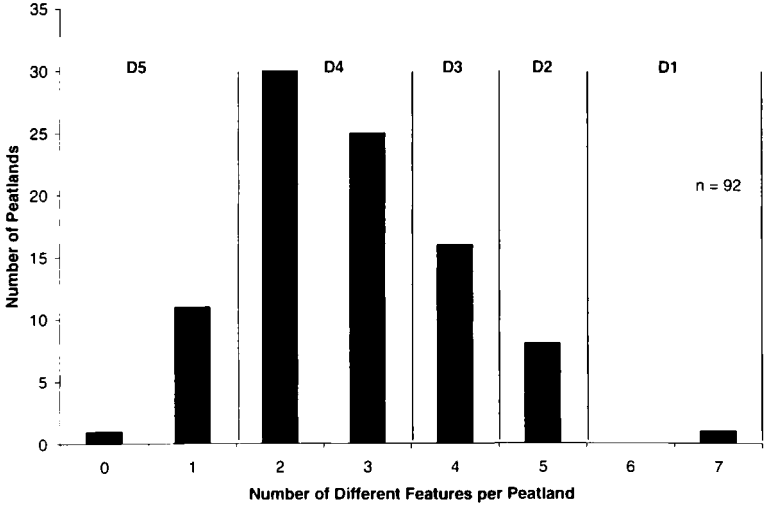


Figure 5. Histogram of the number of different geologic/geomorphic features (other than peatland type) (Table 2; Appendix A) per peatland, and levels of diversity (D1-5) of geologic/geomorphic features (Table 5). Data sources in Table 7.

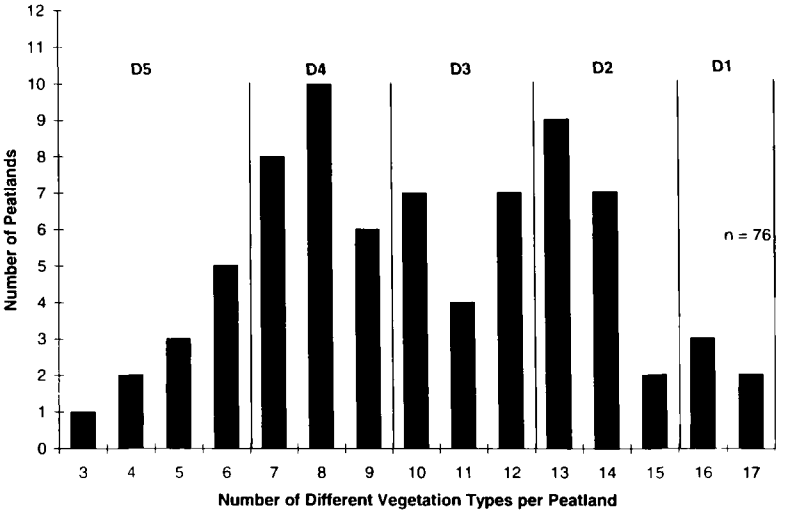


Figure 6. Histogram of the number of different vegetation types (Table 3; Appendix E) per peatland, and levels of diversity (D1-5) of vegetation types (Table 5). Data sources in Table 7.

Diversity of flora

We base standards of floristic diversity (species richness) (Table 5) on a histogram of the number of different species per peatland at 101 Maine peatlands (Figure 7; Table 7; Appendix C). At only three peatlands, Bog at Cold Stream (188 species), Crystal Bog (171 species[8]), and White Pond Fen (206 species) did we find more than 134 species.

These standards (Table 5) are problematic in that they are based on species counts made during differing search times (Table 7; Appendix C). The number of species found is partly a function of hours of search time (linear $r^2 = 0.26$; $p = 0.0001$), although a leveling off of species numbers starts around 12 hours (Figure 8a). One or more factors in addition to search time play strong roles, for example, the large number of species found at White Pond Fen (Figure 8a) in relatively few hours reflect the peatland's truly exceptional floristic diversity. More time was spent searching the

[8]If additional species (not observed by us) reported in the literature (e.g., Fernald and Wiegand 1910) on this outstanding peatland are included, the total number would be 210.

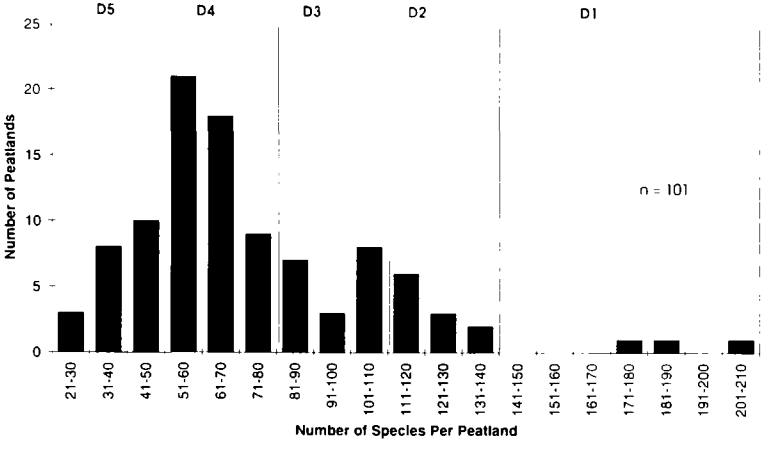


Figure 7. Histogram of number of species per peatland (Appendix C), and levels of floristic diversity (D1-5) (Table 5). Data sources in Table 7.

largest peatlands, to adequately covered them ($r^2 = 0.71$; $p = 0.0001$) (Figure 9a). Generally, more species were found at the largest peatlands ($r^2 = 0.16$; $p = 0.0001$[9]) (Figure 9b), but the overall effect of other sources of variance on species richness is greater.

We have constructed an index of species richness (D_c) that takes differences in search time into account. The time spent was roughly proportional to peatland area (Figure 9a), suggesting that intensity of search was about the same regardless of peatland area. Many hours were spent at some large peatlands (e.g., Cold Stream Peatland, 1673 ha, 30.5 hr; Great Heath, 2536 ha, 60 hr[10]), and only a few hours at others (e.g., Eliot Heath, 65 ha, 6 hr; Nollesemic Kettle, 10 ha, 1.5 hr[11]) (Table 7). A deliberate effort was made to traverse and sample all of the vegetation types at each peatland, regardless of peatland area (Anderson and Davis 1997, 1998; Davis and Anderson 1991; Davis et al. 1983; Widoff and Ruffing 1984). However, practical considerations resulted in exceptions, for example, inadequate time was spent at Meddybemps Heath (Figure 9a and b). The linear relationship between floristic diversity and search time (Figure 8a; $r^2 = 0.26$; $p = 0.0001$) is improved by using $\log_n$ hours (Figure 8b; $r^2 = 0.42$; $p = 0.0001$), more so when White Pond Fen is omitted ($r^2 =$

[9]Without outliers White Pond Fen and Meddybemps Heath (Figure 9b), $r^2 = 0.22$ and $p = 0.0001$.
[10]The longest time spent at any of the peatlands.
[11]The shortest time spent at any of the peatlands.

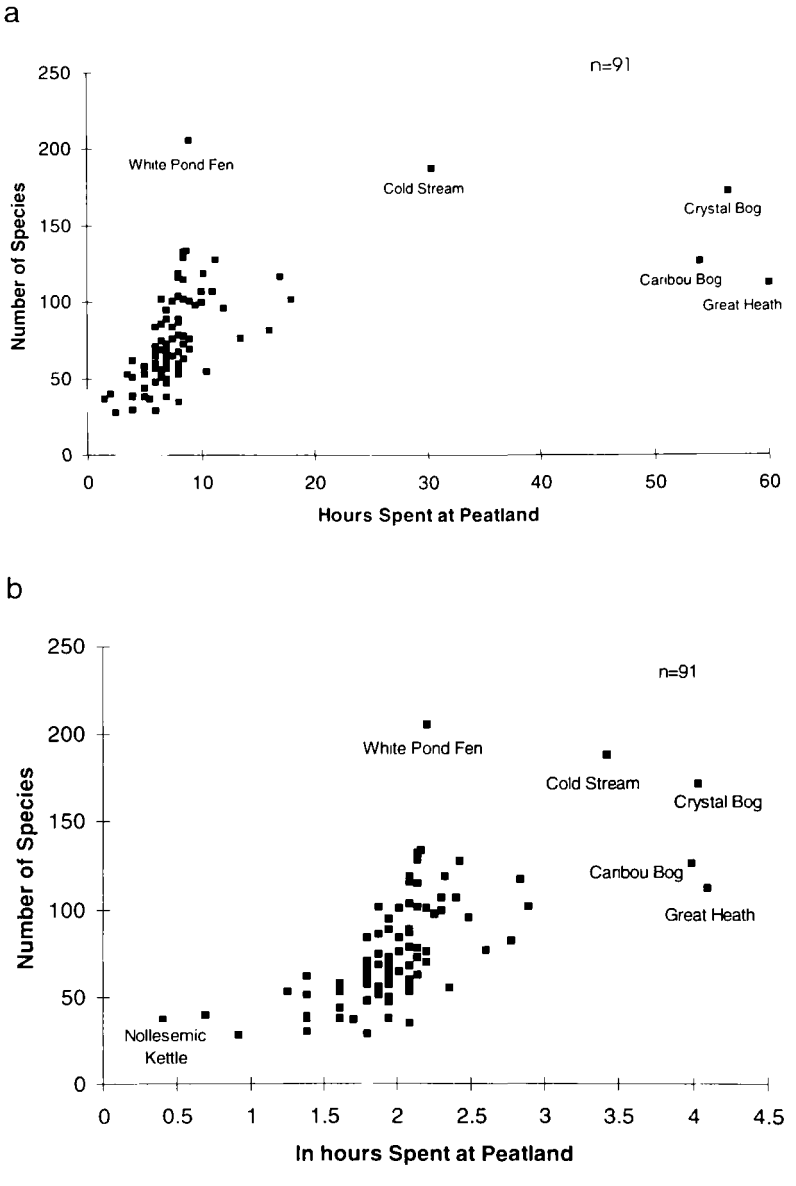


Figure 8. ***(a)*** *Number of species tallied per peatland in relation to search hours (Appendix C), and* ***(b)*** *in relation to $\log_n$ search hours. Peatlands of interest are indicated. Data sources in Table 7.*

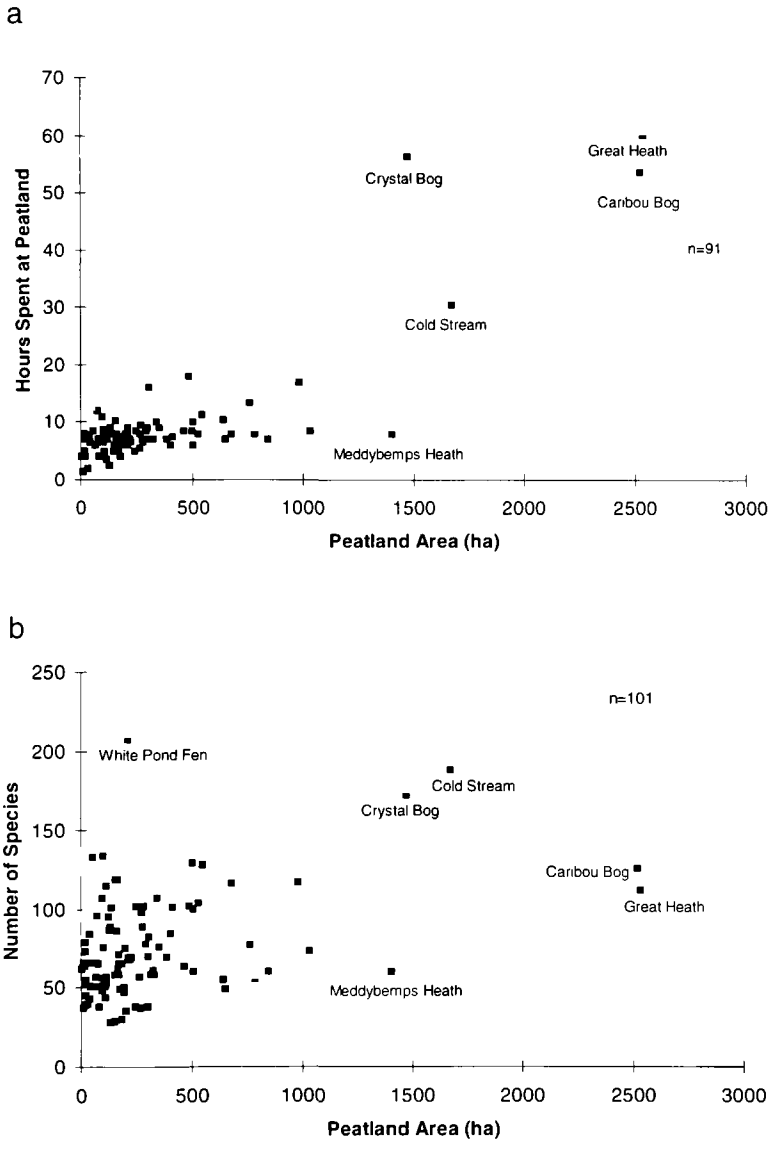
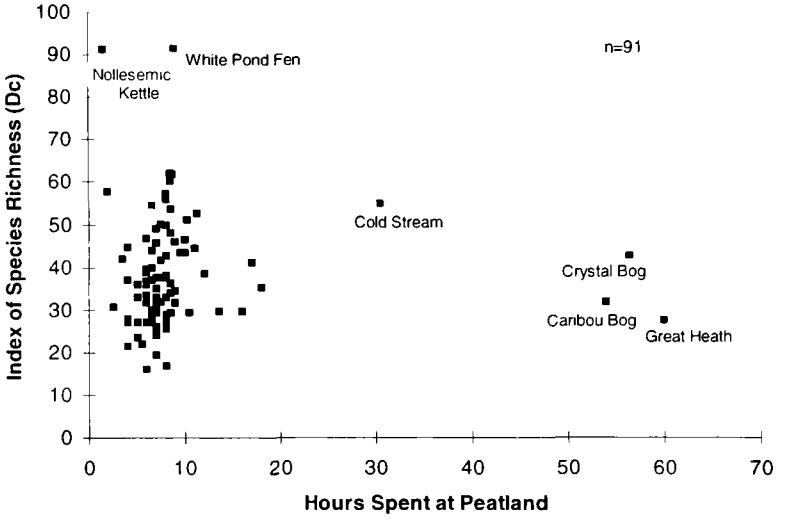
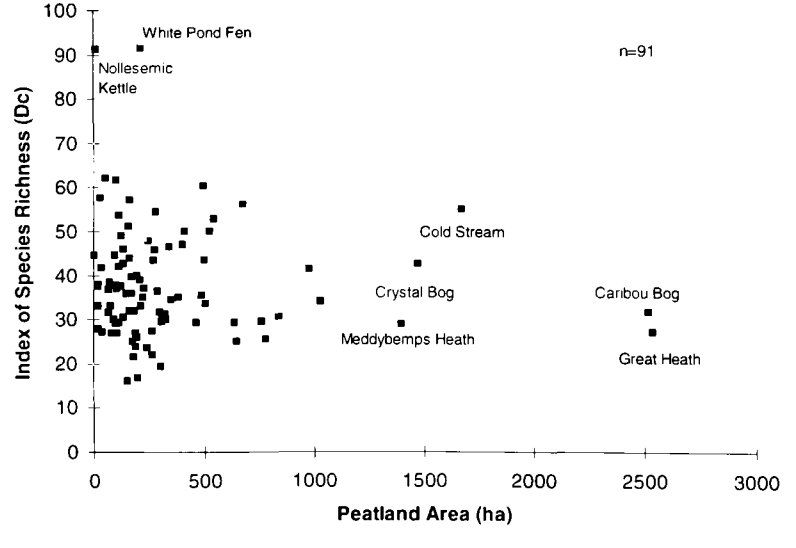


Figure 9. ***(a)*** *Search hours in relation to peatland area;* ***(b)*** *number of species in relation to peatland area;* ***(c)*** *index of species richness* (D_c) *in relation to search hours;* ***(d)*** *index of species richness* (D_c) *in relation to peatland area, based on data in Appendix C. Data sources in Table 7.*

c


Index of Species Richness (Dc)
Hours Spent at Peatland
n=91
White Pond Fen
Nollesemic
Kettle
Cold Stream
Crystal Bog
Caribou Bog
Great Heath
0
10
20
30
40
50
60
70
80
90
100

d


Index of Species Richness (Dc)
Peatland Area (ha)
n=91
White Pond Fen
Nollesemic
Kettle
Cold Stream
Crystal Bog
Meddybemps Heath
Caribou Bog
Great Heath
0
500
1000
1500
2000
2500
3000
10
20
30
40
50
60
70
80
90
100

0.49; p = 0.0001). Accordingly, we derive an index of species richness (D_c), as follows:

$$D_c = \frac{\text{number of tallied species}}{\ln \text{ search hours}}$$

The relationships between hours (roughly proportional to area) and number of species (Figure 8a and b), and between area (roughly proportional to hours) and number of species (Figure 9b) disappear when D_c is substituted for number of species (hours: $r^2 = 0.001$, p = 0.89 (Figure 9c); area: $r^2 = 0.001$, p = 0.42 (Figure 9d)), suggesting that D_c effectively removes the effects of differing search times. Figure 10, a histogram of D_c for 91 Maine peatlands based on the data in Appendix C, shows standards for floristic diversity based on D_c (Table 5).

Essentially, the D_c index approximates diversity per unit area. The index suffers from the shortcoming of overestimating the diversity of some very small acidic peatlands. The vegetation at such sites could be sampled very quickly to obtain a list of ~40 to ~60 species that are ubiquitous or very common in acidic peatlands. An extreme example is the small (~10 ha) Nollesemic Kettle, with a misleadingly high D_c of 91.2 (level D1) based on only 37 species tallied in 1.5 hours (Table 7, Figure 9c and d). On the other hand, relatively prolonged sampling in relation to peatland area, as at 1470 ha Crystal Bog (56.5 hr; Figure 9a) resulted in D_c of only 42.4 (level D3) (Figure 9d), even though we obtained the second highest species count (171 spp.) at this peatland. The parallel between species richness and D_c is a good one ($r^2 = 0.43$; p = 0.0001), but the exceptions to this relationship (Figure 11) and the variety of reasons for these exceptions lead us to retain both ways of scoring diversity of flora (Table 5).

Percentage Scores for Levels of Rarity, Exemplariness, and Diversity of the First Four Peatland Characteristics

A theoretically "perfect" peatland, that is, a peatland with a maximum score for all criteria and characteristics, including area and pristine character, would have a total score (= grade) of 100%. In Table 9, we give percentage assignments for five levels of rarity, exemplariness, and diversity of the first four peatland characteristics. Because scores are applied at multiple geographic scales for rarity and exemplariness, total scores are greater than those in Table 9. For example, a maximum score for exemplariness (E1) of peatland type is 4.5%. Multiplied by four geographic scales (G1 to

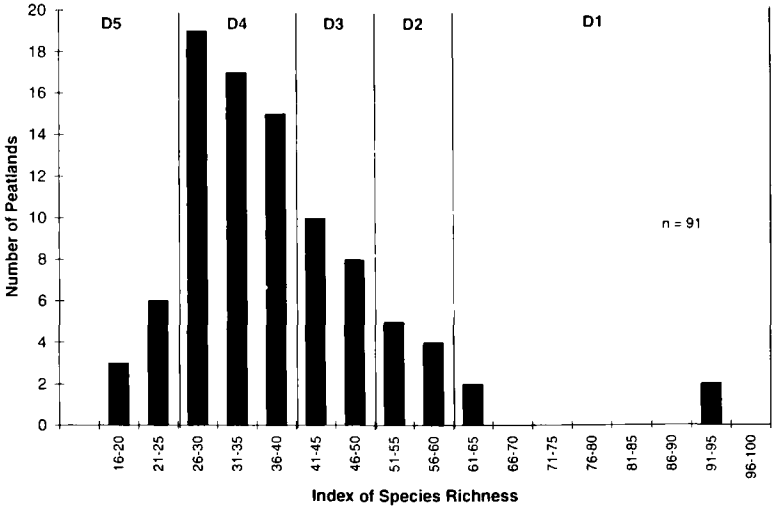


Figure 10. Histogram of index of species richness (D_c) *per peatland (Appendix C), and levels of floristic diversity (D1-5) based on* D_c.

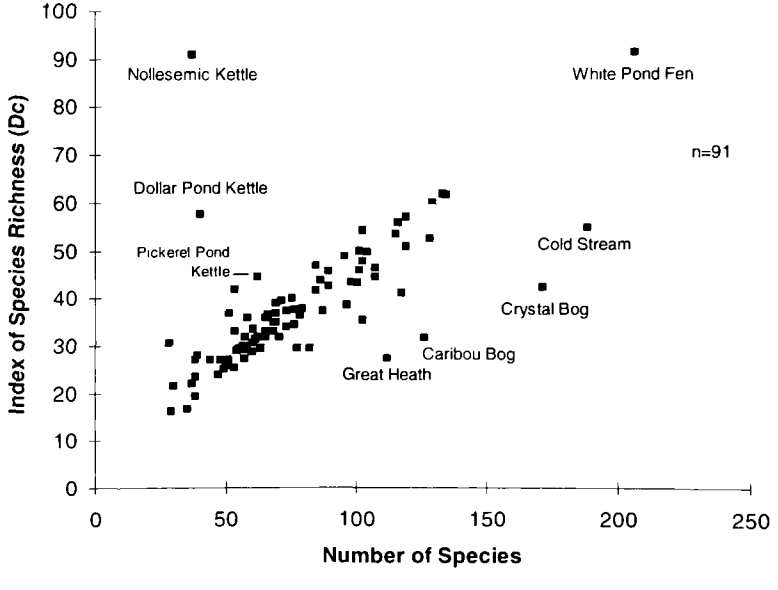


Figure 11. Index of species richness (D_c) *in relation to species count (Appendix C). Data sources in Table 7.*

G4), the total is 18%, as in Table 4. Likewise, for rarity of vegetation types the maximum is 2.0% (Table 9). Multiplied by the two geographic scales (G3 and G4) used for this c/c pair, the total becomes 4.0%, as in Table 4. These details of scoring are summarized by Table 10. The percentage maximum scores in Table 10 correspond to the percentage emphases on the primary criteria and first four characteristics in the Table 4 c/c matrix. The total perfect score in Table 10 is only 91% because scores for the final two characteristics (peatland area and pristine condition) are not included there.

Standards and Percentage Assignments for Peatland Area and Pristine Character

Standards and percentage assignments for levels of peatland area (A1 to A5) and pristine character (P1 to P5) are given in Table

Table 9. Assignment of percentage scores for four peatland characteristics, arranged by primary criteria and levels within criteria. For rarity and exemplariness, scores are applied at multiple geographic scales; therefore, the total scores are greater than indicated here. For example, a maximum for exemplariness of peatland type is 18 (4.5 at four geographic scales), and for rarity of vegetation types is 4.0 (2.0 at two geographic scales, G3 and G4), as explained by Table 10. n.a. = not applicable.

		---- Percentage Scores for Characteristics -----			
Primary Criteria	Level	Peatland Types	Other Geol/Geom	Vegetation Types	Plant spp.
Rarity	R1	4.5	0.25	2.0	4.0
	R2	3.0	0.15	1.4	2.5
	R3	1.0	0.08	0.6	1.5
	R4	0.5	0.03	0.2	0.5
	R5	0.0	0.00	0.0	0.0
Exemplariness	E1	4.5	0.50	2.0	n.a.
	E2	3.0	0.30	1.4	n.a.
	E3	1.5	0.16	0.6	n.a.
	E4	0.5	0.06	0.2	n.a.
	E5	0.0	0.00	0.0	n.a.
Diversity	D1	8.0	2.00	6.0	12.0
	D2	6.0	1.20	4.0	9.0
	D3	4.0	0.64	1.8	3.0
	D4	2.0	0.24	0.6	1.0
	D5	0.0	0.00	0.0	0.0

Table 10. Summary of scoring (maximum percent scores) by primary criteria for the first four characteristics (Table 4) in terms of geographic scale (G). Less than maximum scores for these characteristics are given in Table 9. G1 = international, G2 = national, G3 = Maine, G4 = Maine biophysical region. The "grand total" of 91% is supplemented by the maximum score for peatland area (5%) and pristine character (4%) (Tables 4 and 11) to make 100%. n.a. = not applicable.

		-- Percentage scores for characteristics ---			
Characteristic	Geographic Scale	Rarity	Exemplariness	Diversity	Total
Peatland type	G1	4.5	4.5	n.a.	
	G2	4.5	4.5	n.a.	
	G3	4.5	4.5	n.a.	
	G4	4.5	4.5	n.a.	
Totals:		18	18	8	44
Other geol/geomorph characteristics	G1	0.25	0.5	n.a.	
	G2	0.25	0.5	n.a.	
	G3	0.25	0.5	n.a.	
	G4	0.25	0.5	n.a.	
Totals:		1	2	2	5
Vegetation types	G3	2	2	n.a.	
	G4	2	2	n.a.	
Totals:		4	4	6	14
Plant species (flora)	G1	4.0	n.a.	n.a.	
	G2	4.0	n.a.	n.a.	
	G3	4.0	n.a.	n.a.	
	G4	4.0	n.a.	n.a.	
Totals:		16	—	12	28
Grand totals:		39	24	28	91

11. A histogram of peatland areas for the 102 peatlands in the dataset, showing standards A1 to A5 is given as Figure 12. The total perfect score for these two characteristics, combined, is 9%.

Examples of Scoring

Examples of scoring, in the form of completed scoring sheets for the Cold Stream Peatland and Twelvemile Bog, are given as Appendix F, Additional examples are available from the authors.

Table 11. Standards and percentage scores for levels of peatland area and pristine character.

Characteristic	Level	Standards	Percentage
Peatland area	A1	very large (>1000 ha)	5.0
	A2	large (401–1000 ha)	3.5
	A3	medium (101–400 ha)	1.5
	A4	small (21–100 ha)	0.5
	A5	very small (≤20 ha)	0.0
Pristine character	P1	remote[1] and no known direct[2] human disturbance	4.0
	P2	not remote, no known direct human disturbance	3.0
	P3	minor (insignificant[3]) direct human disturbance	2.5
	P4	small amount of significant direct human disturbance	1.5
	P5	substantial amount of significant direct human disturbance	0.0

[1]Remote = greater than 1 km from a road that is passable by 4-wheel-drive vehicle.
[2]Direct = disturbance by on-the-ground human activity (all peatlands are indirectly disturbed by wet and dry fallout of air pollutants).
[3]Insignificant = disturbance will likely be largely obliterated by succession within a century.

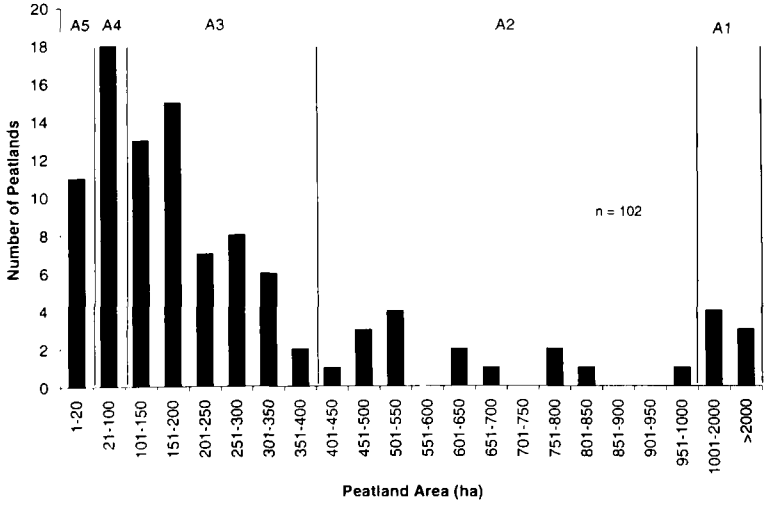


Figure 12. Histogram of peatland area for the 102 peatlands in the dataset.

EVALUATION GRADES FOR 76 MAINE PEATLANDS

The evaluation grades of the 76 peatlands range from 5.4% to 85.0% (to 79.4% based on D_c) (Table 12; Figure 13a and b; Appendix G). The frequency distribution is roughly unimodal and is skewed, with a mean and standard deviation of 28.3 ± 15.8% (± 14.6 when D_c is used), and a median of 25.8% (26.0% when D_c is used).

SCALING OF GRADES, AND PROTECTION RECOMMENDATION (PR) CLASSES

The scaling of evaluation grades is an important step in this evaluation method. A peatland grade has no absolute meaning; it is meaningful only in a relative sense. Scaling allows for the establishment of protection recommendation (PR) classes. Peatlands may differ greatly in scores for the three criteria for all or some of the characteristics to which the criteria are applied. Scores of any of these factors may be extracted and scaled separately, depending on the objectives of the evaluator. The matrix of scores in Appendix G provides the information needed to implement different scalings if desired.

First, we scale the grades of all peatland types together. This approach results in highest grades for large multiple-unit peatlands containing a wide diversity of features including bog complexes. Smaller peatlands, for example, most that include ribbed fen areas, generally have only a small variety of other features (Sorenson 1986a) and receive lower grades. Some outstanding examples of ribbed fens have much lower grades than some not so outstanding extensive multiple-unit peatlands with raised bog complexes. As protection of the most outstanding examples of each ecosystem type (de Groot 1992) or peatland type (Davis and Anderson 1991; Gawler 1998) is a worthy goal, we will also scale grades for separate peatland types.

Scaling Grades of All Peatland Types Together

To determine whether a particular numeric grade for a Maine peatland is very high, high, average, or low in relation to Maine peatlands in general requires comparison of the numeric grade with a distribution of grades for a representative sample of Maine peatlands. The 76 Maine peatlands that we evaluated and use for scaling of grades (Figures 13a and b; Appendix G) were chosen to cover wide ranges of peatland typology (and related hydrology), other geologic/geomorphic features, lithology (and related water

Table 12. Lists of peatlands ranked by grade (using number of species for floristic diversity) within protection recommendation (PR) classes A to D. Peatland complex types (from Table 1) at each peatland are given. Special considerations are summarized in footnotes for those peatlands worthy of a higher rank than their grades indicate. Additional details on these peatlands are given in Appendix B or in data sources listed in Table 7. Numeric definitions of PR classes are (A) >45%, highly recommended; (B) 31%–45%, recommended; (C) 16%–30%, not now recommended; and (D) <16%, unlikely to be recommended (Figure 13a and b).

PR Class	Peatland No.	and Name	Grade (%)	Types
A	42	Great Heath	85.0	1,2,5a,5b,7a,7b
	27	Crystal Bog	77.0	1,2,7a,7b
	12	Caribou Bog	76.2	1,2,4,5a,5b,6,7a
	96	Thousand Acre Hth	59.3	1,5a,7a,7b
	61	Macwahoc Stream	59.2	1,5a,6,7b
	23	Cold Stream Ptld	52.6	1,6
	72	Number 5 Bog	50.5	1,2,4
	63	Marble Fen	46.0	2,4
	46	Hatham Bog	45.8	5b,6
B	99	Vanceboro RR Ptld	44.1	1,2,5a,5b,6,7a
	95	Sweat Bog	44.0	1,2,5a,7b
	25	Cross Lake Fen	43.8	2,4
	65	Meddybemps Heath	38.4	1,2,7a,7b
	22	Coffin Bog	38.1	1,2,6
	102	White Pond Fen	38.0	1
	3	Big Bog	37.8	1,2,6
	32	E Birch Stream Bog	37.3	1,2,7b
	67	Montegail Pond	37.1	1,2,3,5b
	19	Chemo Bog	34.8	1,2,5a,5b
	29	Deer Lake Fen	34.4	2,4,5a
	82	Rocky Rips Bog	33.2	1,2,7b
	83	Saco Heath	32.8	2,4,5b
	36	Ellis Bog	32.6	1,2,4,5a
	53	Jonesport Heath	32.5	1,8
	88	Smith Brook Ddwtr	31.3	1,2,6
	93	Stetson Mt Ptld	31.1	5a,6
	71	Northeast Carry Fen	30.8	1,2,4
C	34	Elevenmile Lake	30.0	1,2,5a,6
	80	Rock Dam Heath	30.0	2,5a,5b
	84	Salmon Brook Lake	29.1	1,2
	43	Great Sidney Bog	28.1	1,5a
	17	Cedar Mt N Ptld	27.9	1,7b

Table 12. Continued.

PR Class	Peatland No.	and Name	Grade (%)	Types
C	100	Wadleigh Bog	27.6	1,6
	54	Kanokolus Bog	27.4	1,5b
	56	Lambert Lake Ptld	27.2	2,6
	69	Nollesemic Kettle	26.5	1,3
	9	Burntland Brook Fen	25.9	2,4
	49	Horseback Bog	25.9	1,2,5a
	47	Hermon Bog	25.6	1,2,5a,5b
	38	Flinn Pond Ptlds	25.2	1,2,6
	97	Twelvemile Bog	24.8	1,2,4
	66	Millberry Stream	24.0	1
	20	Chimenticook Fen	23.7	2,4
	81	Rockland Bog	23.5	1,2
	26	Crossuntic Stream	23.0	1,2,6
	41	Great Cranberry Hth	22.4	8
	60	L Norridgewock	21.6	1,2,5a
	59	Lindsey Brook Ptld	20.4	1,6
	77	Perley Pond Fen	20.2	1,2
	90	Smith Pond Ptld	19.4	1,2,7a
	1	Alton Bog	19.2	1,2
	78	Pickerel Pond Kettle	19.0	3
	70	Nollesemic Stream	18.6	1,2,6
	7	Black Pond Fen	18.5	1,2
	45	Greenville Jct Ptld	18.3	1,6
	13	Caribou Bog, Indian	17.6	2,7b
	62	Magalloway River	17.5	1,2
	92	S Trescott Heath	16.8	2,8
	31	Dottle Brook Fen	16.6	1
	28	Curtis Corner Fen	16.5	1
	50	Inman Bog	15.5	6
D	101	Wells Heath	15.2	2,5a
	10	Burpee Brook Ptld	15.0	1,5a
	55	Kezar Bog	14.9	2
	98	Umcolcus Dwtr Fen	14.5	2
	44	Greenlaw Stream	14.2	1,2
	40	Fowler Bog	13.9	1
	76	Perk Pond Flow Fen	12.7	1
	2	Belgrade Kettles	12.5	3
	64	Meadow Brook Fen	12.5	2
	21	Clifford Stream Fen	11.4	1
	74	Orson Bog	11.1	1,2
	8	Bog and Union River	10.2	1,5a
	6	Black Brook Pond	7.5	1,2
	30	Dollar Pond Fen	6.6	1

Table 12. Continued.

Special considerations

Number 5 Bog: A disjunct stand of *Pinus banksiana*, an uncommon species in Maine, occupies an upland near the eastern end of this large, multiple-unit fen For this and other reasons, the fen is worthy of 4th or 5th place in PR class A.

Meddybemps Heath: This large diverse peatland was inadequately sampled for its biological properties and may deserve a higher grade than it received.

Saco Heath: This well-developed raised bog is at/near the southern limit of raised bogs in northeastern United States. It is unique also for supporting one of very few *Chamaecyparis thyoides* stands in Maine and is worthy of PR class A.

Jonesport Heath: Although most units of this coastal bog have been destroyed by peat mining, the undisturbed north unit remains an outstanding example of its type in Maine and is worthy of PR class A.

Salmon Brook Lake Fen: The exceptionally diverse flora and presence of several rare species render this fen worthy of PR class A.

Great Sidney Bog: This bog is one of the best examples of its type in southwestern Maine, making it worthy of a low rank in PR class B.

Kanokolus Bog: This bog with secondary pools is one of the best examples of its type in south-central Maine, making it worthy of a low rank in PR class B.

Millberry Stream West Branch Fen: This unpatterned fen has a highly diverse flora and at least one very rare species, making it worthy of a low rank in PR class B.

Great Cranberry Heath: This coastal bog is at the extreme southwestern lilit of its type, making it worthy of mid-rank of PR class B.

Little Norridgewock Stream Peatland: A combination of glacial features and so large a multiple-unit peatland in southwestern Maine make this peatland worthy of high rank within PR class C.

Wells Heath: The extreme southern position of this questionably raised bog and some of its coastal floristic elements render it worthy of low rank in PR class C. The rating would rise to low rank in PR class B if the peatland is found to be raised.

Belgrade Kettles: These kettles and the combination of glacial features in their surroundings, if they are considered a single protection unit, would place the unit in PR class C.

Meadow Brook Fen: Peatlands of this size are uncommon in western upland Maine, making this fen worthy of low rank in PR class C.

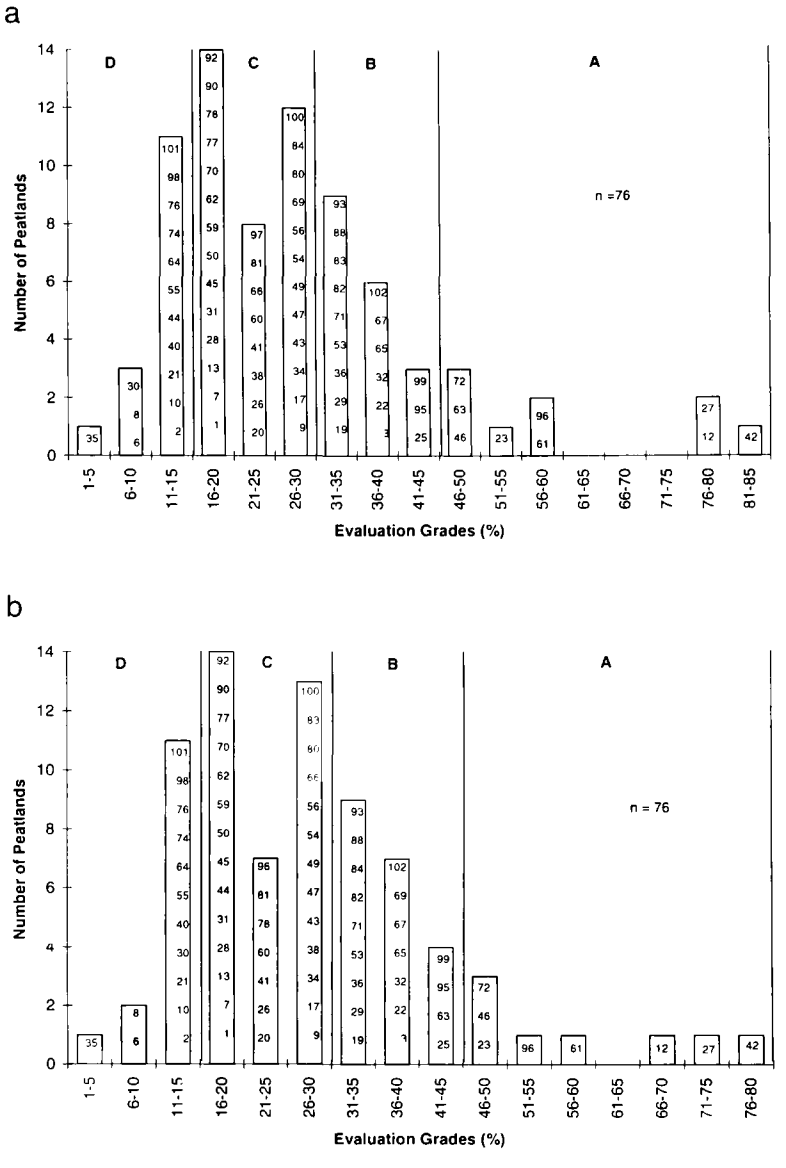


Figure 13. ***(a)*** *Histogram of peatland evaluation grades, using species count for floristic diversity, and* ***(b)*** *using index of species richness* (D_c) *for floristic diversity. Protection recommendation (PR) classes A–D are given. Peatland numbers (in histogram rectangles) are defined in Table 7. Based on data in Table 12 and Appendix G.*

chemistry and flora), size (2 to 2738 ha), and biophysical regions (including climate) of the state (Anderson et al. 1995, 1996; Anderson and Davis 1997, 1998; Davis et al. 1983). Although these aspects are widely represented in the sample, some quantitative aspects of representation fall short. Our statewide surveys (Davis and Anderson in press) indicate that Types 1, 2, 3, and to a much lesser extent Type 8 peatlands (Table 1) are underrepresented, while Type 6, and to a lesser extent Types 4, 5, and 7 are overrepresented. Small (20 ha) peatlands, most of them Types 1, 2, and 3 are greatly underrepresented, and peatlands >100 ha are overrepresented.

Throughout the evaluations of the 76 peatlands, we strived for maximum precision and accuracy. Nevertheless, there were numerous uncertainties in scoring various aspects of the peatlands, and therefore small differences between grades are unlikely to be meaningful. For this reason, and for ease of application of the grades in conservation and regulation decisions, we have lumped numeric grades as a teacher lumps average test scores of students into A, B, C, and D. The result is four PR classes: A (highly recommended), B (recommended), C (not now recommended), and D (unlikely to be recommended). This approach was used by Davis and Anderson (1991) for grouping evaluation grades of Maine eccentric bogs into three "priority classes" for protection as natural areas. For the full range of peatland types covered in this bulletin, the PR classes are defined in terms of numeric grades, as follows: (A) >45%, (B) 31%–45%, (C) 16%–30%, and (D) <16% (Figure 13a and b). The PR classes assigned to individual peatlands are given in Table 12. In some cases, special considerations indicate that a peatland should be raised in priority class (Table 12). These considerations are detailed in the peatland descriptions in Appendix B, and for the eccentric bogs by Davis and Anderson (1991).

Five of the nine peatlands in PR class A (Figure 13; Table 12) have one or more domed bog complexes, and one of the five also has eccentric bog complexes (#61, Macwahoc Stream Peatland); two others have eccentric but no domed complexes (#46, Hatham Bog, and #23, Cold Stream Peatland); and one other (#72, Number 5 Bog) is a large fen complex, a small proportion of which is ribbed. With the exceptions of Number 5 Bog and Marble Fen, these are raised bog complexes, and with the exception of Hatham Bog, all are large or very large peatlands. Each contains a wide variety of features. These nine peatlands are clearly among the most outstanding peatlands of the state. However, other peatlands, generally smaller and with a more limited variety of features, may be outstanding examples of individual peatland types.

Distributions of Grades for Separate Peatland Types

The distributions of grades for separate peatland types differ from each other (Figure 14a–j). We do not divide the histograms into PR classes because of the small samples of separate types. Despite this limitation, some generalizations can be made. Unpatterned fens in stream valleys (Type 1) and in open basins (Type 2), when not occurring in multiple-unit peatlands with ribbed fens or raised bogs, generally have low grades because of their unexceptional features and very common and widespread occurrence in and beyond Maine (Figure 14a and f). The highest scoring unpatterned fen, at 38.0% is peatland #102 (White Pond Fen), a fen with exceptional floristic diversity and several rare plant species (Appendices B and C). The second highest, at 33.1% (based on D_c) or 29.1% (based on species count) is #84 (Salmon Brook Lake Fen), also with high floristic diversity and rare species. Ribbed fens (Type 4) have higher grades, on average, because of their limited distribution and rarity in Maine (Figures 3, 14b and g), despite the fact that most of them in the state are small and unassociated with raised bogs. The highest grade is 50.5% for peatland #72 (Number 5 Bog), part of a very large multiple-unit peatland largely consisting of Types 1 and 2, and for peatlands #25 (Cross Lake Fen) and #63 (Marble Fen) due to their exemplary ribbed patterns, pristine condition and, in the case of Marble Fen, rare flora and exemplary vegetation (Appendices B and G).

Inland bogs lacking concentric or eccentric pattern, i.e., relatively flat inland bogs (Types 5a and b), like unpatterned fens have a limited range of relatively low grades (Figure 14c and h) but have higher mean and median grades than unpatterned fens. Types 5a and b are less common and less widespread in Maine than unpatterned fens, but more common and widespread in Maine than ribbed fens (Figure 3; Table 1). All bog complexes have fen areas associated with them, and typically they are part of multiple-unit peatlands and therefore tend to have a wider diversity of features. The highest scoring flat inland bogs are #19 (Chemo Bog) and #67 (Montegail Pond Peatland), both of which are highly exemplary of Type 5 and, in addition, have other type complexes associated with them in the same multiple-unit peatland.

Eccentric bogs (Type 6), previously evaluated by Davis and Anderson (1991),[1] generally score higher (Figure 14d and i) than unpatterned fens (Figure 14a and f) and flat inland bogs (Figure 14c and h) due to their rarity in Maine and absence in the rest of the United States. The eccentric bogs with highest grades are #12 (Caribou Bog), #61 (Macwahoc Stream Peatland), #23 (Cold Stream

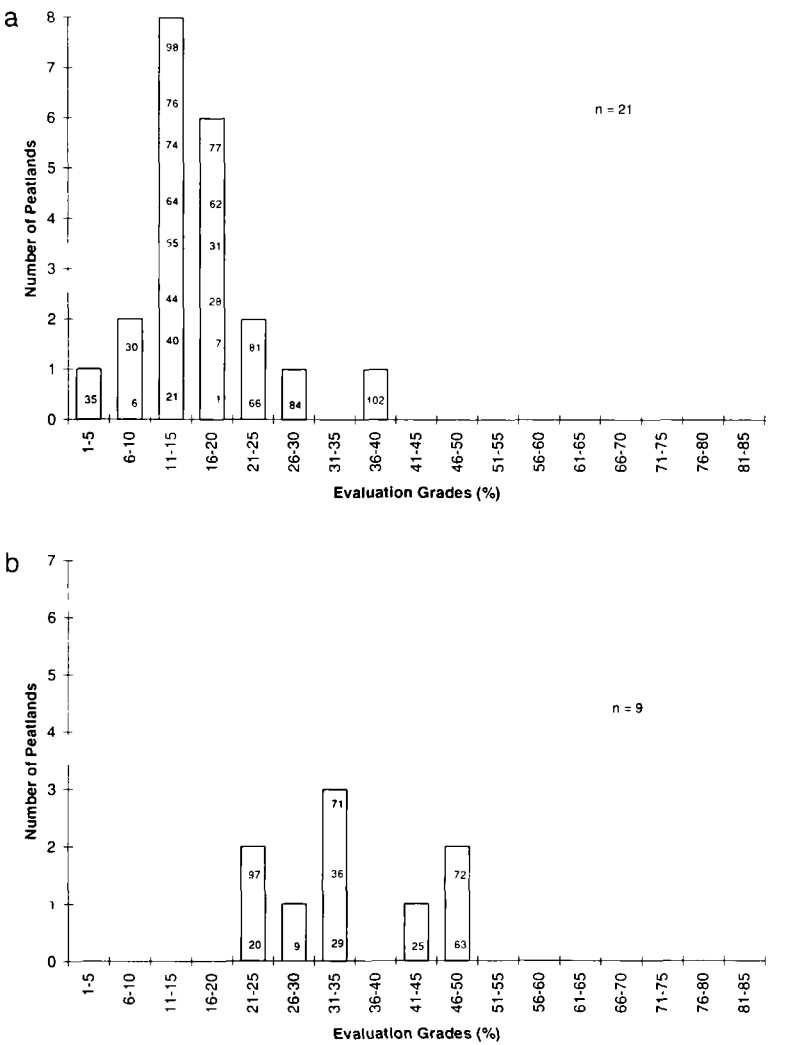
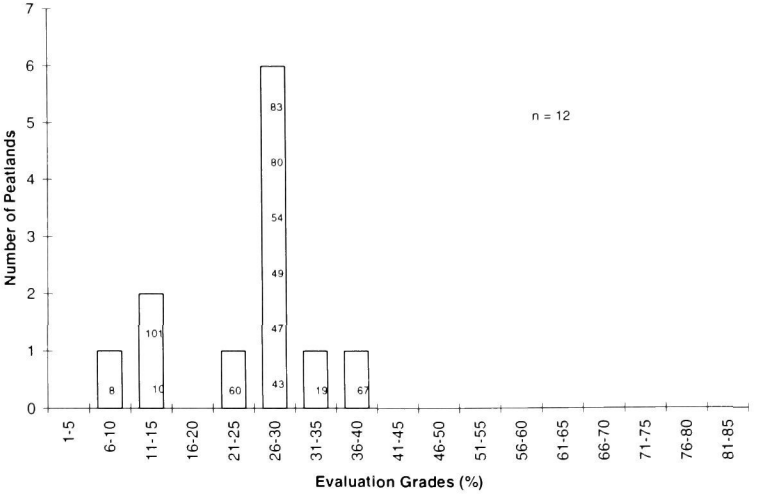
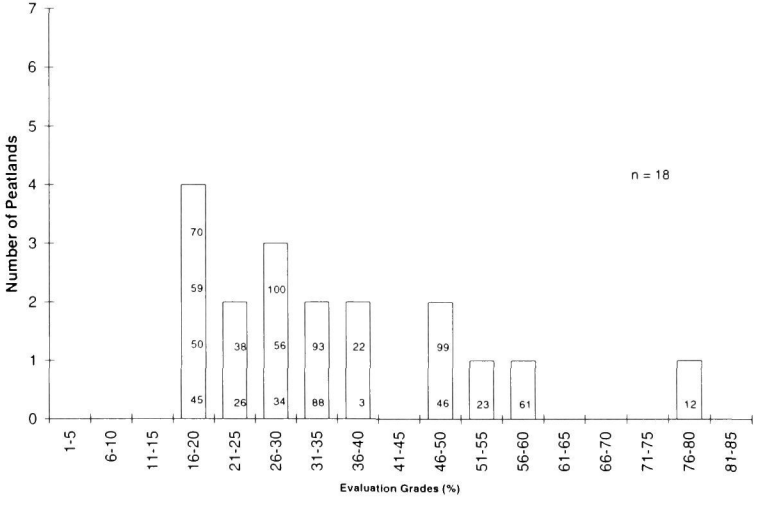


Figure 14. Histograms of evaluation grades per peatland, given separately for peatland types (Table 1), in two groups (1) a to e (using species count for floristic diversity) and (2) f to j (using index of species richness $[D_c]$ *for floristic diversity), in the following order within each group: Types 1 and 2 (combined)* ***(a & f)****, Type 4* ***(b & g)****, Types 5a and b (combined)* ***(c & h)****, Type 6* ***(d & i)****, and Types 7a and b (combined)* ***(e & j)****. Too few peatlands of Types 3 and 8 were sampled (Appendix D) for plotting of grades. Peatland numbers are defined in Table 7. Based on data in Table 12 and Appendix G.*

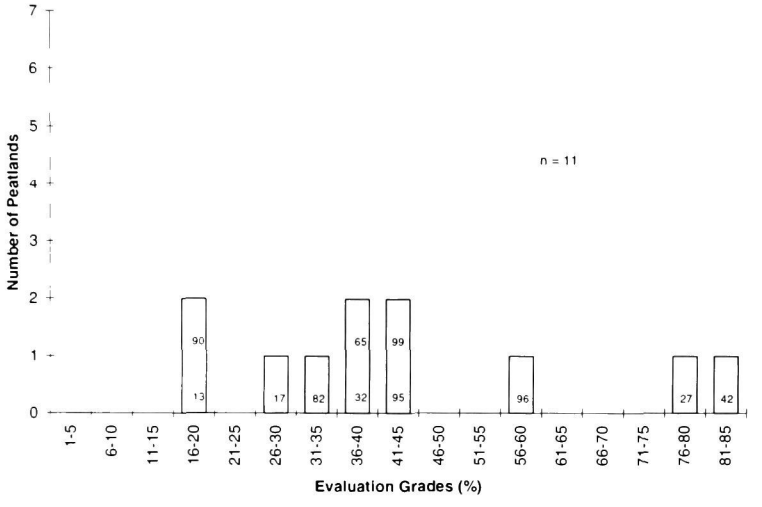
c


Number of Peatlands
Evaluation Grades (%)
n = 12
1-5
6-10
11-15
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
76-80
81-85
8
10
10
60
83
80
54
49
47
43
19
67

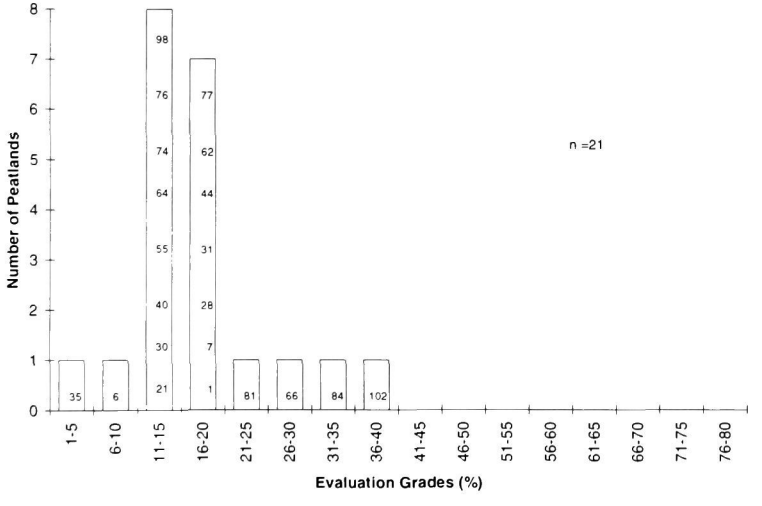
d


Number of Peatlands
Evaluation Grades (%)
n = 18
1-5
6-10
11-15
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
76-80
81-85
70
59
50
45
38
26
100
56
34
93
88
22
3
99
46
23
61
12

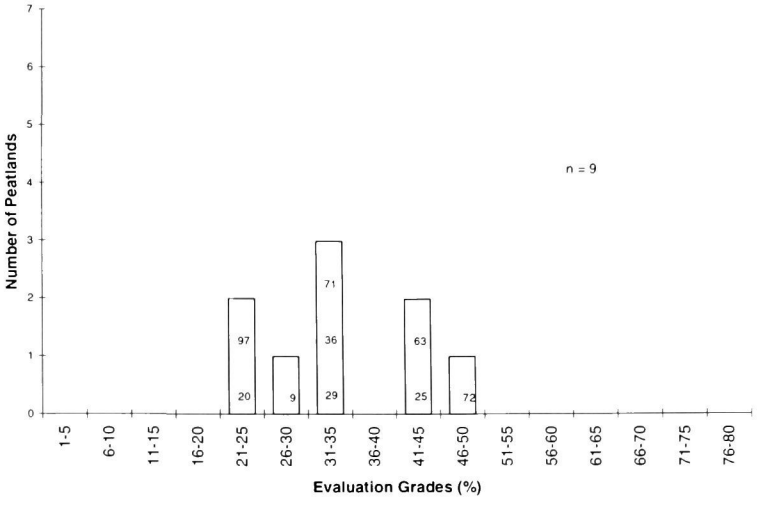
e


Number of Peatlands
n = 11
90
13
17
82
65
32
99
95
96
27
42
1-5
6-10
11-15
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
76-80
81-85
Evaluation Grades (%)

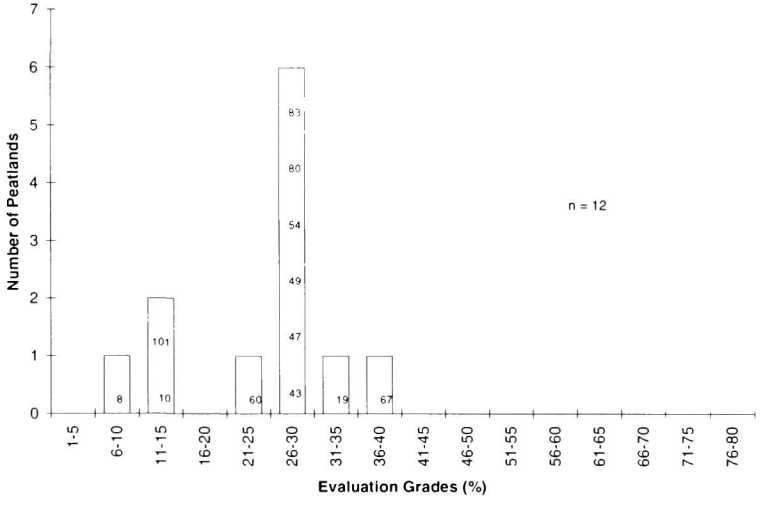
f


Number of Peatlands
n =21
98
76
74
64
55
40
30
21
77
62
44
31
28
7
1
35
6
81
66
84
102
1-5
6-10
11-15
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
76-80
Evaluation Grades (%)

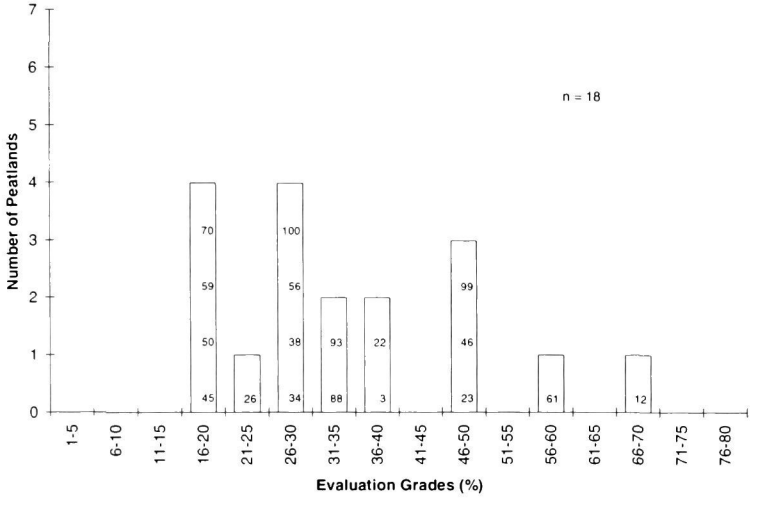
g


Number of Peatlands
n = 9
97
20
9
71
36
29
63
25
72
1-5
6-10
11-15
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
76-80
Evaluation Grades (%)

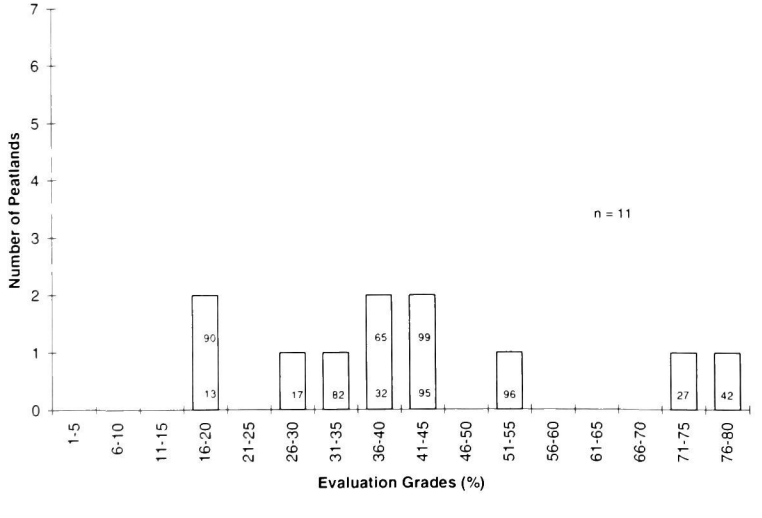
h


Number of Peatlands
n = 12
8
101
10
60
83
80
54
49
47
43
19
67
1-5
6-10
11-15
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
76-80
Evaluation Grades (%)

i


n = 18
Number of Peatlands
Evaluation Grades (%)
1-5
6-10
11-15
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
76-80
70
59
50
45
26
100
56
38
34
93
88
22
3
99
46
23
61
12

j


n = 11
Number of Peatlands
Evaluation Grades (%)
1-5
6-10
11-15
16-20
21-25
26-30
31-35
36-40
41-45
46-50
51-55
56-60
61-65
66-70
71-75
76-80
90
13
17
82
65
32
99
95
96
27
42

Peatland), and #46 (Hatham Bog), the first two of these due to exemplary eccentric units and vegetation, and high diversity of peatland type, vegetation, and flora. Hatham Bog's eccentric units are not so exemplary, but the peatland also possesses an outstanding Type 5b bog unit with an intricate system of secondary pools.

Domed bogs with concentric pattern (Types 7a and b) have the greatest range of grades. A few of these grades are the highest of all 76 grades (Figure 14e and j). Three peatlands stand out above all others. These are #42 (Great Heath), #27 (Crystal Bog), and #96 (Thousand Acre Heath). All of these are very large multiple-unit peatlands.

COMPARISON OF OUR PEATLAND EVALUATIONS TO THOSE OF THE MAINE NATURAL AREAS PROGRAM

In 1997 and 1998 we provided site-specific data from 108 Maine peatlands to the Maine Natural Areas Program (MNAP) (Natural Areas Division, Maine Department of Conservation) (Gawler 1998). MNAP adopted our peatland geomorphic-hydrologic classification (Davis and Anderson 1991, in press), peatland vegetation classification (Anderson and Davis 1997, 1998), with modification, and some components of this evaluation method to evaluate Maine peatlands for conservation (protection priority) purposes. However, unlike our approach, the MNAP evaluations of peatland components were qualitative, producing an evaluation of each peatland on an A to D scale ("Overall EOrank"). The MNAP scheme concentrated on the peatland "ecosystem element" (consistent with the Natural Heritage Program guidelines followed by MNAP). This element was construed by MNAP to include peatland size, diversity and other attributes of peatland type and vegetation, peatland morphology and surface patterns, and geographical, geological, and other "landscape" attributes. In addition to these natural qualities, and pristine (or disturbed) condition of the peatland itself, the "landscape context" (degree of human impact on area surrounding peatland) was included in the element. Exemplariness, although judged to be an important attribute of the element (Gawler 1998), was applied only to peatland type, and only when the evaluator was qualified to do so (therefore, not to all evaluated peatlands). Rarity of flora and vegetation played very minor roles in the evaluation scheme, as the

Natural Heritage Program guidelines considered these aspects as outside the community ("ecosystem") element.[12]

The MNAP evaluation scheme (Gawler 1998) first placed peatlands in one of four groups; each group was evaluated by a somewhat different set of criteria. The groups were (1) "Large Peatlands" (generally over 100 ha) (Types 1, 2, 5a & b, 6, and 7a & b in our Table 1) (2) ribbed fens (Type 4; Table 1), (3) kettlehole peatlands (Type 3; Table 1), and (4) coastal plateau bogs (same as "coastal bogs" [Type 8] in Table 1). Rarity and exemplariness of Maine peatlands and their components in national and international contexts, or in individual biophysical zones of Maine were not considered. In Table 13, we compare the MNAP evaluation results to ours.

Of 20 unpatterned fens (Types 1 and 2 in Table 1) evaluated by both systems (Table 13), only one (White Pond Fen) was given an A rank by MNAP. This fen also had the highest grade (38.0%) for unpatterned fens in our evaluations (peatland #102 in Figure 14a and f). For the ten B-ranked fens (MNAP), our grades ranged from 7.5% (#6, Black Brook Pond Fen) to 33.1/29.1% (D_c/N-spp.) (#84, Salmon Brook Lake Fen), and for the nine C-ranked fens, our grades ranged from 5.4% (#35, Eliot Heath) to 28.0/24.0% (#99, Millberry Stream West Branch Fen). The large differences in these grades, and in the scores for important attributes of these fens (Appendix G), indicate meaningful differences in "protection priority" that are obscured by the MNAP system. Likewise, we perceive a significant difference in "protection priority" of the ribbed fens #72 (Number 5 Bog), with a 50.5% grade, and #36 (Ellis Bog), with a 32.6% grade, both ranked A by MNAP. However, a later informal combination of these MNAP ranks (Gawler 1998) with floristic rarity scores (Gawler pers. comm.) brought the results of the two systems into closer agreement.

We find the same kinds of differences when the two systems are applied to bogs (Table 13). The relatively flat inland bogs (Types 5a and b) ranked B by MNAP range from #54 (Kanokolus Bog), with a 27.4% grade, to #10 (Burpee Brook Peatland), with a 15.0% grade. Furthermore, for these types of bogs there appears to be no meaningful relationship between the A-, AB-, and B-ranked bogs, on the one hand, and the grades we assigned to them, on the other hand. For eccentric bogs (Type 6), the wide ranges of grades within A-, AB-, and B-ranks indicate that the MNAP system does not distin-

[12]Although this element was not included by Gowler (1998), it is considered by MNAP in final determination of protection priority for a peatland (Gawler pers. comm.).

Table 13. Comparison of our grades to MNAP ranks (Gawler 1998) by peatland type. Two percentages (D_c/N-spp.) are given for our grades where D_c and N-spp. based grades differ. Rank for each type, after Gawler (1998), is given. Present protection status, if any, is given. Asterisked peatlands were designated by Widoff (1988) as "ecologically significant". + = special consideration (see Table 12).

Peatland Type, Number and Name	Our Evaluation Grade (%)	Special Consid-erations	MNAP Rank	Present Protection Status
Unpatterned Fens (Types 1 & 2)				
102 White Pond Fen	38.0		A	
*84 Salmon Brook Lake	33.1/29.1	+	B	BPL - m
66 Millberry Stream	28.0/24.0	+	C	
81 Rockland Bog	23.5		B	CMLT - h
77 Perley Pond Fen	20.2		B	
1 Alton Bog	19.2		B	
7 Black Pond Fen	18.5		B	
62 Magalloway River	17.5		B	
31 Dottle Brook Fen	16.6		C	
28 Curtis Corner Fen	18.5/16.5		C	
55 Kezar Bog	14.9		B	
98 Umcolcus Dwtr Fen	14.5		B	
44 Greenlaw Stream	18.2/14.2		C	
40 Fowler Bog	13.9		B	
76 Perk Pond Flow Fen	12.7		C	
64 Meadow Brook Fen	12.5	+	C	
21 Clifford Stream Fen	11.4		C	
74 Orson Bog	11.1		B	
6 Black Brook Pond	7.5		B	
35 Eliot Heath	5.4		C	
Unpatterned Fens (Type 3) (S4)				
69 Nollesemic Kettle	38.5/26.5			
78 Pickerel Pond Kettle	21.5/19.0		B	
2 Belgrade Kettles	12.5	+	B	
Ribbed Fens (Type 4) (S3)				
*72 Number 5 Bog	50.5	+	A	FSM - h
*63 Marble Fen	43.5/46.0		A	TNC - m
*25 Cross Lake Fen	43.8		A	BPL - l
29 Deer Lake Fen	32.0/34.4		B	
*36 Ellis Bog	32.6		A	
71 Northeast Carry Fen	32.8/30.8		BC	
9 Burntland Brook Fen	25.9		AB	TNC - m
97 Twelvemile Bog	24.8		BC	
20 Chimenticook Fen	23.7		B	
Relatively Flat Inland Bogs (Types 5a & b) (S4)				
67 Montegail Pond	37.1		B	
19 Chemo Bog	33.3/34.8		B	
*83 Saco Heath	30.3/32.8	+	A	TNC - m
80 Rock Dam Heath	30.0		B	
*43 Great Sidney Bog	28.1	+	B	
*54 Kanokolus Bog	27.9/27.4	+	B	

Table 13. Continued.

Peatland Type, Number and Name	Our Evaluation Grade (%)	Special Consid-erations	MNAP Rank	Present Protection Status
49 Horseback Bog	25.9		AB	
47 Hermon Bog	25.6		B	
60 L Norridgewock	21.6	+	C	
*101 Wells Heath	15.2	+	B	
10 Burpee Brook Ptld	15.0		B	
8 Bog and Union River	10.2		C	
Eccentric Bogs (Type 6) (S3)				
*12 Caribou Bog	69.7/76.2		A	UM - l
61 Macwahoc Stream	59.2		A	
23 Cold Stream Ptld	48.6/52.6		A	TNC - h
46 Hatham Bog	45.8		AB	
99 Vanceboro RR	44.1		B	
22 Coffin Bog	38.1		A	
3 Big Bog	37.8		A	
*88 Smith Brook Dwtr	31.3		A	
93 Stetson Mt Ptld	31.1		AB	
34 Elevenmile Lake	30.0		B	
100 Wadleigh Bog	27.6		AB	
56 Lambert Lake Ptld	27.2		AB	
38 Flinn Pond Ptlds	26.2/25.2		B	
26 Crossuntic Stream	23.0		AB	
59 Lindsey Brook Ptld	20.4		B	
70 Nollesemic Stream	18.6		AB	
*45 Greenville Jct Ptld	18.3		B	BPL - m
50 Inman Bog	15.5		BC	
Domed Inland Bogs (Types 7a & b) (S3)				
*42 Great Heath	79.3/85.0		A	BPL - m, v
*27 Crystal Bog	69.0/77.0		A	TNC - m
*96 Thousand Acre Hth	55.3/59.3		A	
99 Vanceboro RR Ptld	44.1		B	
95 Sweat Bog	44.0		AB	
*65 Meddybemps Heath	38.4	+	A	
32 E Birch Stream Bog	37.3		AB	
82 Rocky Rips Bog	30.7/33.2		A	
17 Cedar Mt N Ptld	27.9		C	
90 Smith Pond Ptld	19.4		B	
13 Caribou Bog, Indian	16.1/17.6		BC	
Coastal Bogs (Type 8) (S3)				
*53 Jonesport Heath	32.5	+	A	
41 Great Cranberry Hth	22.4	+	A	
92 S Trescott Heath	16.8		B	

BPL Bureau of Parks and Lands
FSM Forest Society of Maine
UM University of Maine
m = most or all of the peatland protected
l = < half of the peatland protected
CMLT Coastal Mountains Land Trust
TNC The Nature Conservancy
h = ~ half of the peatland protected
v = voluntary conservation agreement
een TNC and the town of Columbia

guish some meaningful differences, as between A-ranked #61 (Macwahoc Stream Peatland) with a 59.2% grade and A-ranked #88 (Smith Brook Deadwater Bog) with 31% grade, or between AB-ranked #46 (Hatham Bog) with 45.8% grade and #70 (Nollesemic Stream Peatland) with 18.6% grade. Also, there is no consistent difference in grades between MNAP's AB-ranked and B-ranked eccentric bogs. For A-ranked (MNAP) domed bogs (Types 7a and b) there is a great range in grades, from 85% for #42 (Great Heath) to 33.2% for #82 (Rocky Rips Bog). Both these bogs are worthy of protection, but we would assign much higher "protection priority" to Great Heath.

Again, differences in results of the two methods for some of the above peatlands and others (e.g., #66, Millberry) derive from our inclusion of floristic rarity and diversity, and from our greater emphasis on exemplariness and diversity of peatland complex types within the same multiple-unit peatland (e.g., #67, Montegail, #19, Chemo, #46 Hatham, and #99, Vanceboro). The MNAP method is simpler and quicker in application, once sufficient information on a peatland is available, and requires less expertise and prior experience by personnel applying it. However, much depends on personnel quality in the application of both systems.

EVALUATION BY SEPARATE CRITERIA AND CHARACTERISTICS

Totaling the scores for disparate criteria and characteristics obscures separate values that may be of interest or even sufficient, in themselves, for protection of peatlands or other ecosystems (de Groot 1992). An obvious example is the presence of rare species. In this brief section, we emphasize the value of some peatlands with high scores for individual aspects. Highest scoring peatlands for individual factors are listed in Table 14 (based on Appendix G). Large peatlands such as Great Heath, Caribou Bog, Thousand Acre Heath, Crystal Bog, Cold Stream Peatland, and Sweat Bog are among the high scorers in seven or more categories. Some others that score high in only one to four categories are also deserving of protection, like Marble Fen for its rare flora and exemplariness of vegetation and peatland type (ribbed fen), White Pond Fen for its rare and highly diverse flora, and rare and exemplary vegetation, Coffin Bog for its exemplariness of vegetation and peatland type (eccentric bog), and Nollesemic Kettle for its exemplariness of peatland type. Other peatlands with relatively low grades but deserving of special consideration for protection, for reasons given

Table 14. Peatlands with high percent scores (in parentheses) for separate criteria and characteristics. For diversity of flora, the first score is for number of species, the second is for D_c. Peatlands are listed in a category if they have scores in the top two levels (out of five levels) and if their scores are among the top ten in the category. Given this combined restriction, some categories have fewer than ten listed peatlands. Categories with more than ten listed peatlands have ties for tenth place. In each category, peatlands are ordered by score (for diversity of flora: by number of species). Peatlands with the same score are ordered alphabetically as in Table 7. Scores for all categories for each peatland are given in Appendix G.

RARITY

Peatland types

Great Heath (16.5)
Macwahoc Stream Peatland (15.0)
Caribou Bog (14.0)
Vanceboro Railroad Peatland (14.0)
Meddybemps Heath (13.5)
Number 5 Bog (10.5)
Hatham Bog (10.0)
Greenville Junction Peatland (9.5)
Elevenmile Lake Peatland (9.5)
Smith Brook Deadwater Bog (9.5)

Other geology

Caribou Bog (1.0)
Great Heath (1.0)
Hatham Bog (1.0)
Meddybemps Heath (1.0)
Number 5 Bog (1.0)
Rocky Rips Bog (1.0)
Sweat Bog (1.0)
Thousand Acre Heath (1.0)
Big Bog (0.8)
Cold Stream Peatland (0.8)

Vegetation

Caribou Bog (4.0)
Crystal Bog (4.0)
Great Heath (4.0)
Rock Dam Heath (4.0)
Jonesport Heath (2.8)
Vanceboro Railroad Peatland (2.8)
White Pond Fen (2.8)

Flora

Crystal Bog (16.0)
Marble Fen (11.0)

Table 14. Continued.

Salmon Brook Lake Fen (10.0)
White Pond Fen (10.0)
Great Heath (9.5)
Cross Lake Fen (8.0)
Millberry Stream West Branch Fen (8.0)
Rockland Bog (8.0)

EXEMPLARINESS

Peatland types

Crystal Bog (18.0)
Hatham Bog (18.0)
Nollesemic Kettle (18.0)
Caribou Bog (16.5)
Coffin Bog (16.5)
Cold Stream Peatland (16.5)
Great Heath (16.5)
Thousand Acre Heath (16.5)
Big Bog (15.0)
Macwahoc Stream Peatland (15.0)
Chemo Bog (13.5)
Marble Fen (13.5)
Sweat Bog (13.5)

Other geology

Great Heath (2.00)
Thousand Acre Heath (2.00)
Caribou Bog (1.65)
Stetson Mountain Peatland (1.65)
Belgrade Kettles (1.60)
Sweat Bog (1.25)
Big Bog (1.20)
Cold Stream Peatland (1.20)
Flinn Pond Peatlands (1.20)
Hatham Bog (1.20)
Little Norridgewock Stream Peatland (1.20)
Meddybemps Heath (1.20)
Nollesemic Stream Peatland (1.20)

Vegetation

Caribou Bog (4.0)
Great Heath (4.0)
Macwahoc Stream Peatland (4.0)
Marble Fen (4.0)
Number 5 Bog (4.0)
Saco Heath (4.0)
Thousand Acre Heath (4.0)
Peatland North of Cedar Mountain (2.8)
Coffin Bog (2.8)

Table 14. Continued.

Cold Stream Peatland (2.8)
Cross Lake Fen (2.8)
Crystal Bog (2.8)
Deer Lake Fen (2.8)
Bog East of Birch Stream (2.8)
Smith Pond Deadwater Bog (2.8)
Sweat Bog (2.8)
White Pond Fen (2.8)

DIVERSITY

Peatland types

Caribou Bog (8.0)
Great Heath (8.0)
Vanceboro Railroad Peatland (8.0)
Montegail Pond Peatland (6.0)
Chemo Bog (5.0)
Crystal Bog (5.0)
Ellis Bog (5.0)
Meddybemps Heath (5.0)
Sweat Bog (5.0)
Thousand Acre Heath (5.0)
Macwahoc Stream Peatland (5.0)

Other geology

Great Heath (2.0)
Number 5 Bog (1.4)
(19 peatlands scored 0.6; see Appendix G)

Vegetation

Caribou Bog (6.0)
Crystal Bog (6.0)
Great Heath (6.0)
Thousand Acre Heath (6.0)
(17 peatlands scored 4.0; see Appendix G)

Flora

White Pond Fen (12.0, 12.0)
Cold Stream Pond (12.0, 8.0)
Crystal Bog (12.0, 4.0)
Millberry Stream West Branch Fen (8.0, 12.0)
Salmon Brook Lake Fen (8.0, 12.0)
Thousand Acre Heath (8.0, 12.0)
Northeast Carry Fen (8.0, 10.0)
Black Pond Fen (8.0, 8.0)
Macwahoc Stream Peatland (8.0, 8.0)
Number 5 Bog (8.0, 8.0)
Perley Pond Fen (8.0, 8.0)
Rockland Bog (8.0, 8.0)

in Table 12, are Salmon Brook Lake Fen, Great Sidney Bog, and Saco, Jonesport, and Great Cranberry Island Heaths.

RECOMMENDATIONS

In this technical bulletin we refrain from making specific recommendations for protection of individual peatlands. However, in the individual descriptions (Appendix B) of some high-grade peatlands we elaborate on the reasons why they should be afforded protection or increased protection. Some high-grade peatlands are already afforded some level of protection, and others are not (Table 13). We hope that our results will be useful to government agencies and private organizations involved in the selection and designation of natural areas and in the protection of outstanding wetlands.

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APPENDIX A

Appendix A. Geologic/geomorphic features other than peatland type at 92 Maine peatlands. See Table 2 for definitions of feature numbers and Table 7 for data sources.

No.	Name	Geologic/Geomorphic Features 1	2	3	4	5	6	7	8	9	10	11	12	13	No. Different Features
1	Alton Bog	2				1					4				3
2	Belgrade Kettles					1		3							2
3	Big Bog	1				1					1				3
4	Big Meadow Bog														4
6	Black Brook Pond	4	1								8				3
7	Black Pond Fen	2	1					1			1				4
8	Bog and Union R	2									1				2
9	Burntland Brook	1									1	1			3
10	Burpee Brook Ptld	3													1
11	Call Bog														3
12	Caribou Bog	1	2								10	2			4
13	Caribou Bog, Indian	1		1							3			1	4
14	Carlton Pond East														2
15	Carlton Pond West														2
17	Cedar Mt N Ptld	1		1											2
19	Chemo Bog	2									3				2
20	Chimenticook Fen														0
21	Clifford Stream	1									2				2
22	Coffin Bog	1									1				2
23	Cold Stream Ptld	2				1					1	1			4
24	Crawford Lake Bog														2
25	Cross Lake Fen	1									1				2
26	Crossuntic Stream	1									1				2
27	Crystal Bog	1	1								1	1		1	5
28	Curtis Corner Fen	1	1			1									3
29	Deer Lake Fen		1					1			6			1	4
30	Dollar Pond Fen	1	1			1					1				4
31	Dottle Brook Fen	2	1								1				3
32	E Birch Stream Bog	3	3								1	1			4
34	Elevenmile Lake	1	1								1				3
35	Eliot Heath	1									1				2
36	Ellis Bog	1									3				2
37	Etna Bog														2
38	Flinn Pond Ptlds	1	1			1									3
39	Fourth Machias Lake														3
40	Fowler Bog	1									1				2
41	Great Cranberry Hth									1	1	1			3
42	Great Heath	2	1			1			1	1	1	1			7
43	Great Sidney Bog	1									3				2
44	Greenlaw Stream	2									2				2
45	Greenville Jct Ptld	1				1					1				3
46	Hatham Bog	1		1							1	1	1		5
47	Hermon Bog	1									3				2
48	Holland Pond Ptld														4

No.	Name	Geologic/Geomorphic Features 1	2	3	4	5	6	7	8	9	10	11	12	13	No. Different Features
49	Horseback Bog	1				1					2	2			4
50	Inman Bog					1					1				2
53	Jonesport Heath	1									1	1			3
54	Kanokolus Bog	1				1									2
55	Kezar Bog	2	1												2
56	Lambert Lake Ptld	1			1						1				3
57	Lamb's Dwtr Bog														4
58	Limestone NE Bog														1
59	Lindsey Brook Ptld	1									1				2
60	L Norridgewock	1	1			1		1			1				5
61	Macwahoc Stream	1				1					1				3
62	Magalloway River	2		1				1							3
63	Marble Fen										4			1	2
64	Meadow Brook Fen	1				1					3				3
65	Meddybemps Heath	6	1			1					5	3			5
66	Millberry Stream	1													1
67	Montegail Pond	1	1					1		1			1		5
69	Nollesemic Kettle	1	1			1		1							4
70	Nollesemic Stream	1				1			1		1				4
71	Northeast Carry	2										1			2
72	Number 5 Bog	2	4	2							6	1			5
73	Orchard Bog														4
74	Orson Bog	1													1
76	Perk Pond Flow Fen	1	3												2
77	Perley Pond Fen	2	1								1				3
78	Pickerel Pond Kettle		1			1		1							3
79	Pierce Lake NW Bog														2
80	Rock Dam Heath														0
81	Rockland Bog	2		1							1				3
82	Rocky Rips Bog	4									8	1	1		4
83	Saco Heath	5													1
84	Salmon Brook Lake	1	1											1	3
85	Sargent Bog														3
86	Sawtelle Heath														5
88	Smith Brook Dwtr	1	1												2
90	Smith Pond Ptld	3									1				2
91	S Princeton NE Bog														2
92	S Trescott Heath											1			1
93	Stetson Mt Ptld	1		1							1				3
94	Sunkhaze Stream														1
95	Sweat Bog	4							1		7	4	1		5
96	Thousand Acre Hth	4				1					10	2			4
97	Twelvemile Bog	1													1
98	Umcolcus Dwtr Fen	3	1								1				3
99	Vanceboro RR Ptld	2					1				1				3
100	Wadleigh Bog	1													1
101	Wells Heath								1						1
102	White Pond Fen	1	1												2

APPENDIX B

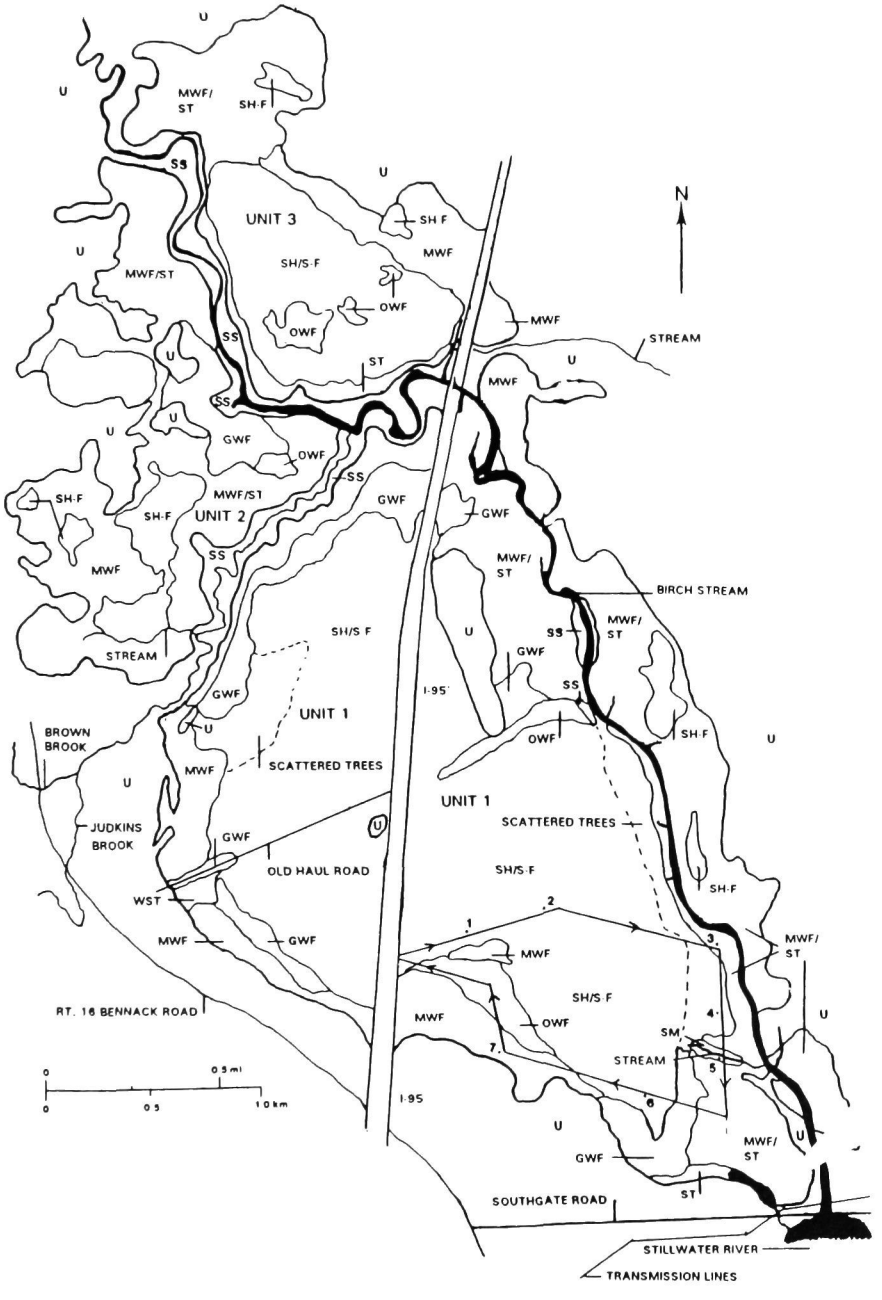
Descriptions of 63 of the 76 evaluated peatlands; the other 13 descriptions (eccentric bogs) were given by Davis and Anderson (1991). Vegetation cover maps of 60 of the 63 described peatlands are given here. Two of these 60 maps (Dollar Pond Fen and Kettle near Pickeral Pond) appear on the same map as Horseback Bog. Maps of Marble Fen, Nollesemic Kettle, and Smith Brook Deadwater Bog are not included here, but appear, respectively, in Sorenson (1986a & b), Davis and Anderson (1991), and Widoff and Ruffing (1984). Map titles ending in 1983 were done by Davis et al. (1983) but not published in their report. These maps are less detailed than the more recent ones. All maps were prepared from 1:16,000 to 1:20,000 black and white air photos, using photo centers as much as possible to minimize radial lens distortion, except for maps of Caribou Bog, Crystal Bog, and Great Heath which were prepared by G. L. Jacobson, L. S. Widoff, D. S. Anderson, R. B. Davis, and Maine Geological Survey from 1:7200 infrared color transparencies. Peatland numbers are from Table 7. Peatland locations are given by number on Figure 1. Names of U.S.G.S. 7½' topographic quadrangles covering each peatland are given under the title of each description. The mostly straight lines bearing number codes (relevé sites) and/or letter/number codes (observation points) on the maps are traverses carried out for vegetation, chemistry, and peat studies. Abbreviations used on the maps are defined as follows:

AG = agricultural (Great Heath only)
AWF = angiosperm wooded fen
Ch = *Chamaedaphne*
D = drainage
DD = drainage ditch
F = fen
F* = ribbed fen
FB = forested bog
FE = fen (1983 peatlands)
FL = fen lawn (1983 peatlands)
G-SH = *Gaylussacia* shrub heath (Great Heath only)
Gr = graminoid
GWF = gymnosperm wooded fen
K-SH = *Kalmia* shrub heath (Great Heath only)
L = lawn (1983 peatlands)
LL = lichen lawn (Great Heath only)
LG = lagg
LST = low shrub thicket
MB = mud bottom
MC = *Chamaedaphne*-moss lawn
ML = moss lawn
MWF = mixed wooded fen
OAWF = open angiosperm wooded fen
OGWF = open gymnosperm wooded fen
OWF = open wooded fen
P = pattern

S = sedge
Sch = *Scheuchzeria*
SH = shrub heath
ShF = shrub (mostly non-ericaceous) fen
S-L-S = *Trichophorum* - lichen - *Sphagnum* lawn (Great Heath only)
SM = streamside meadow
SS = streamside swamp (mineral soil wetland)
ST = shrub thicket
U = upland
WSH = wooded shrub heath
WST = wooded shrub thicket
WT = water track

1. ALTON BOG
Greenbush and Old Town Quadrangles

Alton "Bog" is a very large (~1030 ha), unpatterned, very acidic to acidic fen occupying a flat open basin in the Penobscot River lowland. A representative portion of the southern part of Unit (complex) 1 (see map) was sampled for vegetation, chemistry, and peat stratigraphy. The peat is shallow (generally ~ 1 m deep; maximum of ten probings: 2 m); boulders emerge through it in some places. The peat began accumulating about 5500 ^{14}C yr B.P. (H. Almquist-Jacobson, Univ. Maine, pers. comm.) as open and wooded fen atop soils derived from glaciomarine silt-clay. *Sphagnum* remains are absent below 0.5 m depth; oligotrophication/ acidification had not progressed enough for an abundance of *Sphagnum* until recent time. The peatland is bordered on the southwest by an esker. Birch Stream flows generally south-southeastward through the peatland. The much smaller Brown Brook passes northeastward through the fen and into an eastward flowing bend of Birch Stream. Along much of their courses through the peatland, these streams are narrowly bordered by swamp forest on largely-mineral soil. The southern roughly two-thirds of the peatland (Unit 1), south of Brown Brook and mostly west of Birch Stream, contains the largest expanse of shrub heath and sedge fen vegetation characteristic of very acidic conditions. This complex is bisected, and its drainage and vegetation disturbed by the south to north alignment of U.S. Interstate Highway 95 (I95). Further disturbance on the western side of I95 was caused by a haul road that was used for construction of I95. This disturbance is still evident in the vegetation. Mixed wooded fen vegetation is present on the east side of the stream. The northern third (approx.) of the peatland is split into roughly equal western (Unit 2) and eastern (Unit 3) parts by Birch Stream. Unit 2 vegetation consists of a patchwork of wooded fen and shrub-thicket. Unit 3 contains the peatland's second largest area of open shrub heath and sedge (very acidic fen type). The pore-water in near-surface peat in Unit 1 ranges from pH 4.0 to 4.5, with dissolved calcium from 0.4 to 5.7 mg L^{-1}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SH-F
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UNIT 3
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STREAM
GWF
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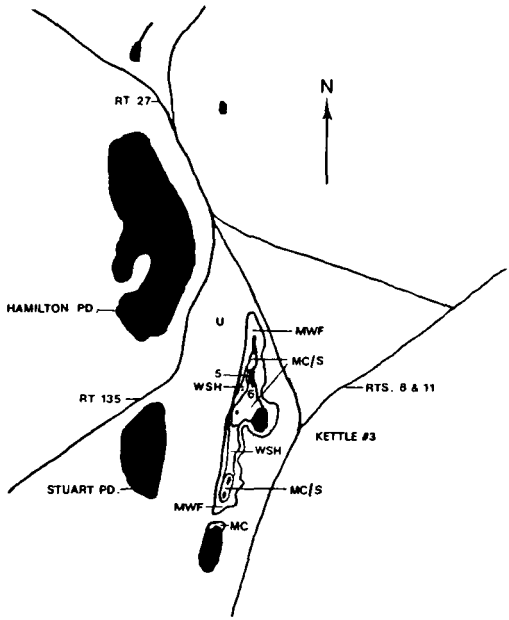
MWF/ST
SCATTERED TREES
UNIT 1
BROWN BROOK
JUDKINS BROOK
OLD HAUL ROAD
WST
RT. 16 BENNACK ROAD
I-95
BIRCH STREAM
SOUTHGATE ROAD
STILLWATER RIVER
TRANSMISSION LINES
N
0 0.5 mi
0 0.5 1.0 km

2. BELGRADE KETTLES
Belgrade Quadrangle

These three very small kettles (ice-block depressions) contain "kettle-hole bogs" with floating mats encroaching centrally located remnants of the lakes that once filled the depressions. The three peatlands are associated with the extensive Belgrade Esker system. They are good examples of their type (schwingmoor), as are several others (e.g., the Colby-Marston Preserve) associated with this esker system. In addition, the system contains numerous kettle lakes, and peripheral to it are large wetlands/peatlands and lakes including Austin Bog and Belgrade Bog which border Great Pond and Messalonskee Lake, respectively. In all, the system contains an impressive array of glacial recessional deposits and geomorphological features. The three studied "bogs" are not true raised bogs, and may best be designated as extreme acidic (poor) fens, as they probably receive some drainage from upland mineral soils (which have developed on base poor, largely granitic deposits). Peat pore-water chemistry (pH 3.6–3.9; Ca 0.4–1.0 mg L^{-1}), as sampled at two sites in each of the three kettles is typical of extreme acidic fens and bogs alike (Davis and Anderson 1991). These small peatlands, while good examples of their type, are otherwise rather ordinary. Their evaluation total score is only 12.5%. However, they occur within a larger context which is of considerable interest, namely a splendid system of glacial features, lakes, and wetlands/peatlands that is readily accessible and close to the human populations centered at Augusta and Waterville. Road construction, gravel extraction, recreational and other developments have compromised, and continue to compromise, the integrity of the system, but most of the features remain largely intact. As such, some creative form of protection, perhaps using a variety of approaches as appropriate to specific areas, should be pursued as soon as possible.


N
RT 27
HAMILTON PD
RT 135
STUART PD.
U
MWF
MC/S
5
WSH
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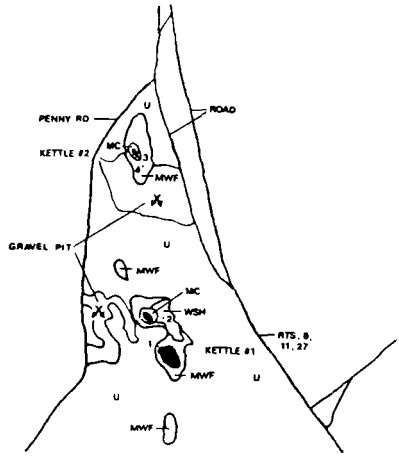
RTS. 8 & 11
KETTLE #3
WSH
MC/S
MWF
MC


PENNY RD
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RTS. 8, 11, 27
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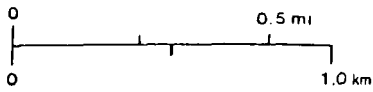
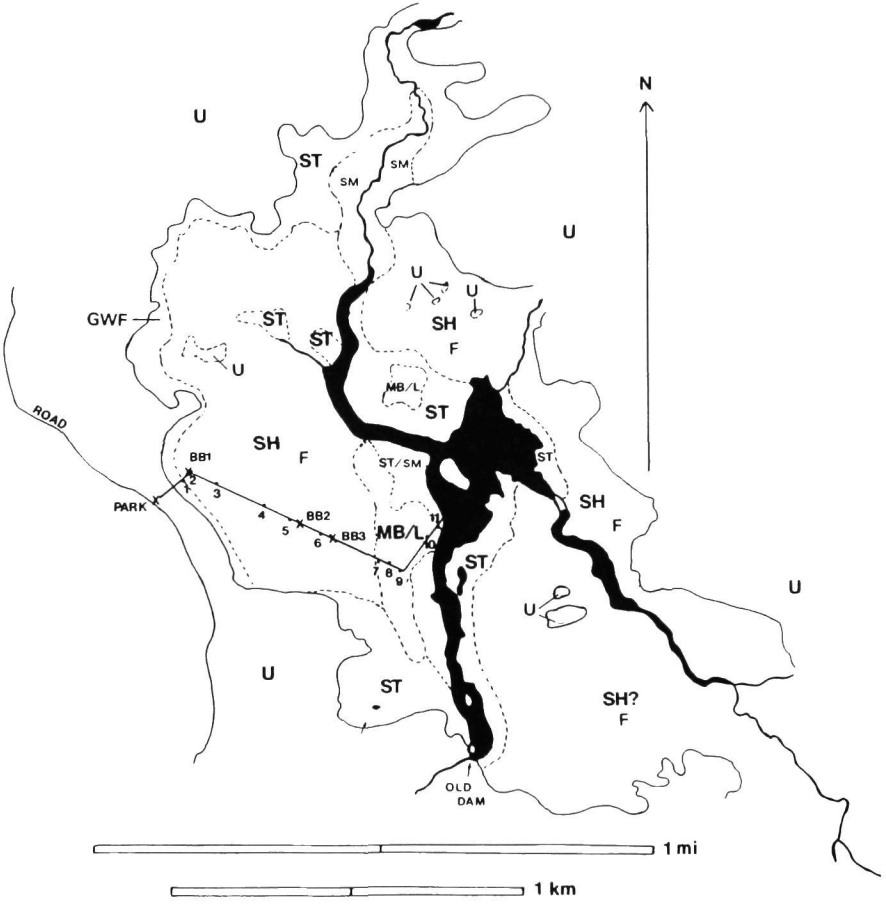

0
0.5 mi
0
1.0 km

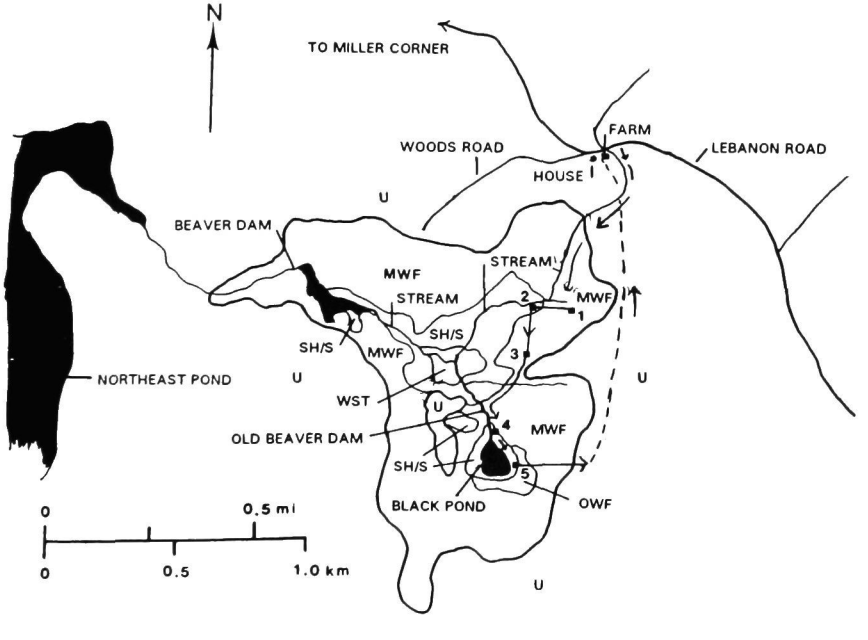
6. BLACK BROOK POND FEN, 1983
Little Bigelow Mtn. and Basin Mountain Quadrangles

The fen around Black Brook Pond in Pierce Pond Twp is a ~320-ha unpatterned basin fen with radiating unpatterned fens in stream valleys. The fen surrounds a primary water body, Black Brook Pond. Black Brook runs through the peatland from the north, into the lake, exits the south side of the lake, and continues southward through the peatland. An old, now non-functional dam is present where the brook exits the peatland. According to Gary Cobb, sporting camp owner at Pierce Pond, the peatland was flooded by this "river driving dam" in the late 1800s or early 1900s. Numerous dead standing snags remain on the peatland as testimony to the effect of the flooding. The peatland vegetation appears to have been greatly disturbed by the flooding, and is still recovering. Although much of the peat is shallow (e.g., the southeastern arm: aver. 5 ft depth [Cameron et al. 1984]), peat is over 20 ft deep around and north of the lake. Many upland "islands" rise above the peat.



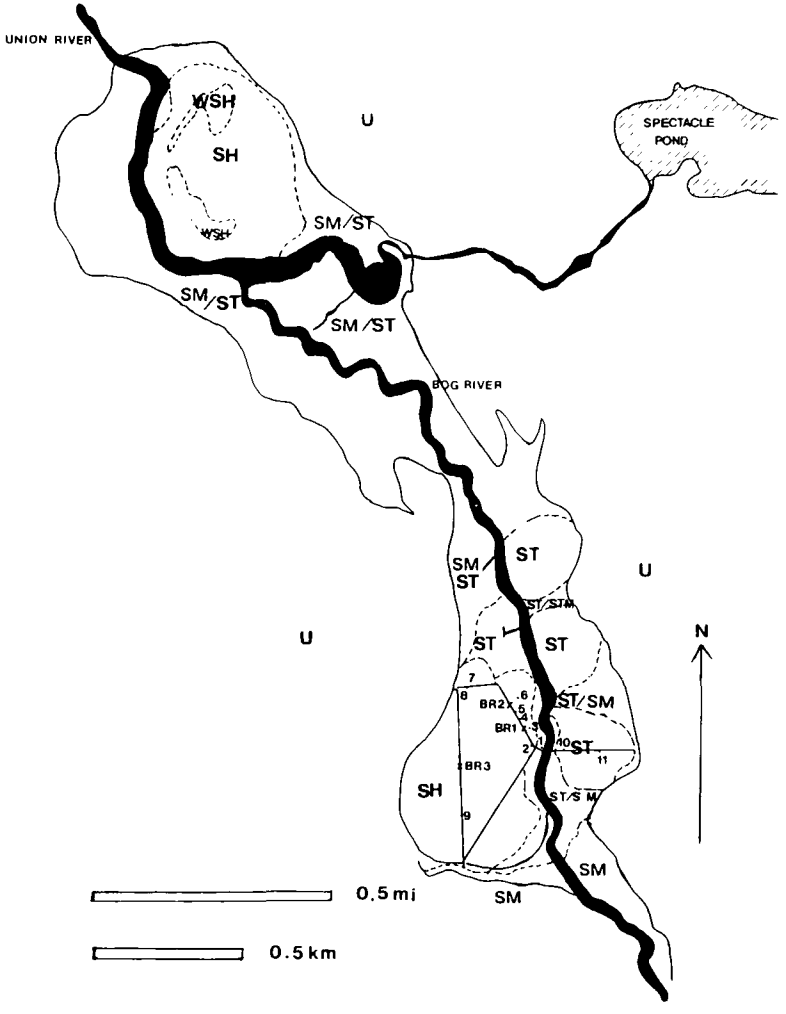
7. BLACK POND FEN
Milton Quadrangle

This ~110-ha unpatterned fen in southern Maine occupies an open basin that drains into Northeast Pond on the Salmon Falls River along the border of New Hampshire. The outlet stream is fed by two main branches. One originates on the upland north of the fen, enters the fen's northeast corner, and flows southwestward to the fen's center where it is joined from the south by the other branch—the outlet stream of Black Pond. Beaver activity was evident along the streams. Black Pond, approximately 1.3 ha area, in the southern part of the fen had been larger in the past, but has been reduced in area by the encroaching fen (process of terrestrialization). However, judging from peat cores at a few locations, much of the fen away from the pond originated by paludification. Near the peatland center and around the pond, the vegetation in 1988 consisted of open areas of shrub heath with abundant sedges. Most of the rest of the peatland had mixed wooded fen vegetation. The relatively southern location of this peatland is reflected by the presence of *Lyonia ligustrina*. Gradients of decreasing pH (~7.3 to ~5.3) and base ion concentrations were found from the periphery to the center of the fen. These relatively high pHs for a Maine peatland are reflected by the fen's relatively high floristic diversity.



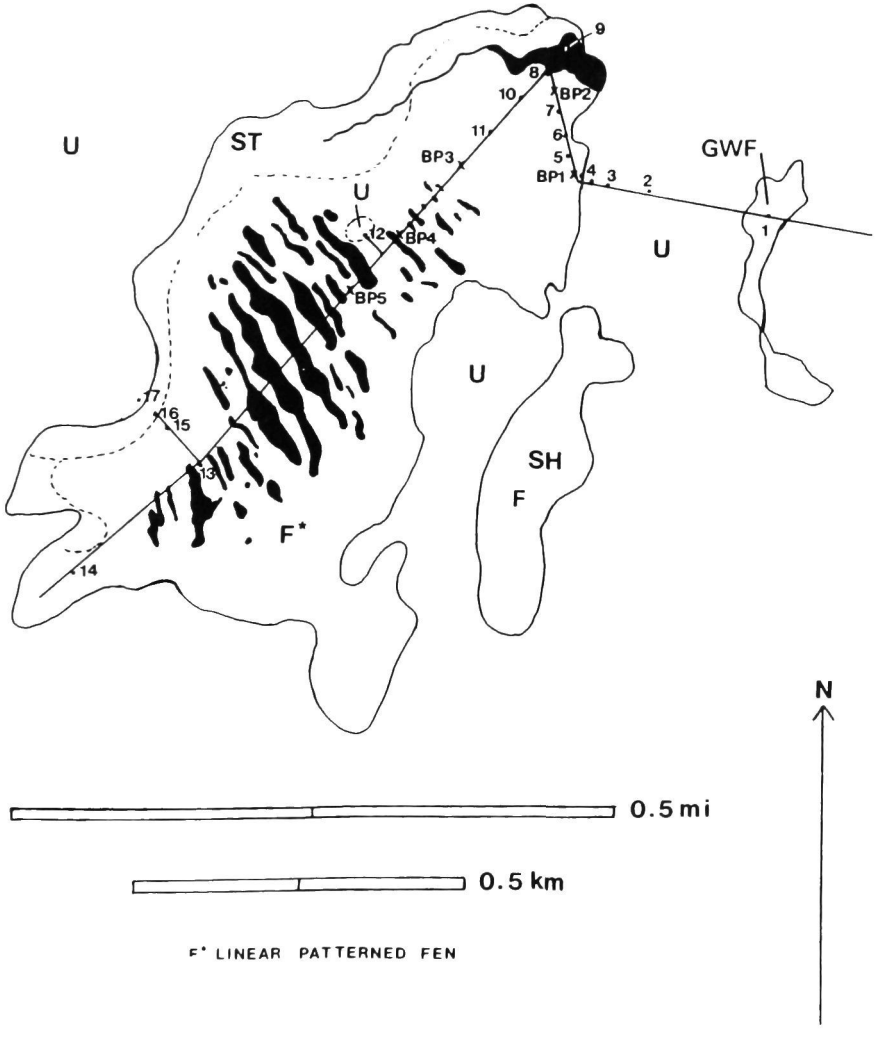
8. BOG AND UNION RIVER PEATLAND, 1983
Amhurst and Eastbrook Quadrangles

The peatland along the Bog and Union Rivers in Osborn (primarily) and Eastbook Twps is an elongate (along river valley), ~200-ha multiple-unit peatland with two featureless gently convex bog complexes and a variety of unpatterned open fens. Ledge Falls Dam, now roughly 100 m downstream from the peatland, may have once flooded all or part of of the peatland. The peatland narrows and pinches out at its south (upstream) end, where a woods road crosses at "Stone Dam," south of which another, similar multiple-unit peatland (not studied) is present along the Bog River in Eastbrook Twp. The studied peatland is unexceptional in all respects.



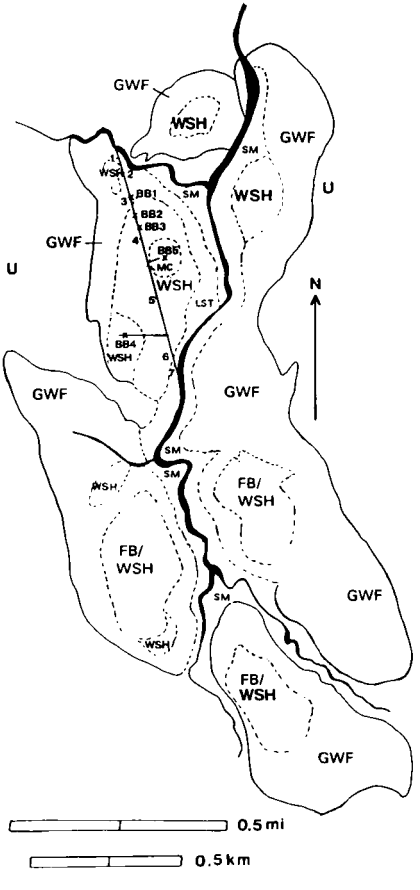
9. BURNTLAND BROOK FEN, 1983
Beaver Pond Quadrangle

Burntland Brook Fen, in T11R17 WELS in northwestern Maine is at the head of a small tributary of Burntland Brook. It is a ~35-ha peatland consisting of a ribbed fen and a much smaller, barely connected unpatterned fen in an open basin. The main complex is a very fine, but not truly exceptional example of a ribbed fen in Maine. Observations from small aircraft in late June 1982, a dry period, indicated that most of the flarks lacked standing water. The LURC air photos used to map the peatland indicated water filled flarks.



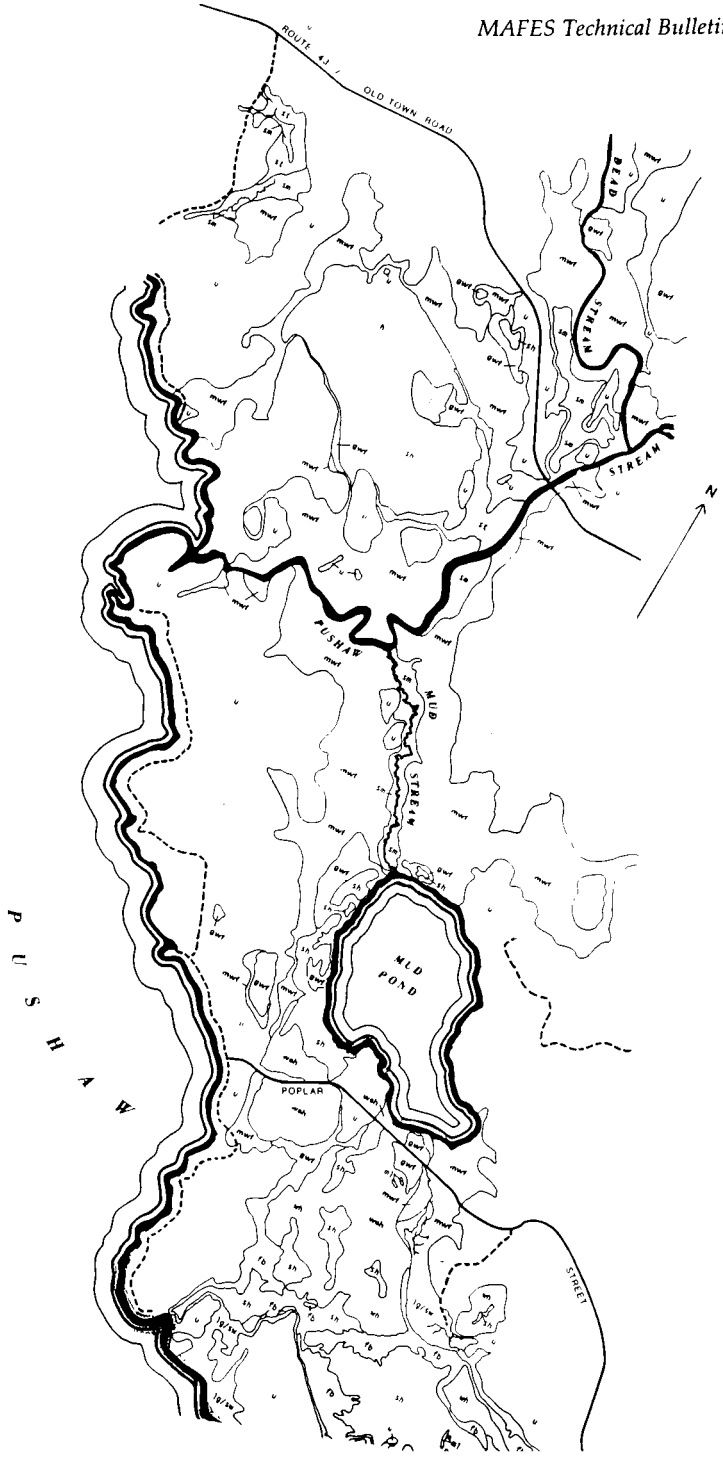
10. BURPEE BROOK PEATLAND, 1983
Ashland and (a little) Portage Lake East Quadrangles

Burpee Brook Peatland in Ashland, with a small part extending northward into T13R5 WELS, is a ~300-ha multiple-unit peatland of elongate shape surrounding the brook, its southeastern tributary, and the terminal part of a northwestern tributary. The peatland is largely a black spruce wooded fen. However, five (or six) ovoid areas of more open forest of lesser stature, with areas of wooded shrub heath and shrub heath, are present. These areas appear to be transitional to raised bogs. Peat depths in these areas are limited to 2.1–3.4 m (7–11 ft) with clay-peat mixture underneath (Cameron et al. 1984), too shallow to be typical of ombrotrophic peatlands, except for some blanket bogs. The most open complex, with deepest peat, is on the west side of the brook, just south of the northwest tributary. It is dominated by a gently convex bog (without concentric pattern). An old log driving dam, no longer functional, at the head of the deadwater part of the brook, may have raised the water level in the peatland.



12. CARIBOU BOG
Old Town, Pushaw Lake, and Veazie Quadrangles

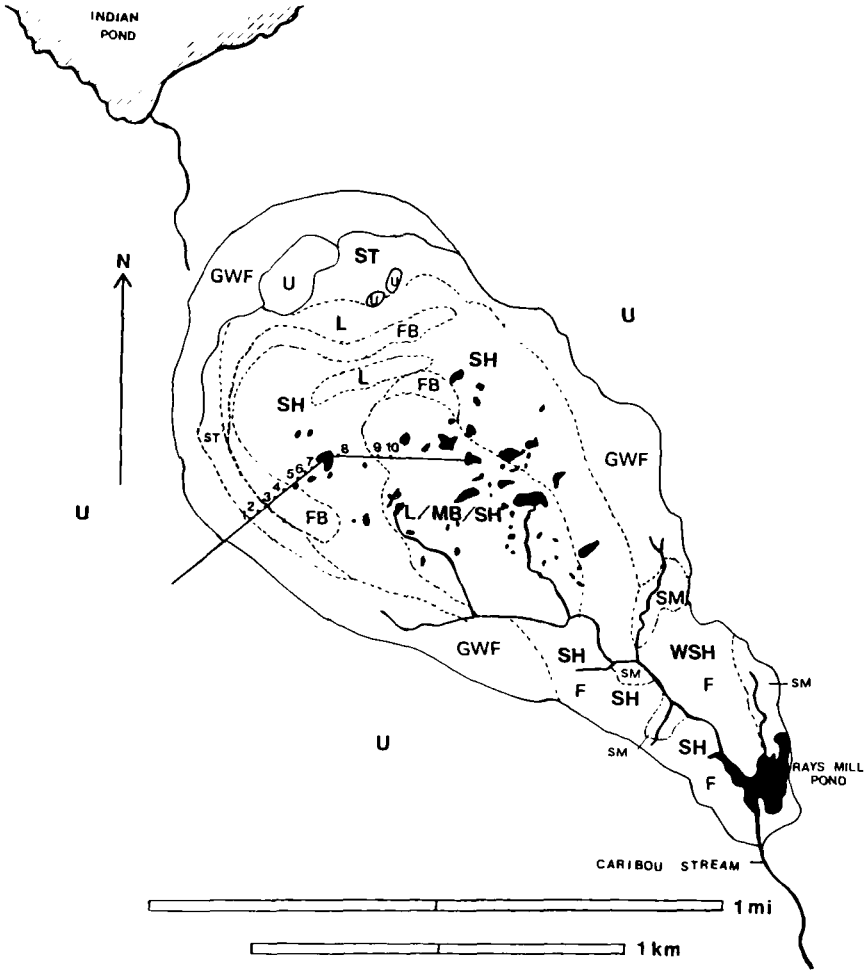
Caribou Bog, also known locally as Bangor Bog and Orono Bog, is a very large multiple-unit peatland by Maine standards, located south to north in the towns of Bangor (a small area), Orono, Old Town, Hudson, and Alton. The studied part in the aforementioned towns, extending S-N at least 17 km, excludes Whitten Bog, east of Dead Stream in Alton, which is really part of the same multiple-unit peatland. Without Whitten Bog (~215 ha), and excluding lakes and upland inclusions, the peatland covers ~2200 ha. Much of the length of the peatland parallels, and is just east of, Pushaw Lake. On the east, part of the peatland is bordered by Mud Pond, a ~140-ha lake whose outlet, Mud Stream, passes through the peatland and empties into Pushaw Stream. The latter stream flows for about 4½ km through a northern part of the peatland. The peatland and associated lakes are in the Penobscot River lowlands and largely underlain by glaciomarine clay-silt. The peatland contains several raised bog complexes, some of them coalesced with each other, surrounded by extensive gymnosperm, angiosperm, and mixed wooded fens. At least two of the bog complexes have an eccentric arcuate pattern of secondary pools (one complex) and/or hollows alternating with ridges. The fan-shaped complex with extensive pool development centered about 1 km north of the Orono Landfill has been subjected to leveling study (GPS) in 1999, confirming that it is an eccentric bog. As such, it is an outlier of the mapped area of eccentric bogs in Maine (Figure 3) starting 35 km to the northeast, and was not included by Davis and Anderson (1991). The peat under central parts of the raised bogs is at least 8 m deep (Cameron et al. 1984). The other bog complexes lack pattern. Several open fen areas are present, at least one of which has parallel features and may be a ribbed fen. There are two well-defined water tracks draining raised bog complexes toward Pushaw Lake. The vegetation of Caribou Bog is extremely diverse and includes a full array of Maine peatland vegetation types (17), only lacking three strictly coastal types. However, the diversity of flora is not nearly comparable to Crystal Bog with its much wider range of chemical conditions. Five vascular plant species considered rare or very uncommon in Maine are now known to occur in Caribou Bog, including *Arethusa bulbosa, Betula pumila*, *Carex livida* and *C. tenuiflora*, and *Cypripedium reginae*. Given the only 54-hour survey and the great size of the peatland, additional rare species may have been overlooked. Caribou Bog is one of the few most outstanding peatlands in Maine. Map from Jacobson, Widoff, Davis, and Anderson (unpublished). Map on pages 80–81.


ROUTE 43 / OLD TOWN ROAD
REAR
STREAM
STREAM
N
PUSHAW
MLD
STREAM
MLD
POND
POPLAR
STREET
PUSHAW


L A K E
N
STREET
FOREST
AVENUE
GROND
LANDFILL
STILLWATER
AVENUE
KILOMETERS
METERS
1000
2000

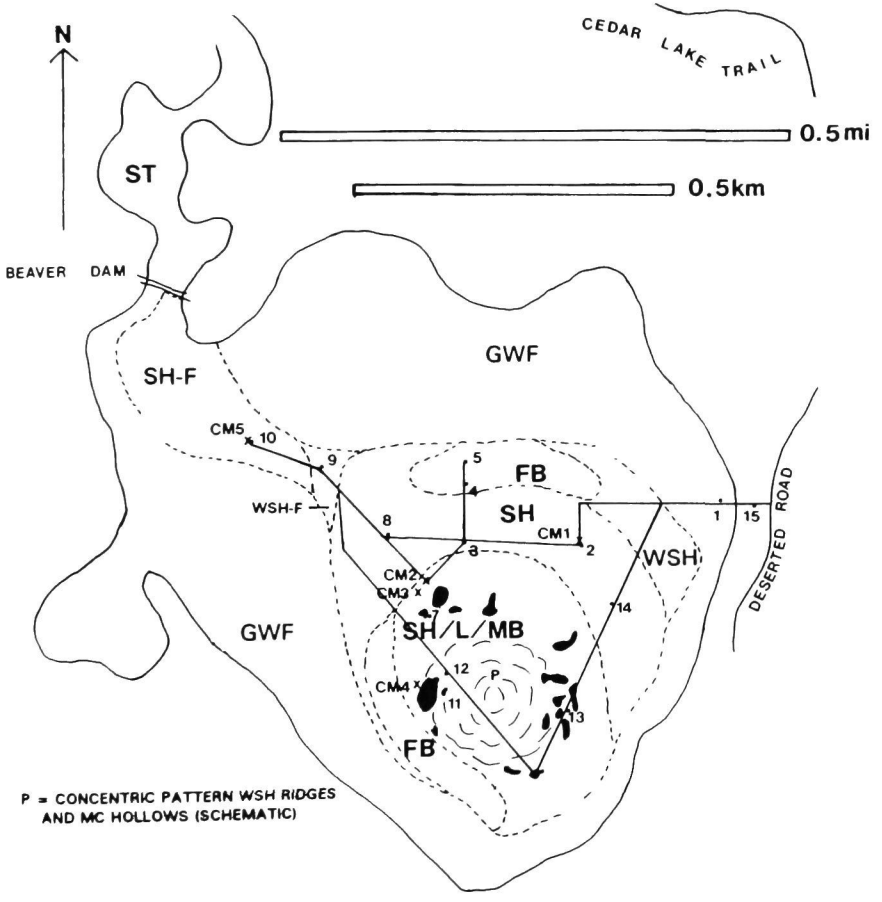
13. CARIBOU BOG NEAR INDIAN POND, 1983
Barren Mountain East Quadrangle

Caribou Bog south of Indian Pond in T7R9 NWP is a ~130-ha concentrically patterned domed bog. The concentricity is most apparent around the edges of the dome. The top of the dome has numerous secondary pools arranged chaotically. Between the pools the vegetation consists of moss lawns, mud bottoms (where pool water level has diminished), and shrub heath. The dome is surrounded by gymnosperm wooded fen. The low part of the peatland, toward the outlet stream, had been disturbed by a dam that raised the water level. The extent to which this disturbance still alters the hydrology of the dome is unknown.



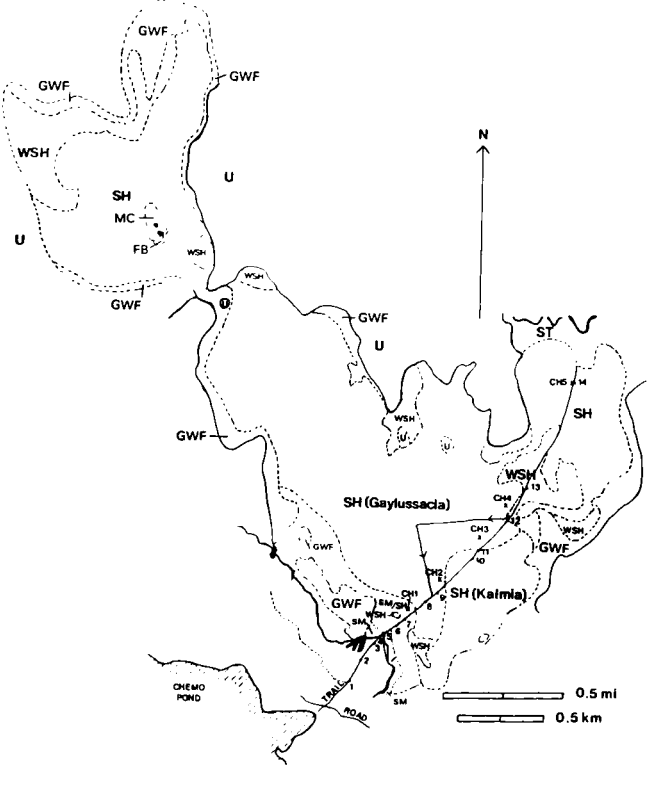
17. PEATLAND NORTH OF CEDAR MOUNTAIN, 1983
Cedar Lake Quadrangle

The Bog North of Cedar Mountain in Long A Twp is a fine example of a small (~65 ha) concentric bog. A well-defined dome with concentric arrangement of secondary pools and moss lawns in hollows, separated from each other by ridges of shrub heath and wooded shrub heath, is located near the southeast end of the bog. The northwest slope exhibits several additional pools before bottoming out into a fen. The outlet stream area of the fen has been slightly flooded by a beaver dam, which may have caused more extensive flooding of the fen in the past.



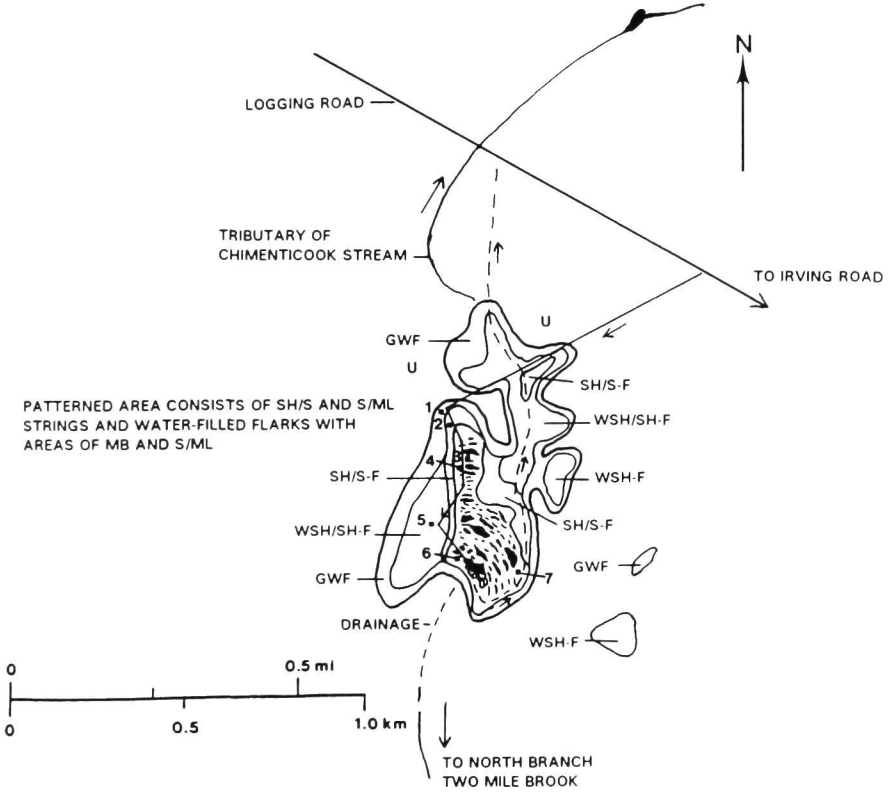
19. CHEMO BOG, 1983
Chemo Pond Quadrangle

Chemo Bog in Bradley Twp, with a small area in Clifton Twp, is a large (~780 ha) multiple-unit peatland in the Penobscot River lowlands. The peatland is part of a larger multiple-unit peatland that continues northward along Great Works Stream and encompasses Number 16 Swamp. As a northern limit for Chemo Bog along the stream, we adopted the same boundary as Cameron et al. (1984), namely 1.9 km south of the northern edge of the U.S.G.S. Chemo Pond 7½' Quad. Chemo Bog contains a very fine example of a large, gently convex bog complex without pattern, perhaps a coalescence of two or three smaller units. A vast expanse of the complex is covered by a rather uniform shrub heath vegetation. Separated from this large complex by a narrow constriction of the peatland on the northwest is another raised bog complex, about half the size of the former. It, too, has a major area of shrub heath, but also contains large areas of wooded shrub heath and forested bog. In addition, it has a small area with two secondary pools and a moss lawn. The ombrotrophic areas of Chemo Bog are surrounded by gymnosperm and mixed wooded fens and, near the streams also by shrub thickets, shrub heath fens, and streamside meadows.



20. CHIMENTICOOK FEN
East Lake SE Quadrangle

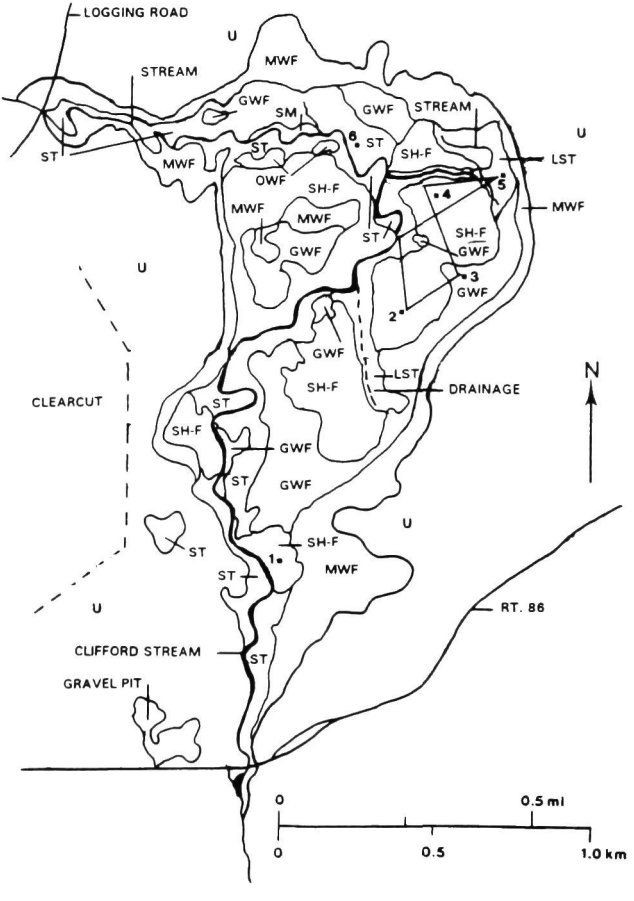
This small ~20-ha headwater fen is located at 419 m a.s.l. in extreme northern Maine about 2.5 km from Québec. The northern third (approx.) of the fen complex is unpatterned and drains northward to Chimenticook Stream. Its vegetation consists of central areas of wooded shrub heath and sedge moss lawn—all surrounded by gymnosperm (largely *Picea mariana*) wooded fen. The southern two-thirds (approx.) of the complex contains a central ribbed area, a fine example of a ribbed fen, that drains southward to a tributary of the North Branch of Two Mile Brook. This patterned area is bordered on the northwest by an unpatterned stretch of shrub heath/moss lawn and on the west by a lenticular unpatterned area of open-wooded moss lawn and shrub heath. The entire south part is bordered by gymnosperm wooded fen. The flora and peat pore-water chemistry indicate that this peatland is a very acidic to acidic ("poor") fen. pH was 4.1 to 4.8 and Ca 0.2 to 1.8 mg L^{-1}



21. CLIFFORD STREAM FEN

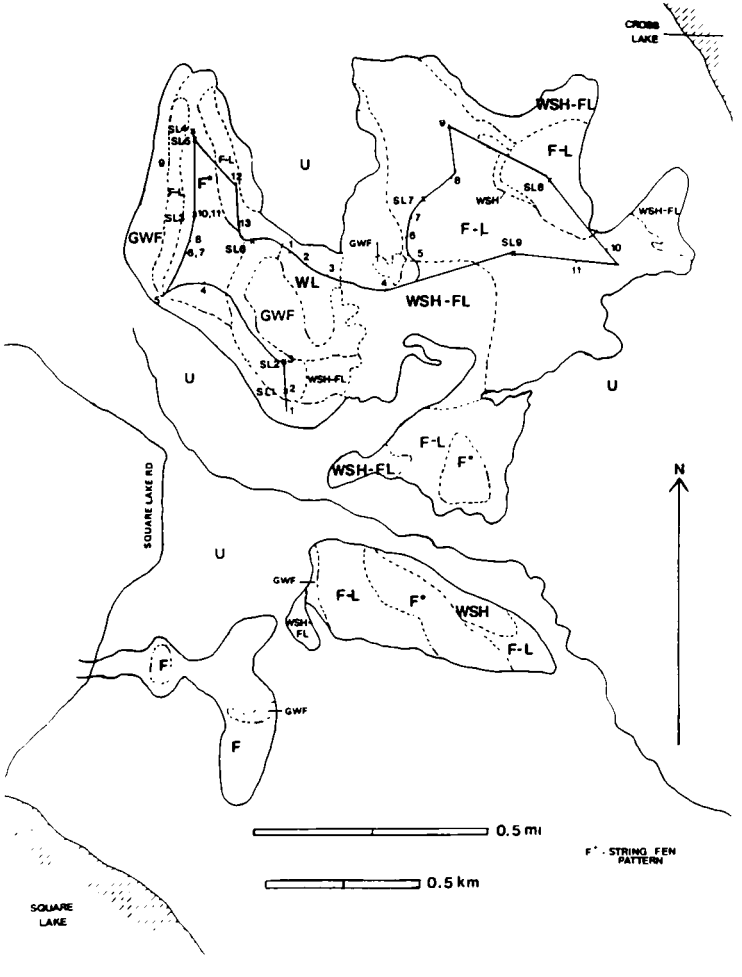
Porcupine Mountain and Long Lake Quadrangles

This ~130-ha unpatterned fen surrounds a stretch of Clifford Stream in NO 14 and Marion Townships. Much of the peatland originated by filling (terrestrialization) of a lake, but some peripheral and upstream areas may have originated by paludification. Shrub thickets and robust shrub heath fens occur close to the stream.These areas contain an abundance of *Rhododendron canadense*, *Photinia melanocarpa*, *Chamaedaphne calyculata*, *Myrica gale*, *Alnus incana* ssp. *rugosa*, *Nemopanthus mucronatus*, and *Spiraea latifolia*. Drier open areas farther from the stream are covered with a lower, more strictly ericaceous shrub heath and a more continuous ground layer of *Sphagnum* spp. These very acidic (extreme poor) fen areas (pH 4.0–4.3), with peat depths largely 2.0 to 3.0 m, appear to be transitional to a raised bog condition.



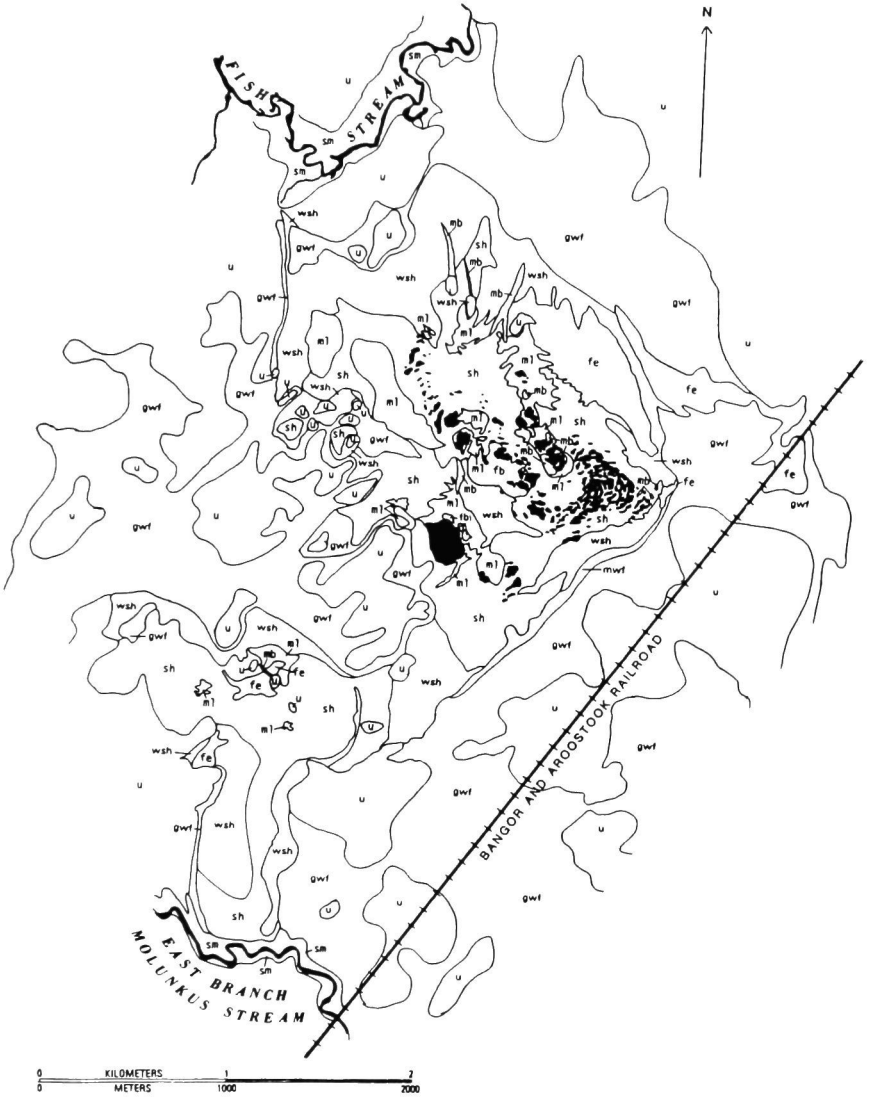
25. CROSS LAKE FEN, 1983
Square Lake East Quadrangle

Cross Lake Fen is in T17R5 WELS and T16R5 WELS (Square Lake) Twps in extreme northern Maine. Only the area east of the Square Lake Road is considered here. The peatland complexes north and south of Black Brook, ~260 and ~190 ha, respectively, were studied during an overflight and from air photos; only the complexes north of the brook were studied on the ground. This peatland ranges from extremely acidic (extreme poor) fen to moderately acidic (poor) fen (Anderson and Davis 1997, 1998), with pH 4.1 to 5.2 (n = 80; an 81st reading pH 6.0), and mean pH 4.69 ± 0.50; and Ca 0.4 to 4.8 mg/L (n = 81), and mean Ca 1.43 ± 0.74 mg/L (Sorenson 1986a and b). At least two areas north of the stream and one south of the stream are outstanding examples for Maine of ribbed fens with numerous flark pools.



27. CRYSTAL BOG
Patten and Crystal Quadrangles

Crystal Bog is a ~1470-ha multiple-unit peatland in the towns of Crystal and Sherman. The core area of this outstanding peatland, also called Thousand Acre Bog, is owned and protected by The Nature Conservancy. The larger peatland occupies the area from Fish Stream on the north, south to the East Branch of Molunkus Stream, and west to the Patten spur of the Bangor and Aroostook Railroad (BARR). The BARR main line passes southwest to northeast through the eastern part of the peatland. About a quarter of the peatland area, largely wooded fen, is east of this line (largely unmapped). The southern half of the peatland, with relatively shallow peat, contains numerous upland islands, a few of them greater than 25 ha each. The northernmost part of the peatland along the railroad is called Crystal Fen. Crystal Fen extends ~600 m east of the railroad. Its northern edge intersects the BARR main line about 200 m south of the automobile road at Crystal Depot. From Crystal Depot, the road runs northward along a distinctive esker (not contiguous with Crystal Bog) that is associated with small peatlands. Only the core area of Crystal Bog, ~630 ha and west of the BARR main line plus the part of Crystal Fen east of the railroad, was studied on the ground and appears on the accompanying vegetation cover map. This core area is only about half of the multiple-unit peatland. As indicated by the wetland delineation on the USGS 7½ quadrangles, other sections of the peatland are located north of Fish Stream (including peatland #30 in Cameron et al. [1984]), east of the railroad and extending southward, and at other peripheral areas including on the west side of the core area. The core area contains two major raised complexes, north and south, connected by a narrow strait of fen with shallow peat. The north complex appears to include two domes at opposite ends of a northwest-southeast axis, with a slightly lower but well-raised peatland surface between the domes (see profiles in Cameron [1975]). The elevational contours of each dome are marked by numerous secondary pools. The eastern slope of the southeastern dome displays a spectacular series of concentrically arranged secondary pools. A large primary pool, surrounded by relatively shallow peat, occurs at the foot of the south slope of the raised portion, and near the strait. The south complex has a more restricted, single dome of peat (see profiles in Cameron [1975]), and lacks permanent secondary pools. The rest (most) of the south complex is flat and classified as fen. Crystal Fen is the most outstanding peatland site in Maine for rare, threatened, and endangered vascular plant species, containing 19 out of 25 such species in our extensive Maine Peatland Database. Overall, Crystal Bog is one of the few most-outstanding peatlands in Maine. Map from Jacobson, Widoff, Davis, and Anderson (unpublished).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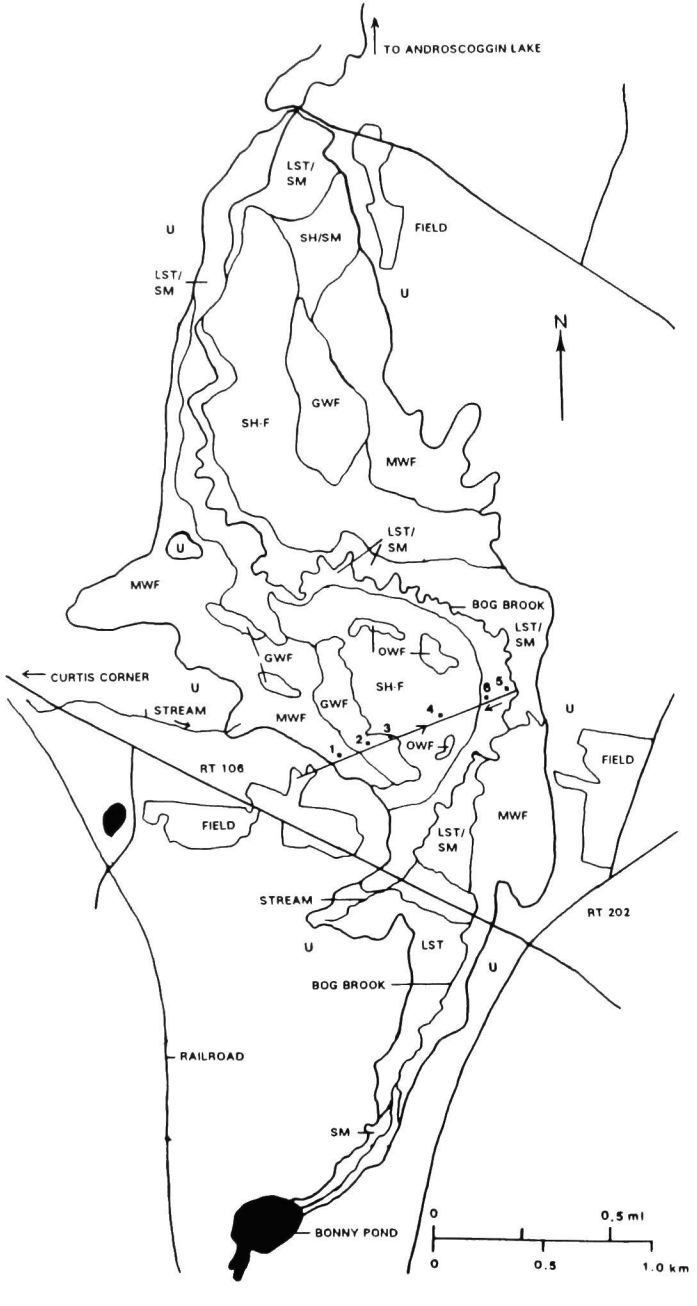
FISH STREAM
EAST BRANCH MOLUNKUS STREAM
BANGOR AND AROOSTOOK RAILROAD
0 KILOMETERS 1 2
0 METERS 1000 2000

28. CURTIS CORNER FEN
Wayne and Monmouth Quadrangles

This ~400-ha peatland surrounds Bog Brook along the Androscoggin/Kennebec County line at Leeds/Monmouth. A major source of water for the fen is the deep glacial till and small wetland south of Bonny Pond. This water flows into the pond and exits (as Bog Brook) from its north end where the peatland begins. Another major water source for the wetland is the esker and glaciomarine sand and gravel deposits on the east. Bog Brook flows generally northward through the fen, and enters Androscoggin Lake 0.6 km after leaving the fen. Parts of the fen near the stream have been flooded for periods of unknown duration, perhaps due to blockage of flow by the road that passes east-west at the north end of the fen. The 1966 USGS 7½' Wayne Quadrangle, based on 1964 photos, shows an elongate lake up to 0.5 km wide, but mostly about less than half that wide, instead of a narrow stream. However, the 1910 USGS 15' Livermore, Maine Quadrangle shows the peatland in unflooded condition, as does the 1 November 1964 air photo from which we mapped the peatland. At the time of our field visit on 4 June 1988 the peatland was unflooded. The vegetation in 1988 of the area flooded on the 1966 quadrangle consisted largely of streamside meadow with much *Carex lasiocarpa* var. *americana*, *C. lacustris*, and *C. stricta*. Farther from the stream, the fen surface rose slightly and the vegetation changed to shrub heath fen or mixed wooded fen. Patches of gymnosperm wooded fen dominated by *Picea mariana* occurred at mid-level surfaces. In the semilunar area of shrub heath fen traversed in 1988 (see plan map), the part south and southwest of the small patches of open-wooded fen was higher and drier, and the peat pore water more acidic (pH 3.7–3.9; Ca 1.0–1.3 mg L^{-1}) than at the low areas close to the stream (pH 6.7–8.2; Ca 3.5–9.2 mg L^{-1}). The shrub stratum of the higher area was dominated by *Chamaedaphne calyculata*, *Kalmia angustifolia*, and *Rhododendron canadense*. The peripheral parts of the peatland were vegetated mostly by mixed wooded fen dominated by *Acer rubrum*, and contained much *P. mariana* and *Thuja occidentalis*. Peat stratigraphic study along the 1988 traverse indicated peat depths averaging about 2 m (max. ~3 m). Cameron et al. (1984) found peat depths generally about 1.5 m along a west-east traverse about 1.5 km north of our traverse. Along our traverse, the peatland appeared to have originated as a mostly open, sedge-rich wetland, with woody plants in some places. Aquatic indicators were sparse. Intermediate peat depths were more woody. Charcoal was detected at these depths in two cores. No *Sphagnum* remains were found in peat at any depth, even at the most acidic open area (relevé 4) where *S. capillifolium* dominated the ground stratum in 1988, suggesting that the present acidic condition at this and perhaps other high areas of the fen have been recent developments.


TO ANDROSCOGGIN LAKE
LST/
SM
U
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MWF
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CURTIS CORNER
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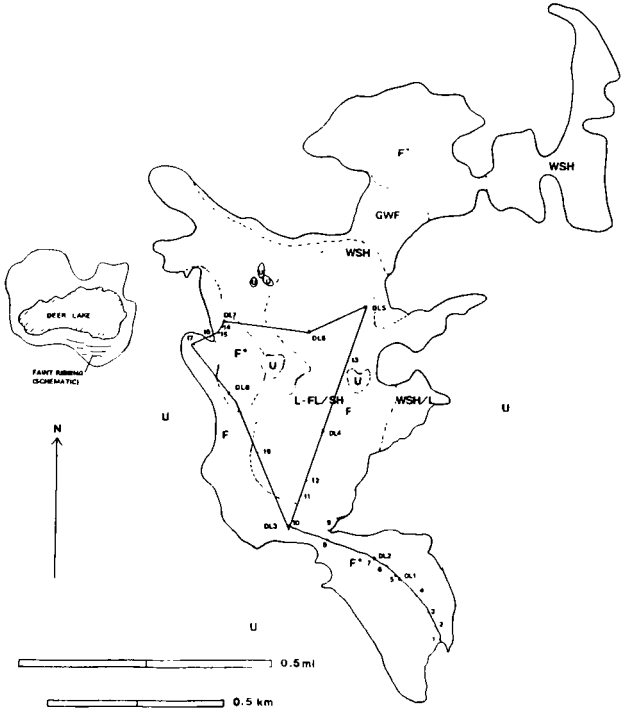
SH-F
STREAM
MWF
GWF
OWF
U
FIELD
RT 106
FIELD
MWF
LST/
SM
STREAM
RT 202
U
LST
U
BOG BROOK
RAILROAD
SM
BONNY POND
0
0.5 mi
0
0.5
1.0 km

29. DEER LAKE FEN, 1983
Hamlin Quadrangle

The peatland between Deer and Mud Lakes in Caswell Plantation in extreme northeastern Maine is a ~123-ha multiple-unit peatland in an area of interbedded pelite and limestone and/or dolostone covered by stagnation moraine. The moraine is covered by extensive areas of peatlands and many small lakes and streams. We include in Deer Lake Fen the very small peatland around Deer Lake itself (an ice-block depression or kettle) and the peatland just east of it and separated from it by a narrow upland. The eastern peatland (~115 ha) has three parts, separated from each other by narrow corridors of peatland: a central part and smaller southeast and northeast parts. The central part has a distinctly patterned ribbed fen area in its northwest corner; the other parts have areas of ribbed fens which are less distinctly patterned. The fens have pH 4.1 to 4.7, and Ca 0.3 to 0.6 mg/L (Sorenson 1986a), which puts them in the very acidic (extreme poor) to moderately acidic (poor) categories (Anderson and Davis 1997, 1998). The northeast expanse of the central part appears to be a slightly raised bog without pattern or pools. The southern expanse may not be sufficiently raised to be strictly ombrotrophic, and is best classified as an unpatterned fen. The moderately diverse flora includes at least three vascular plant species that are rare or infrequent in Maine: *Arethusa bulbosa*, *Betula pumila*, and *Carex wiegandii*.

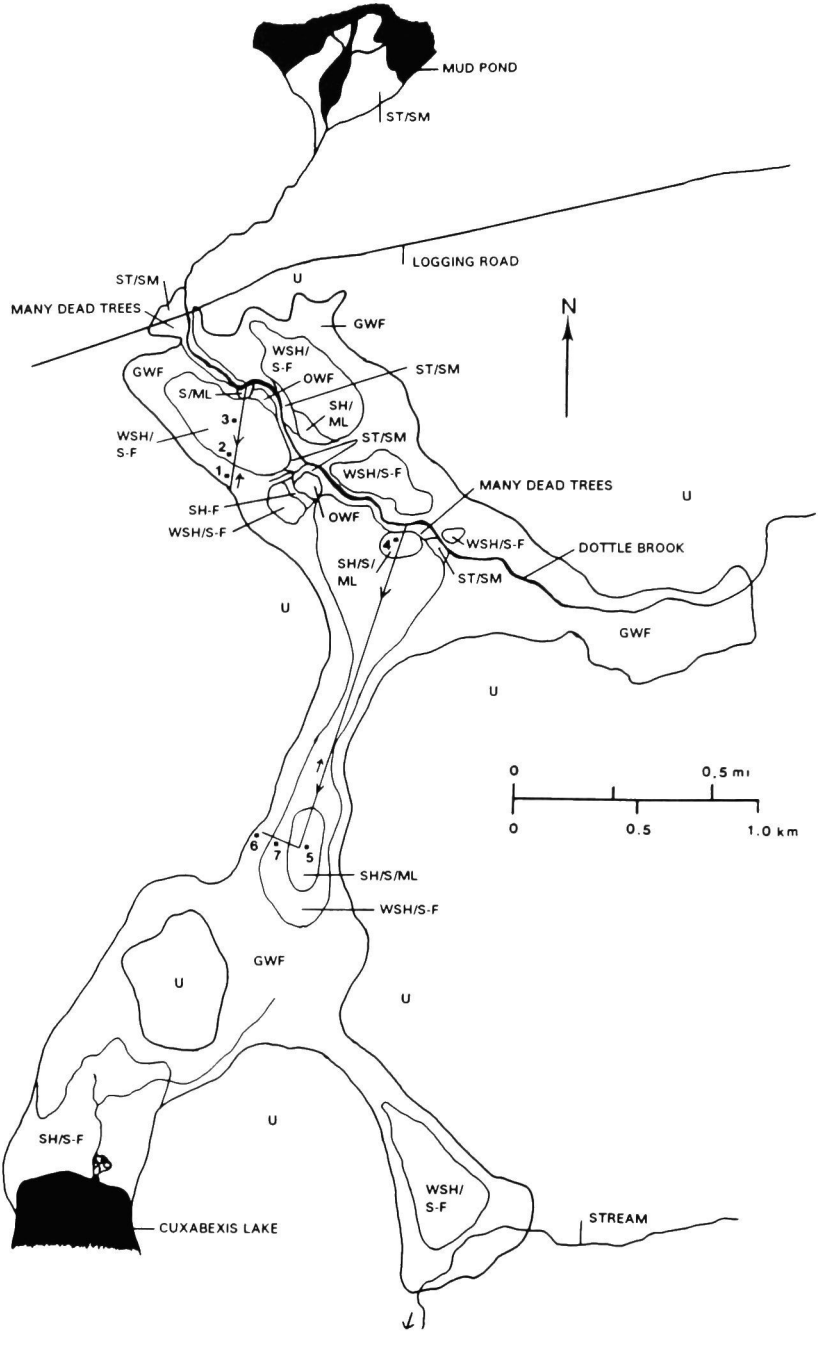


30. DOLLAR POND FEN
The Horseback Quadrangle

Dollar Pond Fen is a small (roughly 30 ha) unpatterned and very acidic (extreme poor) fen adjacent to the Horseback (esker) in T32MD. The pond may occupy a kettle (ice-block depression) associated with the esker, but the peatland appears to spread more widely than a typical kettle would, and may extend to the shore of Sunkhaze Stream. The high value for index of species richness (D_c = 57.7) is an artifact of the very short sampling time, during which 40 plant species common in Maine's acidic peatlands could be tallied quickly. The peatland is ordinary in every way we could determine in a two-hour walk on it. It is shown on the map of Horseback Bog.

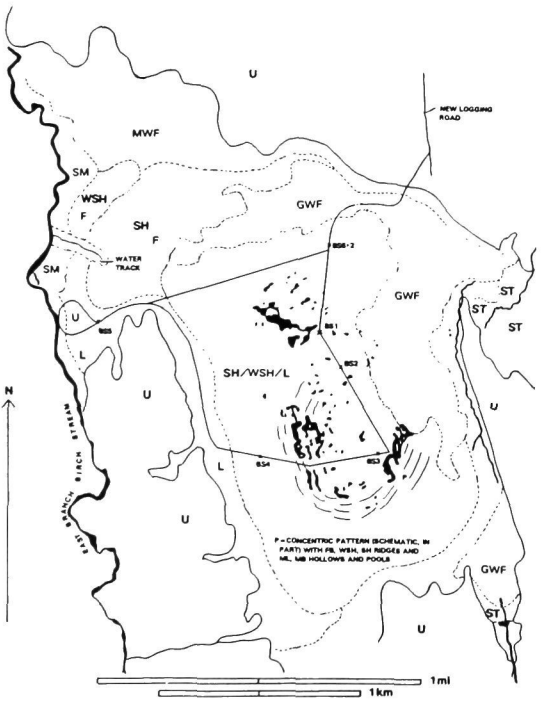
31. DOTTLE BROOK FEN
Mud Pond and Cuxabexis Lake Quadrangles

This ~270-ha unpatterned fen (multiple-unit) is located in north-central Maine, mostly in T6R12 WELS with a small portion in T5R12 WELS. It straddles a narrow drainage divide, with drainage northward via Dottle Brook to Mud Pond and southward via two unnamed streams to Cuxabexis Lake. The part around Dottle Brook consists of five ovoid areas of wooded shrub heath/sedge fen (WSH/S-F), transitional to raised bog, plus one larger WSH/S-F area that stretches through the narrow divide to the Cuxabexis drainage. Farther southward, the fen splits into two arms: the western extending to the north shore of Cuxabexis Lake, and the eastern to a stream that drains toward the northeast shore of the lake. When sampled in August 1988, the WSH/S-F areas had upper peat pore-water pH 3.9–4.2 and Ca 0.36–1.28 mg L^{-1}, and were dominated by *Picea mariana, Kalmia angustifolia, Chamaedaphne calyculata, Carex* spp., and *Sphagnum recurvum* aggr. Small wetter patches of shrub heath/sedge/moss-lawn (SH/S/ML) within the WSH/S-F areas, with pH 4.0–4.3 and Ca 0.14–0.25 mg L^{-1}, were dominated by *S. rubellum, C. calyculata, Carex* spp., and *Eriophorum* spp. The peripheral parts of the peatland were covered by gymnosperm wooded fen (GWF), with pH 6.2–7.5 and Ca 2.88–4.13 mg L^{-1}, dominated by *Thuja occidentalis, P. mariana*, and *Alnus incana* ssp. *rugosa*, with abundant *Carex* spp. and other herbs, *Osmunda cinnamomea*, *Sphagnum* spp. and other bryophytes. At the SH/S/ML center of the peatland at the head of the Cuxabexis drainage, the deepest organic deposit, resting on silt-clay at ~5.5 m depth, consisted of about 1 m of humic lake sediment (dy). This limnic sediment was overlain by peat characteristic of a sedge/brown-moss fen. At a SH/S/ML area close to Dottle Brook, with a total organic deposit of 3.7 m resting on silt-clay with fine sand, the deepest organic material indicated initiation of peatland as limnic sedge fen. At WSH/S-F sites with shallower (2–3 m) peat on silt and/or sand and/or gravel, the deepest peat indicated peatland initiation as semi-wooded sedge fen (paludification). At GWF sites near the periphery of the peatland, with still shallower (1–2 m) peat and varied mineral substrates, the deepest peat indicated peatland initiation as wooded fen (paludification). Cameron et al. (1984), who probed the WSH/S-F areas around Dottle Brook, found peat depths of 3.5–4.5 m. Map on page 94.


MUD POND
ST/SM
LOGGING ROAD
ST/SM
MANY DEAD TREES
U
GWF
N
WSH/
S-F
GWF
OWF
ST/SM
S/ML
SH/
ML
3
WSH/
S-F
2
ST/SM
1
WSH/S-F
MANY DEAD TREES
U
SH-F
OWF
WSH/S-F
4
WSH/S-F
DOTTLE BROOK
SH/S/
ML
ST/SM
U
GWF
U
0
0.5 mi
0
0.5
1.0 km
6
7
5
SH/S/ML
WSH/S-F
GWF
U
U
U
SH/S-F
WSH/
S-F
STREAM
CUXABEXIS LAKE

32. BOG EAST OF BIRCH STREAM, 1983
LaGrange, Howland, S. LaGrange, and Greenbush Quadrangles

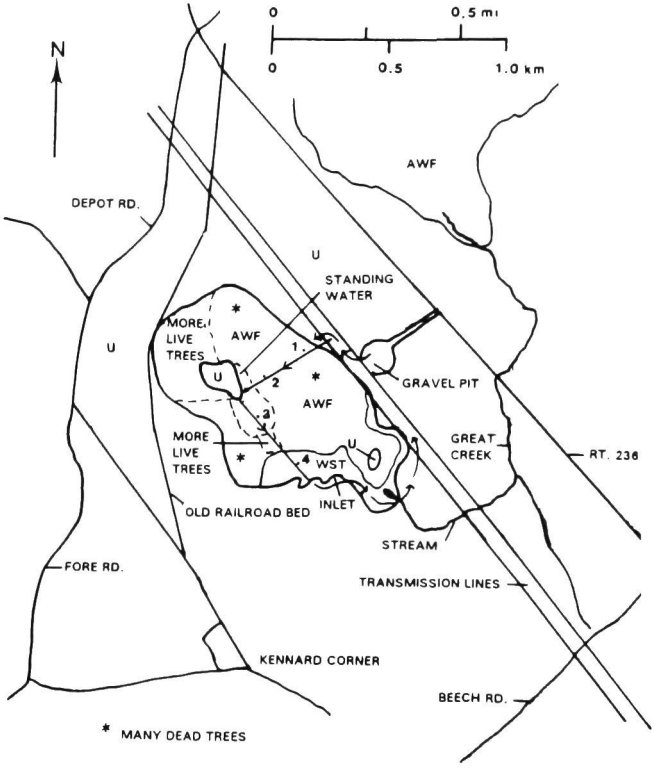
The bog along the East Branch of Birch Stream in Lagrange, Edinburg, and Argyle Townships is a fine example of a concentrically patterned bog with secondary pools. We studied this peatland in 1982 prior to development of our final survey method and, as a result, the plan map is insufficiently detailed, and our floristic survey too brief. The plan map, plus an overflight and the USGS 7½' quadrangles indicate a ~840-ha multiple-unit peatland draining into portions of the East Branch of Birch Stream (EBBS) on the west, Hemlock Stream on the east, and an unnamed tributary of EBBS on the south. We arbitrarily defined this peatland as only the peatland area east of EBBS.[1] Unpatterned fens surround these streams where they pass through the peatland. The raised bog unit occupies the center of the area. It has an ovoid dome, with long axis north-south, and with clear concentric pattern and roughly concentric arrangement of secondary pools on the south part. Concentricity is unclear on the north part. The pools are numerous, between 50 and 100, depending on season and weather. During dry periods, the water level drops below the bottom of many of the pools, leaving mud bottoms surrounded by *Sphagnum cuspidatum* lawns. Between the numerous pools and/or mud bottoms is a complex pattern and various combinations of moss lawn, shrub heath, wooded shrub heath, and forested bog vegetation.



[1]However, it may be considered as part of a much larger multiple-unit peatland that continues west of EBBS and on both sides of a major esker, and includes Sargent Bog and the [illegible] around Holland and Pickerel Ponds.

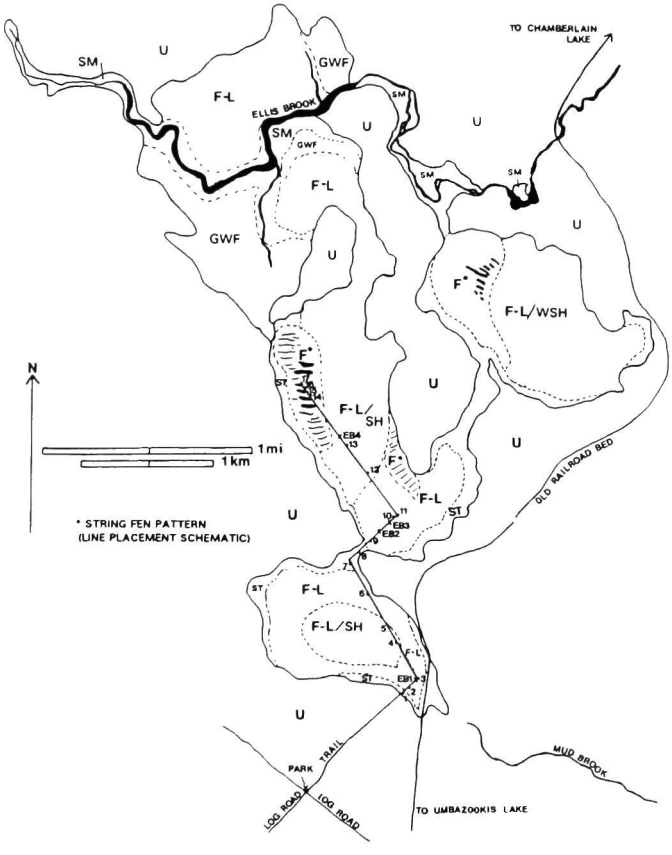
35. ELIOT HEATH
Dover East Quadrangle

This ~65-ha peatland in extreme southern Maine occupies a head-water tributary-basin of Great Creek. The peatland's name suggests a shrub heath vegetation, but on 7 June 1988 when we visited it, the vegetation largely consisted of angiosperm (largely *Acer rubrum*) wooded fen and *Ilex* shrub thicket. The presence of *Lyonia ligustrina* and *Ilex laevigata* reflect the relatively southern location of this peatland. A large number of dead trees, probably killed by flooding and most numerous at the northern half of the fen, were seen. There was 0.1 to 0.5 m of surface water in most places. The considerable influence of waters originating from mineral substrates is indicated by the relatively high pH (7.7–8.1) and base cation concentrations in the pore water of the upper peat. Cores taken at the four widely spaced relevé sites indicated that the peatland is underlain by glaciomarine silt-clay, over which is lake sediment. The lake sediment is overlain by peat indicative of open fen succeeding to wooded fen. If heath-like vegetation was present when the peatland was named, its existence was brief, as the top 30 cm of peat, and the peat around 90 cm depth failed to indicate such vegetation, and no *Sphagnum* remains were found.



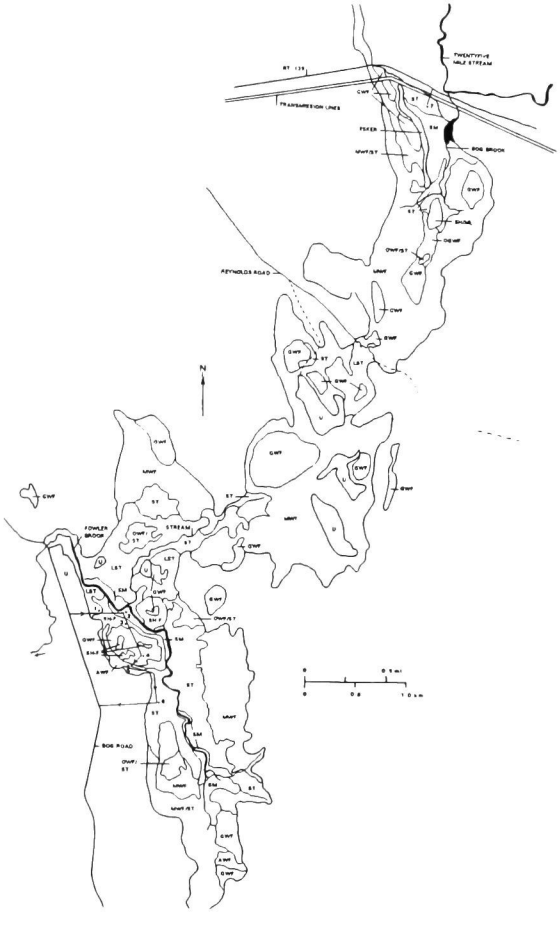
36. ELLIS BOG, 1983
Longley Pond and Mud Pond Quadrangles

Ellis Bog in T7R13 WELS and T6R13 WELS in northwestern Maine is a ~640-ha multiple-unit peatland with four major complexes. The eastern complex probably contains a gently convex raised bog (lacking secondary pools), and has the deepest peat (Cameron et al. 1984); the other three appear to be slightly raised (transitional) but still fens. Three ribbed fens are present at the periphery of the units: (1) west side of central complex, (2) southeast side of central complex, and (3) west side of eastern complex. The eastern complex is a very fine example of a ribbed fen for Maine. These three fens are described by Sorenson (1986a). He also gives chemical data indicating that the fens are very acidic (extreme poor) to moderately acidic (poor). This chemistry does not support a great floristic diversity, even when considered together with the raised and transitional areas, and the surrounding gymnosperm wooded fens. Only one relatively rare (in Maine) vascular plant species (*Betula pumila*) was found at Ellis Bog.



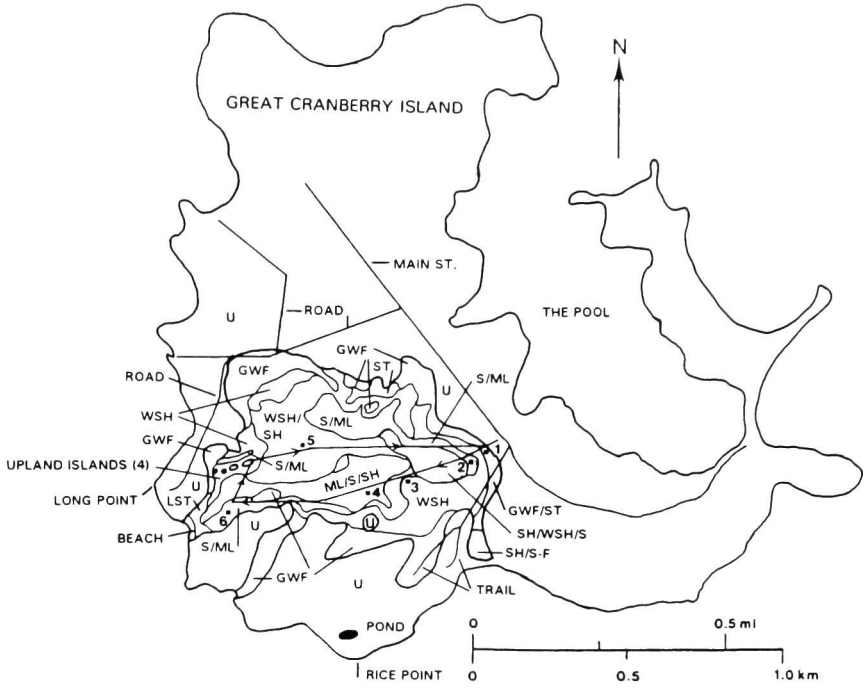
40. FOWLER BOG
Albion Quadrangle

Fowler Bog is an unexceptional fen in Albion and Unity. The "bog" proper, as mapped by Cameron et al. (1984) covers 338 ha. Our plan map adds an additional part of the same multiple-unit peatland that extends north-northeastward to Maine Route 139, both parts totalling ~600 ha. The peatland occupies stream valleys. The vegetation consists largely of mixed wooded fen, a variety of shrubby fens, and streamside meadow, with gymnosperm wooded fen on a few slightly raised (but still fen; not true raised bog) areas. One of these areas, west of Fowler Brook and across from the stream entering the brook from the north, was sampled. Except for one relevé site in gymnosperm wooded fen, with very acidic (extreme-poor) fen character, the area and surrounding fens are all moderately acidic and circumneutral.



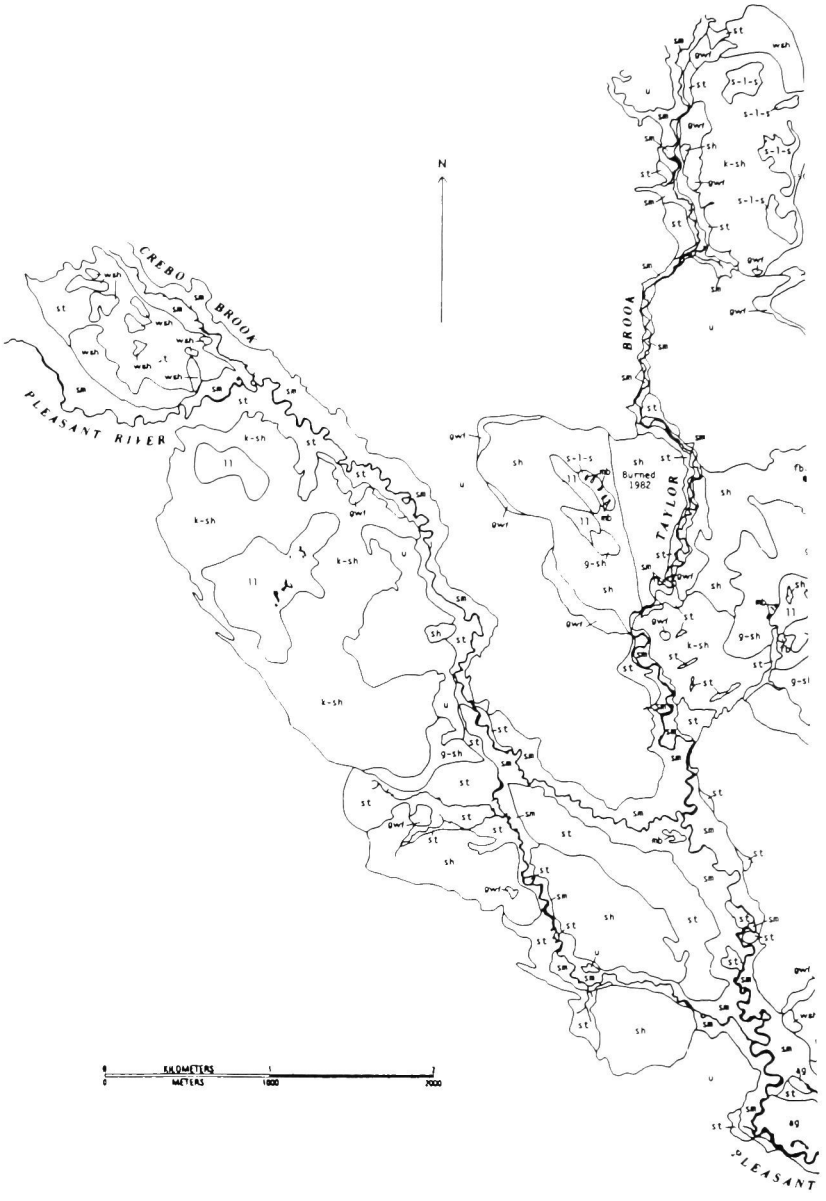
41. GREAT CRANBERRY ISLAND HEATH
Bass Harbor Quadrangle

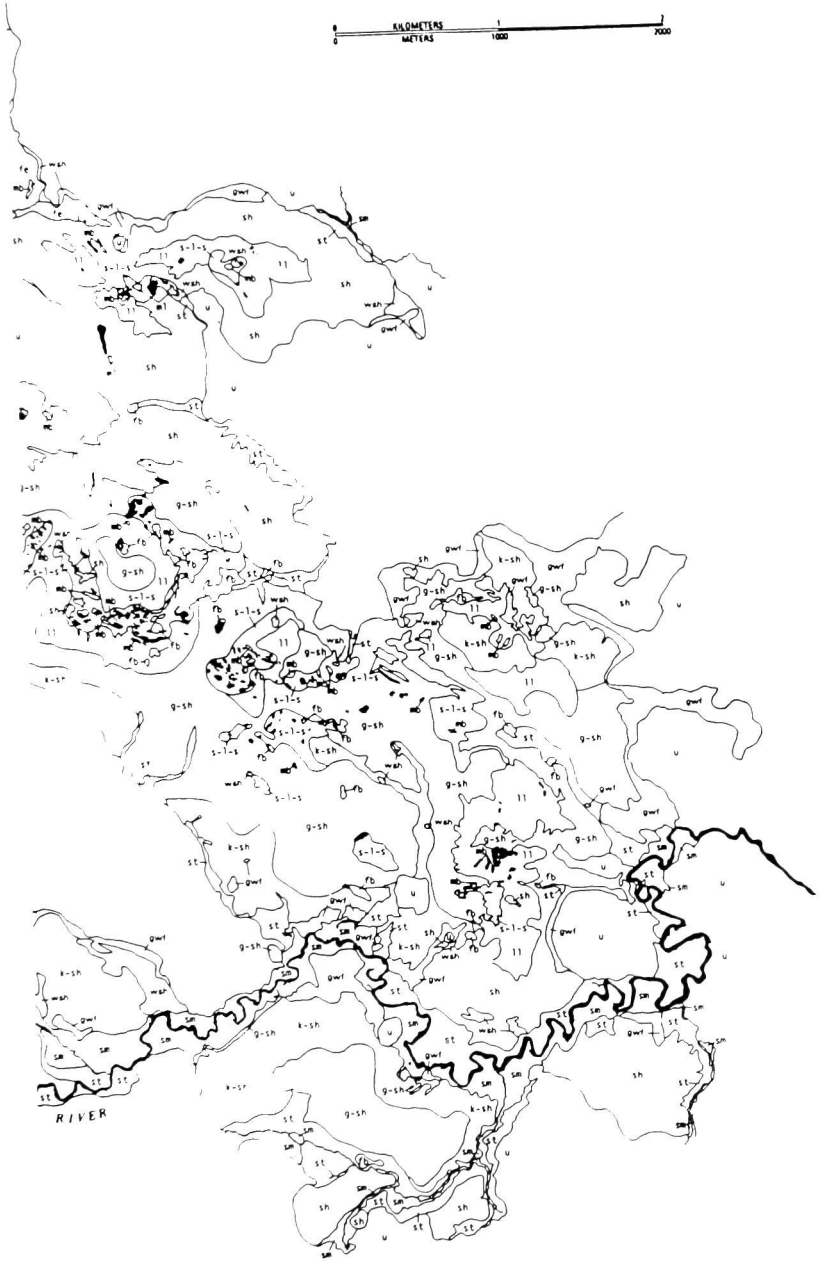
Great Cranberry Island (GCI) is about 1 km off the south shore of the much larger Mount Desert Island (MDI), at the junction of the central and eastern thirds of the coast of Maine. The southwestern part of GCI is largely occupied by The Heath, a ~90-ha "plateau" bog , which together with Big Heath on MDI, is at the southern limit of this bog type in eastern North America (Worley 1980; Davis and Anderson in press). Although The Heath does not have as high an evaluation score as some "plateau" bogs farther "down east" in Maine, its location at the geographic limit of its type makes it highly worthy of protection. Only a relatively small central area (around relevé 5) is obviously raised, and this area (and the entire Heath) lacks the steep marginal slopes characteristic of some "plateau" bogs farther east in Maine. The Heath occupies a shallow sand- and gravel-surfaced basin, and is bordered by small hills. It appears to drain westerly and southwesterly to the sea via two low corridors between hills. Probably, the drainage seeps through the storm beach gravel ridges at the corridor outlets. No inlet streams were observed. At the time of our July 1988 field visit, the upper peat pore water of the raised area had pH 4.2 and Ca 0.26 mg L^{-1}. This area was vegetated largely by shrub heath and wooded shrub heath dominated by *Picea mariana, Gaylussacia dumosa* var. *bigeloviana* (largely a coastal peatland species [CS] in Maine), *Empetrum nigrum* (largely a coastal and alpine species [CAS] in Maine), and *Sphagnum fuscum*. Additional abundant species were *Larix laricina, Chamaedaphne calyculata, Rhododendron groenlandicum, Vaccinium oxycoccos, Rubus chamaemorus* (CAS), *S. imbricatum* (CS), *S. flavicomans* (CS), and *Cladina rangiferina*. On its northern slope, the raised area was more heavily wooded by *P. mariana*. On its other sides, it sloped down, with little change in pore water chemistry, to moss-lawn/sedge/shrub heath fen. Although many of the same species were present, dominance in the fen area shifted to *Trichophorum cespitosum* (CAS) and *Sphagnum flavicomans*. Also common were *Eriophorum vaginatum* var. *spissum* and *E. angustifolium, Solidago uliginosa, Sphagnum imbricatum* and *S. rubellum*. The very wet open fen (pH 5.2; Ca 1.10 mg L^{-1}) on the south side of the western drainage corridor had many of the same species, but was dominated by *S. pulchrum* with abundant *Rhynchospora alba*. Most of the periphery of the peatland was wooded fen dominated by *P. mariana*. Peat depths ranged from ~5.5 m at the raised area, 2–3 m in the open fen areas, to shallower in the peripheral wooded fens. No aquatic sediment was found on the basal sands and gravels. The characteristics of the deepest peat indicated that the first ecosystem was wooded wetland/peatland. By mid-core levels, the peat became dominated by *Sphagnum* remains. Map on page 100.


GREAT CRANBERRY ISLAND
N
MAIN ST.
THE POOL
ROAD
U
GWF
ST
S/ML
WSH
WSH/
SH
UPLAND ISLANDS (4)
LONG POINT
LST
BEACH
ML/S/SH
WSH
GWF/ST
SH/WSH/S
SH/S-F
TRAIL
POND
RICE POINT
0
0.5 mi
0.5
1.0 km

42. GREAT HEATH
Schoodic Lake, Epping, and Montegail Pond Quadrangles

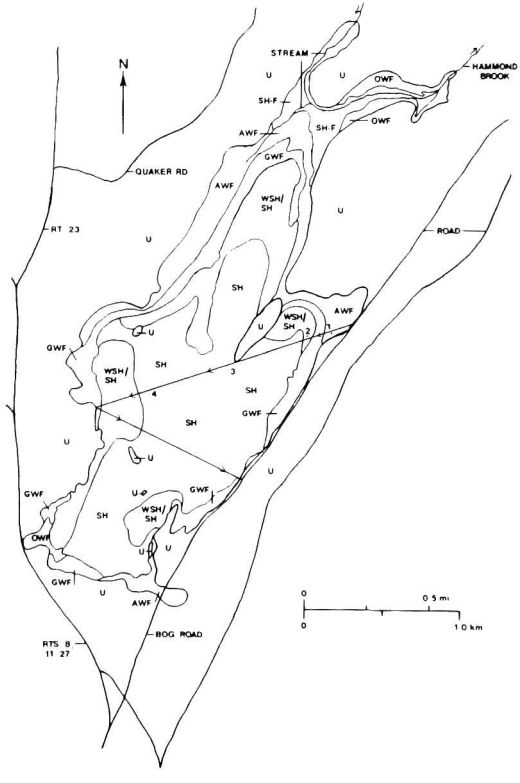
The Great Heath is one of the largest multiple-unit peatlands in Maine. This ~2500-ha peatland is located in Washington County in T18MD BPP and Columbia Townships, with a small incursion into T19MD BPP. The southern end of the peatland is about 10 km inland from embayments of the Gulf of Maine. The southward flowing Pleasant River and its tributary, the Taylor Branch, border and traverse parts of the western and northern sections of the peatland, respectively. About 2 km south of the entry of Taylor Branch into the main branch, the main branch takes an eastward bend and meanders in a generally eastward direction through the southern part of the peatland. The Great Heath proper is north of this section of river, but parts of the multiple-unit peatland, namely Pigeon Hill Heath and an unnamed heath (bog) are located on the south side of the river. Although not formally mapped as such (Thompson and Borns 1985), the west side of the peatland appears to be bordered by an esker (Prof. H. Borns pers. comm.). A terminal moraine (Pineo Ridge) of a late-glacial readvance borders the south side of the peatland. The south side of the moraine grades into a glaciomarine delta. Beach lines were cut into the foreslope of the delta during pauses in the emergence of the land from the sea. This Pineo Ridge moraine-delta-shoreline complex and esker comprises an outstanding (world-level) display of geological features. The peatland, too, is outstanding, especially in its diversity of peatland morphological types including at least seven coalescences, each consisting of two or more raised bogs. Some of these bogs are domed and have concentric patterns and secondary pools. The high morphological diversity and associated hydrological diversity of Great Heath result in a wide variety of plant communities, despite the widespread acidic and oligotrophic conditions and absence of calcareous substrates. These communities were studied in moderate detail by means of 61 relevés. The vegetation contains several coastal features including lichen lawns, *Trichophorum cespitosum*-lichen-*Sphagnum* communities, and abundant *Gaylussacia dumosa* var. *bigeloviana* in dwarf shrub heath communities, along with scattered occurrences of *Empetrum nigrum* and *Rubus chamaemorus*. However, maritime influence is not as strong, nor vegetation as clearly coastal in character as at the plateau bogs of the Washington County coast. Overall floristic diversity is only moderate for so large and complex a peatland. A large proportion, but unfortunately not all of this outstanding peatland. is protected by the state. Priority should be given to enlargement of the protected area, preferably to include not only all of the peatland plus upland buffers, but also the exceptional geological features bordering the peatland. Map from Jacobson, Widoff, Davis, and Anderson (unpublished). Map on pages 102–103.


N
CREBO
BROOA
PLEASANT RIVER
BROOA
TAYLOR
Burned
1982
PLEASANT
KILOMETERS
METERS
1000
2000


KILOMETERS
0
1
METERS
1000
2000
RIVER

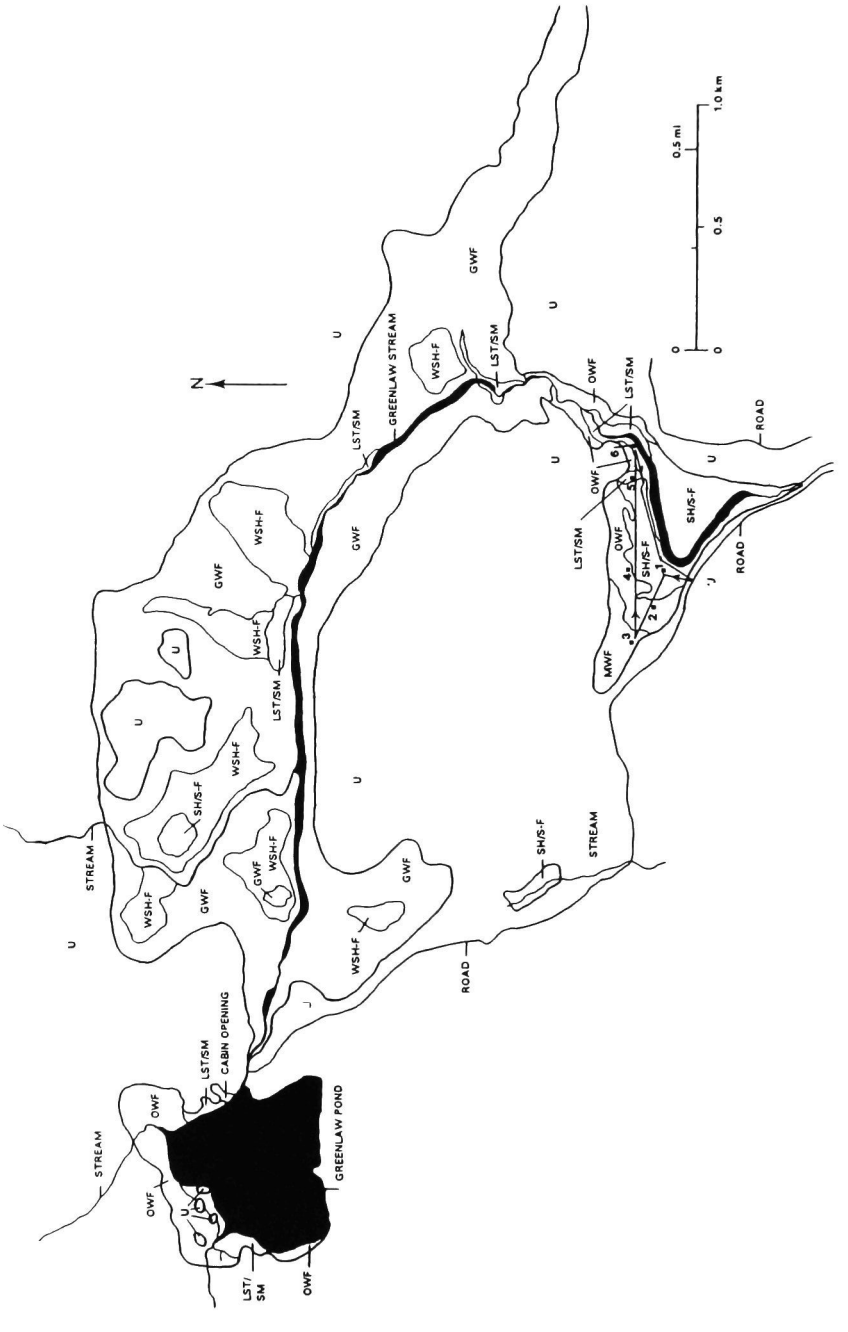
43. GREAT SIDNEY BOG
Belgrade Quadrangle

Great Sidney Bog is a ~400-ha peatland in an elongate, NNE-SSW depression.The peatland is crossed by the Sidney-Augusta town line. Stream inflows are mainly from the north and west, and outflows northeastward via Bog Brook and southward via Sidney Bog Brook. The peatland is one of the best examples of a raised bog in southwestern Maine and so far south in eastern North America. The open (largely shrub heath) expanse of the peatland has no obvious patterning. A small wet area, perhaps incipient secondary pools, occurs near the center of the peatland. The peripheral areas of the peatland are vegetated largely by wooded fens of various composition, from gymnosperm to angiosperm dominated. The open bog area had peat pore water pH ~3.8, and a peripheral *Acer rubrum* fen pH 7.8, based on limited sampling. Abundant *Rhododendron canadense* and *Kalmia angustifolia* in the shrub heath produce an outstanding floral display. The easy access to this peatland in the Augusta-Waterville area enhances its value for education and research. In contrast to the uplands of the region, the peatland has been relatively undisturbed.



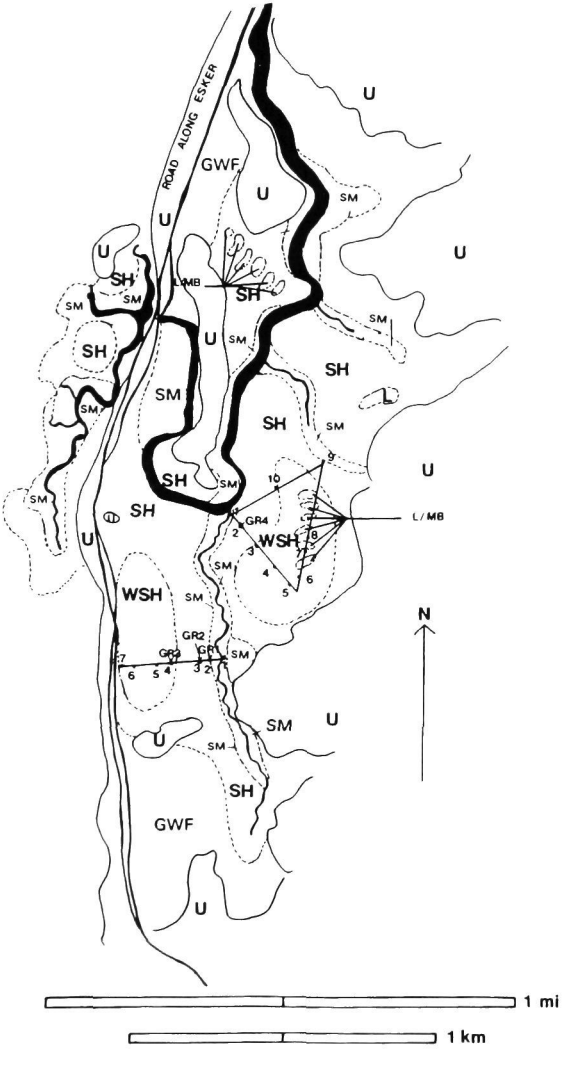
44. GREENLAW STREAM FEN
Greenlaw Pond Quadrangle

The northern and western shores of Greenlaw Pond (lake), and the 5-km stretch of Greenlaw Stream starting just below the outlet of the lake is bordered by peatland. This ~270-ha peatland in northeastern Maine is located in T12R7 WELS, except for the part on the west side of the lake which is in T12R8 WELS. Generally, the peatland vegetation consists of a series of wooded shrub heath areas extensively surrounded by gymnosperm wooded fen. The peatland is widest around deadwater sections of the stream where water levels may have been augmented by ancient beaver dams. Our field sampling (16 Aug 88) was limited to one such area, 4 to 5 km downstream from the lake and on the west side of the stream (see map). This portion was largely unwooded along the stream and became more wooded westward as it narrowed away from the stream. Near the stream, peat depths varied from 0.5 to 2.0 m. The southwest flowing stretch of the stream was bordered by low shrub-thicket/sedge-meadow (LST/SM) fen vegetation with abundant *Nemopanthus mucronatus, Chamaedaphne calyculata* and other ericaceous species, *Carex* spp. (including *C. lasiocarpa* var. *americana*), *Muhlenbergia glomerata*, and *Triadenum virginicum*. The upper peat pore water pH 6.37 and Ca 2.69 mg L^{-1} were consistent with the presence of *M. glomerata* and *Oclemena nemoralis*. A discontinuous mat of bryophytes including *Scorpidium scorpioides* covered the ground. Away from the stream and LST/SM area, peat depths increased to 2–3 m, and vegetation consisted of shrub heath/sedge fen (SH/S-F) with scattered coniferous trees and *Alnus incana* ssp. *rugosa*, and with abundant *Myrica gale, Chamaedaphne calyculata* and other ericads, *Carex* spp. (*C. oligosperma* and *C. stricta* abundant), *Eriophorum* spp., and a nearly continuous and diverse *Sphagnum*-dominated bryophyte mat (with *Aulocomnium palustre*). Still farther from the stream, and on similar peat depths, was a zone of open wooded fen (OWF) vegetation with *Acer rubrum* and *Picea mariana* trees, ericaceous dwarf shrub species, *Carex* spp. with abundant *C. trisperma*, a *Sphagnum* mat with abundant *S. recurvum* s.l., and with pH 4.11–4.97 and Ca 1.24–3.17 mg L^{-1}. The narrowed western end of the sampled peatland area, with shallow (~<1 m) peat, pH 7.69 and Ca 8.02 mg L^{-1} was occupied by mixed wooded fen vegetation dominated by *Thuja occidentalis, A. rubrum* and *P. mariana*, with abundant *Carex* spp. and a discontinuous and diverse mat of bryophytes including *Sphagnum warnstorfii*. At all but this narrowed area, which originated as a wooded fen by paludification, the peat was underlain by 1 to 2 m of organic lake sediments. Map on page 106.


N
0 0.5 0.5 mi
0 1.0 km
GREENLAW STREAM
GREENLAW POND
CABIN OPENING
STREAM
ROAD
GWF
WSH-F
SH/S-F
LST/SM
OWF
MWF
U

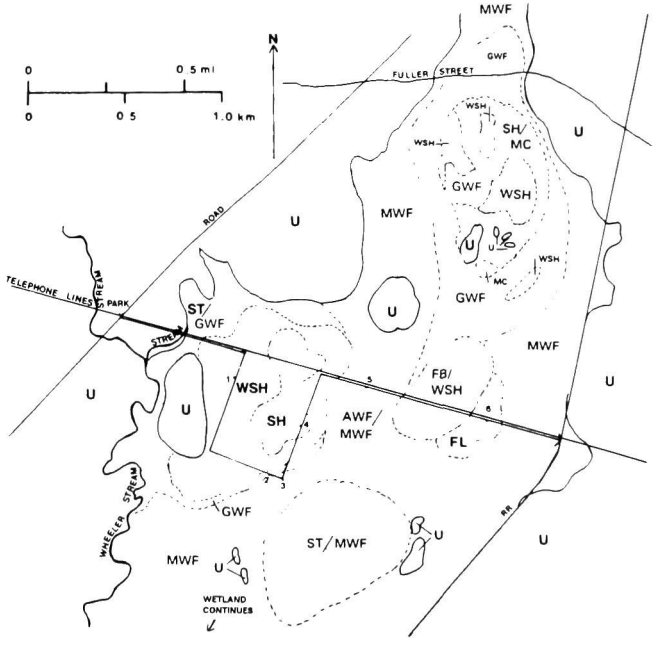
45. GREENVILLE JUNCTION PEATLAND, 1983
Big Squaw Pond Quadrangle

The peatland south of Greenville Junction in Little Squaw Twp is a ~225-ha peatland in a stream valley adjacent to an esker. Two poorly developed eccentric domes occur along the valley walls, each with downslope extensions bearing mud bottoms with intermittent pools. The rest of the peatland (most of it) is fen.



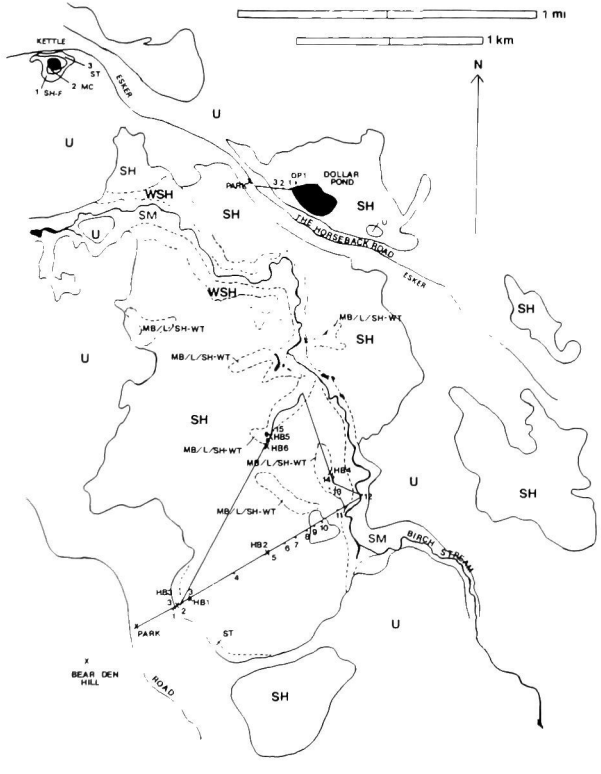
47. HERMON BOG, 1983
Bangor and Hermon Quadrangles

Hermon Bog is a large (~650 ha) multiple-unit peatland in the Penobscot lowlands in Hermon Twp, with a small portion in Bangor Twp. The peatland is drained by Wheeler Stream on the south, and a small stream to Kenduskeag Stream on the north. The peatland setting is suburban. A major railroad junction and small town dissect its southeast corner, a railroad bed and major airport runway skirt its eastern border, a road skirts its northern end, and roads pass through the narrow northern and southern extensions of the peatland. However, its vast major expanse appears relatively undisturbed except for the minimal effects of a telephone line that passes over its center. Two coalesced raised bog complexes dominate the eastern, elongate (north-south) part of the peatland. This part is separated from a western raised complex by a corridor of shallow peat. The peat in the three complexes attains depths of 6.0 to 7.5 m (Cameron et al. 1984). Although open areas (shrub heath, *Chamaedaphne* moss lawn, moss lawn, and a few small secondary pools) occur on the highest portions of the complexes, most of the raised surface is covered by wooded shrub heath and bog forest—to a greater extent than is typical for Maine raised bogs. Given the likelihood that this peatland has burned over during the period of wood- and coal-fired locomotives, the forest cover may have been even better developed in the past. The aforementioned corridor and the peripheral areas of the peatland are vegetated by gymnosperm, angiosperm, and mixed wooded fens.



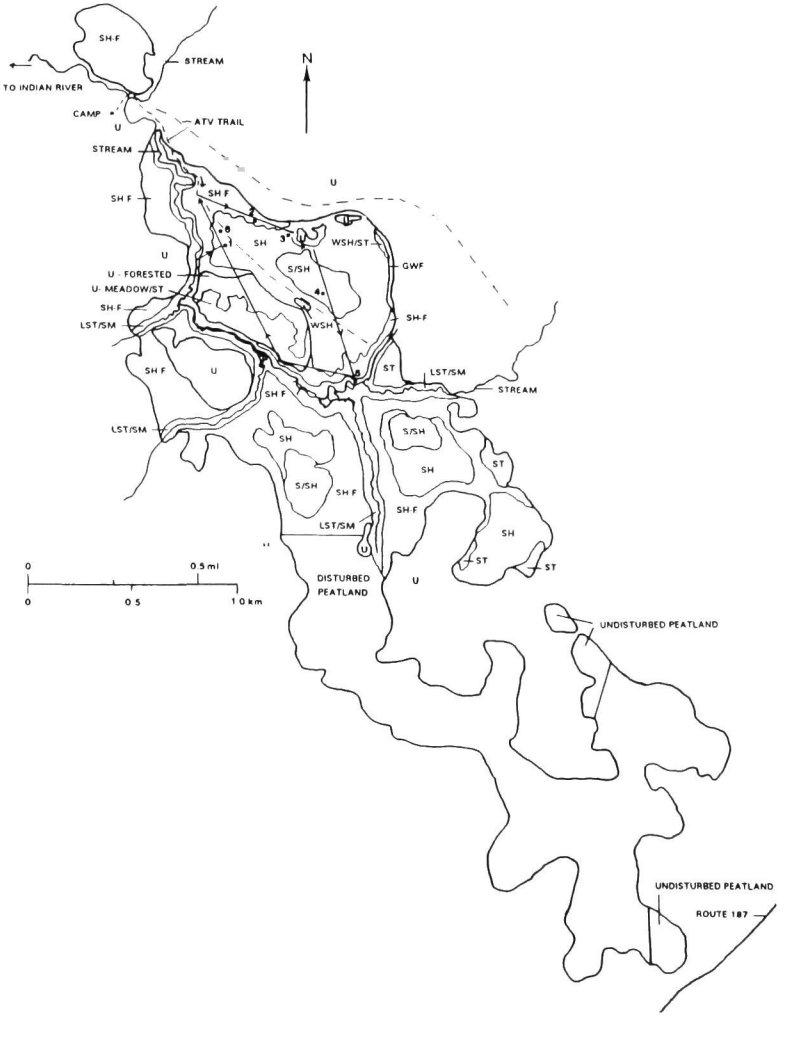
49. HORSEBACK BOG, 1983
The Horseback Quadrangle

The bog just south of the Horseback and around Birch Stream in T32MD is a ~275-ha multiple-unit peatland consisting of two to four raised bog complexes. The raised parts lack pattern and secondary pools (except in water tracks). The raised parts are bordered by unpatterned fens around Birch Stream and in open basins. The bog is is not considered to include Dollar Pond Fen (just north of the esker) and the kettle fen by Pickerel Pond (~1 km northwest of Horseback Bog), each of which we describe separately. Determination of the exact number of raised bog complexes in Horseback Bog would require a leveling survey. By far the largest definitely raised bog slopes up from the fen on the western side of Birch Stream. This complex and the other raised or near-raised ("transitional") complexes are largely covered by a monotonous shrub heath vegetation. Two interesting water tracks with pools on the eastern slope of the major complex flow toward Birch Stream. The large areas of shrub heath on the central expanses of the raised bogs are complimented by a variety of other peatland vegetation types on the slopes of, and around, the raised areas, *in toto* including a diverse flora.



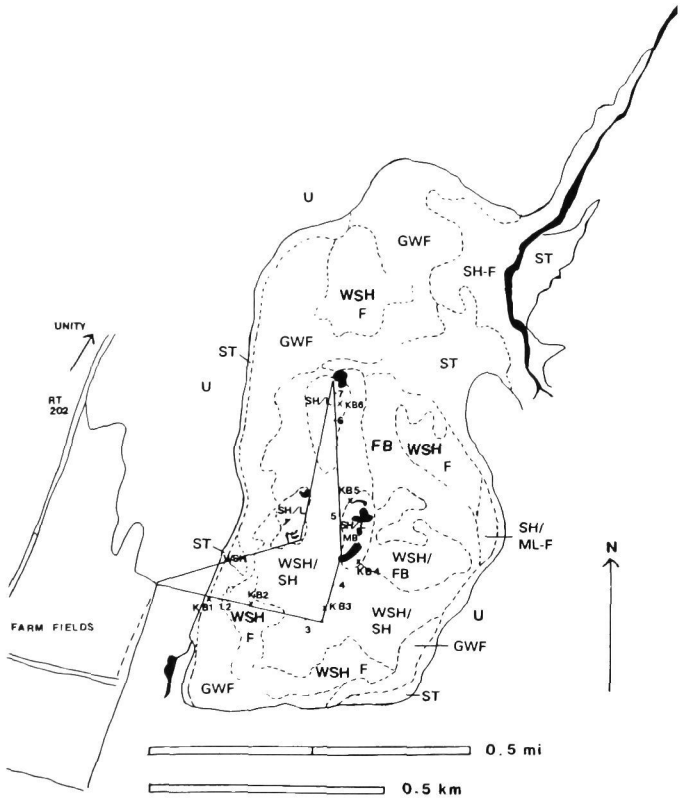
53. JONESPORT HEATH
Jonesport and Addison Quadrangles

Jonesport Heath in the town of Jonesport is a large, multiple-unit plateau bog. We consider Jonesport Heath to include all of the contiguous peatland starting just north of Maine Route 187 where it passes the head of Sawyer Cove. From that point, the peatland extends 5.6 km north-northwestward (only the extreme nnw part on Addison Quadrangle). Jonesport Heath has 6–8 bog complexes. All but the northernmost 3–4 bog complexes have been mined for peat. We studied the major northern, undisturbed complex, which is a fine example of a plateau bog. Unpatterned fens occupy the stream valleys between the bogs. In addition to Jonesport Heath, as just defined, and in its vicinity in Jonesport are several coastal bogs including Kelley Point Heath south of Route 187.



54. KANOKOLUS BOG, 1983
Albion and Unity Quadrangles

Kanokolus Bog in Unity is one of several raised bogs in a finger-shaped zone of raised bogs that extends from the Penobscot lowlands southwestward in the Central Interior Biophysical Region (Davis and Anderson in press). This zone represents the southern limit of the contiguous raised bog zone in Maine.[1] Kanokolus is a single bog complex, about 165 ha in area, in a basin drained by Bacon Brook. An indistinct esker skirts the southern end of the complex. Two well-defined sets of secondary pools are present on the raised part of the complex. For its southern location, Kanokolus is a fine example of a raised bog with secondary pools. Its diverse vegetation is typical of Maine raised bogs. Although it is less than 1 km from a major highway (US202), and additional roads as well as agricultural fields and houses are present in its catchment, the peatland is relatively undisturbed. It is worthy of protection.

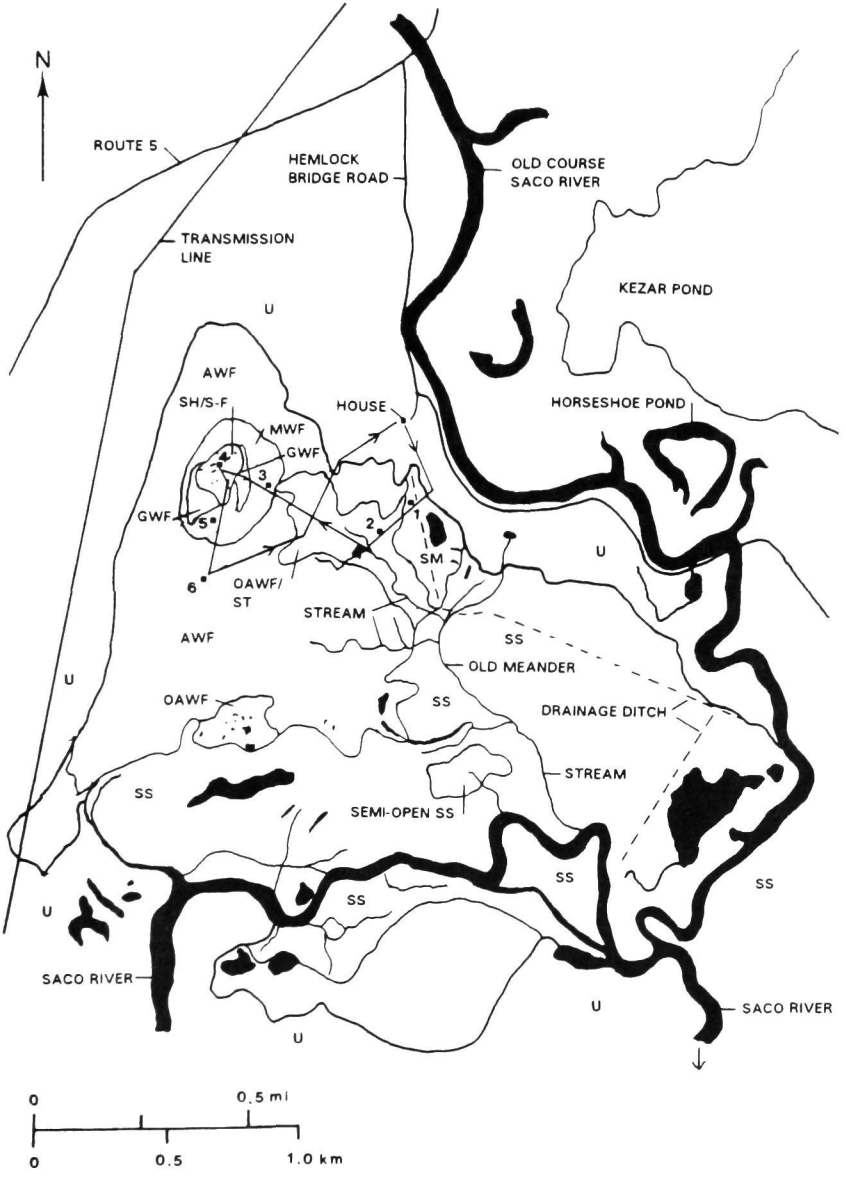


[1]A small outlier zone of a very few raised bogs (e.g., Saco Heath) exists in extreme

55. FEN WEST OF KEZAR POND
Fryeburg Quadrangle

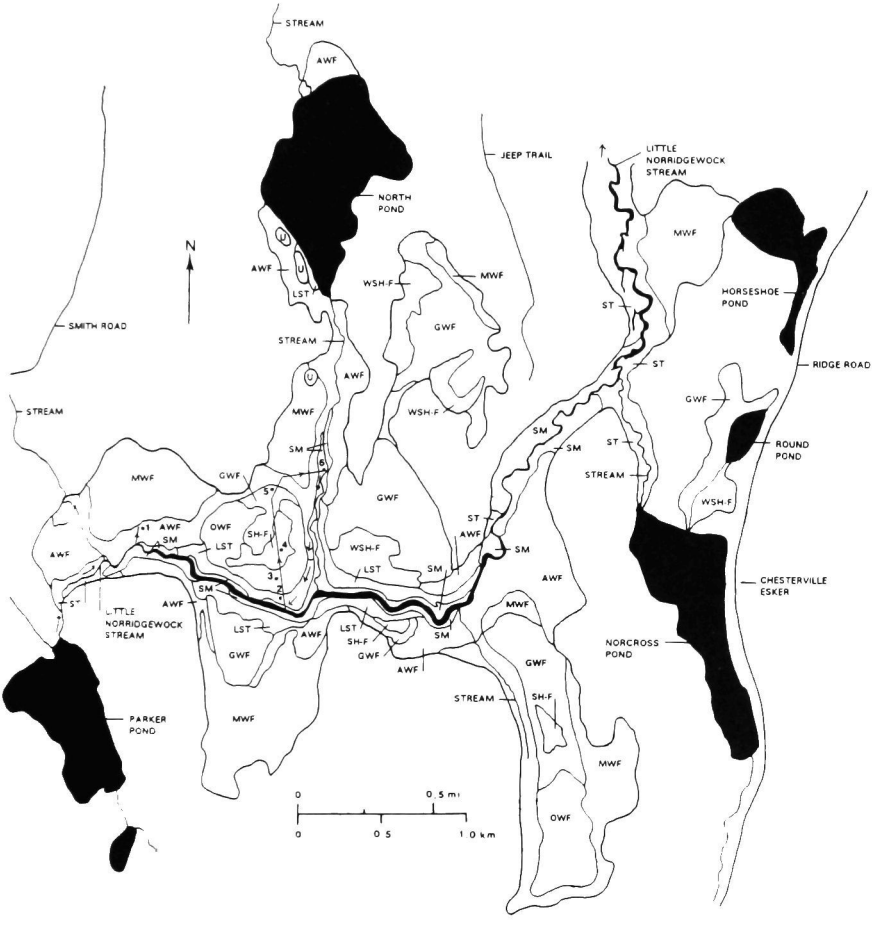
This ~500-ha wetland is located on the Saco River floodplain east of Fryeburg Center and just west of the old course of the Saco River where it skirts the western side of Kezar Pond. It is bordered on the south by the northeasternmost part of the present main channel of the Saco River. This wetland is part of a much larger aggregation of wetlands on the Saco River floodplain from Swimming Bog north of Kezar Lake south to Brownfield Bog Wildlife Management Area and East Brownfield, a north to south distance of about 19 km. Changes in river water level undoubtedly affect the hydrology of the studied wetland, most notably at the wetland's southern and eastern sections.These sections, which are variously wooded and semi-wooded, with *Acer rubrum* as the most abundant tree species, are probably not true fen (minerotrophic peatland) but are on muck and mineral soil, and are represented on the plan map as streamside swamp (SS). The eastern part of the wetland is ditched, perhaps to drain water away from the adjacent agricultural fields. The true fen area is located north and west of the SS limit. Only the northern part of the fen was field sampled on 16 June 1988. The eastern edge of this area contained a drainage ditch and small pond surrounded by streamside meadow vegetation dominated by *Carex* spp., with *C. lasiocarpa* var. *americana* and *C. utriculata* as the most abundant species. A *Sphagnum cuspidatum* mat was well developed. Upper peat pore water had pH 6.37 and Ca 1.72 mg L^{-1}. The peat was only 0.8 m deep. Most of the fen was covered by angiosperm wooded-fen (AWF) vegetation dominated by *Acer rubrum* and *Alnus incana* ssp. *rugosa*, and with scattered individuals or patches of *Ilex verticillata, Viburnum dentatum* var. *lucidum* and *V. nudum* var. *cassinoides, Chamaedaphne calyculata, Rhododendron canadense, Toxicodendron vernix, Rubus hispidus, Spiraea alba* var. *latifolia, Dulichium arundinaceum, Iris versicolor, Calla palustris*, and *Onoclea sensibilis, O. regalis* var. *spectabilis* and other fern species. Swards of *Carex lacustris, C. utriculata*, and *Calamagrostis canadensis* were present in some of the larger openings. Bryophytes were limited to widely scattered small patches. The large area of open angiosperm wooded-fen/shrub-thicket (OAWF/ST) at the wet eastern part of the fen contained more widely scattered trees, and greater abundances of shrubs and large graminoids. The peat pore water at the relevé sites in AWF and OAWF/ST, respectively, had pH 6.37 and 6.84, and Ca 2.99 and 3.56 mg L^{-1}. Peat depths were 2 to 3 m. A roughly ovoid area with a greater abundance of conifers was present near the north end of the fen. Here, *Acer rubrum* and *Alnus incana* ssp. *rugosa* were joined by *Larix laricina* and *Picea mariana* to form mixed wooded fen (MWF) vegetation. *Chamaedaphne calyculata* was more abundant and occurred together with several other ericaceous dwarf shrub species, as well as *Myrica gale*, small-size *Carex* spp. (e.g., *C. exilis, C. folliculata*, and *C. oligosperma*), *Scheuchzeria palustris* ssp. *americana*, and *Maianthemum trifolium*. In the ovoid area, bryophyte cover was greater than in the AWF and OAWF/ST areas and was dominated by *Sphagnum recurvum* s.l. and *S. centrale*. The two relevé sites in MWF of this area had peat pore water with pH 5.38 and 5.68 and Ca 2.26 and 2.18 mg L^{-1}. Peat depths were 4.7 and 3.7 m. A small tract of shrub heath/sedge fen (SH/S-F) in the center of the ovoid area had a much better developed ericaceous dwarf shrub stratum. *Carex exilis* and *Myrica gale* also were common on the nearly continuous mat of *Sphagnum magellanicum*. Here, pH was

6.26 and Ca 2.23 mg L^{-1}, and 5.9 m of peat was present atop lake sediment. The ovoid area appears to have developed in what was once a depression in the plain.



60. LITTLE NORRIDGEWOCK STREAM PEATLAND
Farmington Falls, Wilton, and Fayette Quadrangles

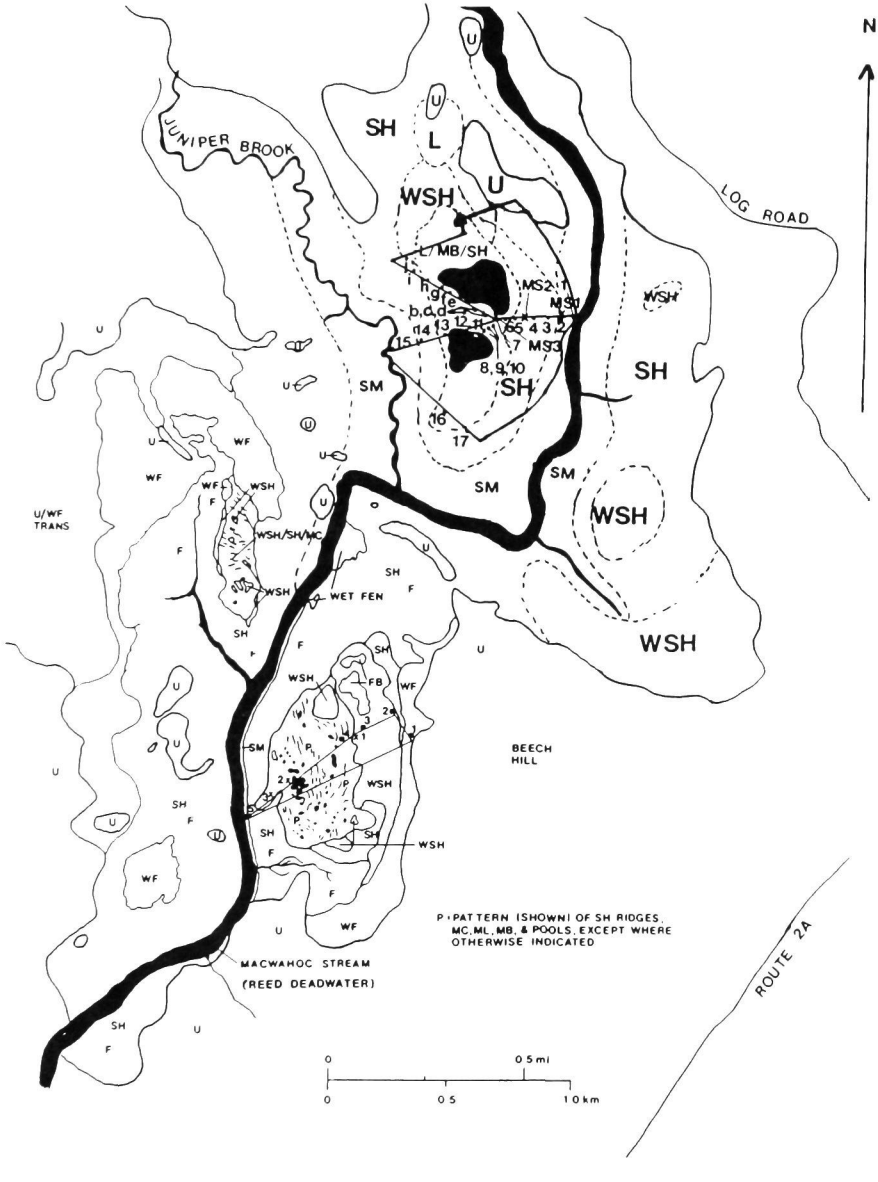
This large multiple-unit peatland in Chesterville and Jay Twps contains five major complexes, several smaller complexes, and an extensive stretch of streamside meadow. The upstream end of the peatland begins around Little Norridgewock Stream (LNS) near its exit from Parker Pond, and continues downstream on both sides of LNS, along the stream exiting North Pond flowing south to LNS, and at least as far down LNS as the vicinity of Horseshoe Pond. All complexes and meadows together comprise roughly 525 ha. Of the major complexes, Davis et al. (1983) indicated on the basis of an overflight and air photos, but no on-ground visit, that one is "obviously raised (but not obviously domed)," and the others are "transitional" or geogenous. By "transitional," Davis et al. (1983) meant slightly raised but not enough to be strictly ombrotrophic. A more recent overflight and additional air photos, plus on-ground vegetation study and peat pore-water chemical analyses suggest that only the central-most part of the complex with "obviously raised" area (station 4, see map) may be ombrotrophic, but could be in the extreme acidic ("poor") fen category. Whether this area, or the postulated "transitional" areas, are raised sufficiently to be truly ombrotrophic "raised bogs" would have to be confirmed by more intensive studies. The peatland is near the western limit of raised bogs in inland southwestern Maine (Davis and Anderson in press). The Chesterville Esker passes north-south just to the east of the peatland. Ice-block depressions (kettles) occupied by Horseshoe, Round, and Norcross Ponds abut the west side of the esker. Small extensions of the peatland reach these ponds. The peatland also abuts kame-like hills in several places. Adjacent to the east side of the esker is another peatland (not studied). McGurdy Stream originates in that peatland. Overall, the combination of glacial landscape features and so large a peatland area is unique for western inland Maine, and make this peatland area worthy of consideration for protection.


STREAM
AWF
NORTH POND
JEEP TRAIL
LITTLE NORRIDGEWOCK STREAM
MWF
HORSESHOE POND
RIDGE ROAD
N
AWF
U
LST
WSH-F
MWF
ST
SMITH ROAD
STREAM
GWF
AWF
ST
GWF
STREAM
MWF
WSH-F
SM
SM
ST
ROUND POND
MWF
GWF
S
6
STREAM
WSH-F
GWF
ST
AWF
OWF
SH-F
SM
AWF
LST
WSH-F
SM
LST
SM
AWF
CHESTERVILLE ESKER
SM
AWF
MWF
LITTLE NORRIDGEWOCK STREAM
LST
AWF
LST
SH-F
SM
NORCROSS POND
GWF
SH-F
GWF
AWF
GWF
STREAM
SH-F
PARKER POND
MWF
MWF
0
0.5 mi
0
0.5
1.0 km
OWF

61. MACWAHOC STREAM PEATLAND, 1983[1]
Reed Pond, ME Quadrangle

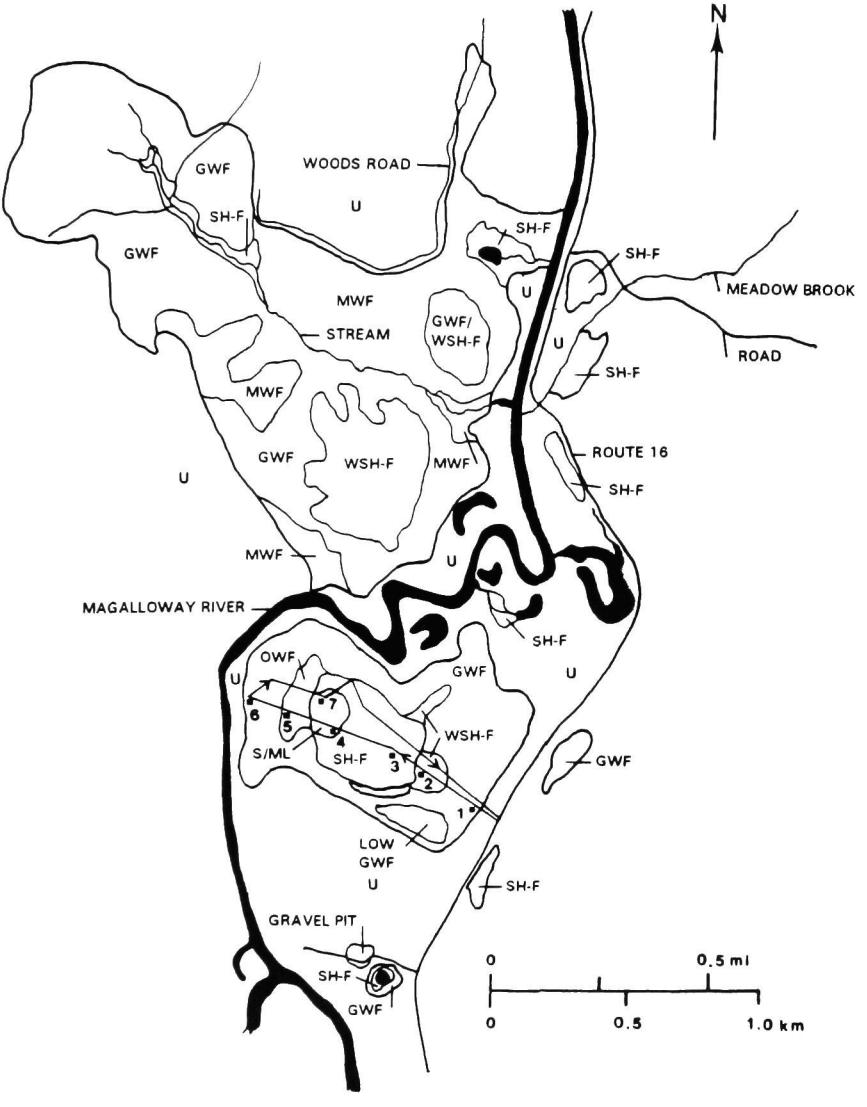
This ~675-ha multiple-unit peatland in T1R4 WELS (North Yarmouth Academy Grant and Upper Molunkus) Township was previously described by Davis et al. (1993), and the eccentric bog units redescribed in more detail by Davis and Anderson (1991). We summarize those descriptions here. The peatland extends 5 km northward from the crossing of Macwahoc Stream by a woods road. That woods road starts at US Route 2A 1 km northeast of Reed Pond. The northern end of the peatland is marked by a woods road that originates at US Route 2A where it crosses Wytopitlock Stream. Additional peatland areas, not included in the ~675 ha, and not described here, are present around Macwahoc Stream north of the last-mentioned woods road. Macwahoc Stream Peatland extends on both sides of the portion of Macwahoc Stream known as Reed Deadwater. Two eccentric bog complexes are present in the southern half of the peatland, one east and one west of the Deadwater. The one on the east side is an exemplary eccentric bog. The northern half of the peatland contains a unique domed bog complex. This complex is located north of a major bend of the Deadwater. Juniper Stream flows into the bend of the Deadwater. The bog complex is east of Juniper Stream and west of the Deadwater. The complex appears to be a coalescence of what were two raised bogs, each with a large secondary pool atop. That coalescence was erroneously classified as an eccentric bog in Davis and Anderson (1991). On the opposite side (east) of the Deadwater is a relatively flat, unpatterned raised bog lacking obvious pools. These raised bog complexes, taken together with the areas of wooded and unwooded fens between them, and their diverse vegetation and flora collectively comprise one of the most diverse multiple-unit peatlands in Maine.

[1]The northern part of the previously unpublished map of Davis et al. (1983) is combined here with the map of Davis and Anderson (1991).


N
JUNIPER BROOK
LOG ROAD
SH
L
WSH
U
L/MB/SH
MS2
MS1
MS3
SM
WF
WSH/SH/MC
WET FEN
FB
BEECH HILL
MACWAHOC STREAM
(REED DEADWATER)
P-PATTERN (SHOWN) OF SH RIDGES, MC, ML, MB, & POOLS, EXCEPT WHERE OTHERWISE INDICATED
ROUTE 2A
U/WF TRANS
0 0.5mi
0 0.5 1.0km

62. MAGALLOWAY RIVER FEN
Wilsons Mills Quadrangle

This ~300-ha multiple-unit fen occupies the flood plain of the Magalloway River where it straddles the border between western Maine and northeastern New Hampshire. The fen consists of two main divisions: (1) a northern division west of a south flowing stretch of the river, and north of the river after it bends to the west (this westward stretch is meandering; abandoned meanders are present), and (2) a southern division east of the river after it resumes a southward course, and south of the aforementioned meandering stretch. The northern division is separated into two complexes by a small tributary of the river. Each of these complexes contains a distinct, roughly ovoid area at its southern end. Although the northern division is largely covered by gymnosperm and mixed wooded fen vegetation, the two ovoid areas are more open (wooded shrub heath). These areas appear to be slightly raised, and may be transitional to an ombrotrophic condition. Only the southern division of the peatland was sampled in the field. It consists of a single complex whose periphery is covered by gymnosperm wooded fen (GWF) vegetation with *Picea mariana*. An understory of small *P. mariana, Nemopanthus mucronatus*, and *Viburnum nudum* var. *cassinoides* is present. Lower strata contain abundant *Carex trisperma* and ericaceous shrubs, and a diverse bryophyte mat with abundant *Sphagnum recurvum* s.l. A roughly oval central area is vegetated largely by open shrub heath, suggesting that it, too, may be slightly raised and transitional to an ombrotrophic condition. The plant community of ericaceous dwarf shrubs (mostly <0.5 m tall), very slow-growing *P mariana* (<1.5 m tall), and the continuous mat of *Sphagnum* spp. (largely *S. magellanicum, S. capillifolium, S. fuscum*, and *S. recurvum* s.l.) indicate an oligotrophic condition. However, the occurrence of the poor fen indicators *Maianthemum trifolium, Carex oligosperma, Platanthera clavellata*, and *Aulocomnium palustre*, the shallowness (0.8–1.4 m) of the peat, and the restriction of abundant *Sphagnum* remains to the top half meter of the peat, suggest that the oligotrophic condition is relatively recent and that low-nutrient waters from mineral substrates still occasionally reach the rooting zone. Despite the acidic and oligotrophic conditions (upper peat pore water pH 3.97–4.06, Ca 0.11–0.60 mg L^{-1}, and total P 0.04–0.10 mg L^{-1}), we hesitate to apply the term bog (implying ombrotrophic) to this peatland. A patch of sedge/*Sphagnum* moss lawn at the west end of the ovoid area may be slightly less oligotrophic, as suggested by the abundance of small *Carex* spp., *Scheuchzeria palustris* ssp. *americana*, *Andromeda polifolia* var. *glaucophylla*, and *Maianthemum trifolium*. Lake sediments were absent from the seven widely spaced probe sites; the peatland appears to have originated by paludification or primary mire formation on a silt-clay substrate. A good example of a small kettle-hole (ice-block depression) fen, ~0.7 km south of this peatland is threatened by adjacent mining of gravel.

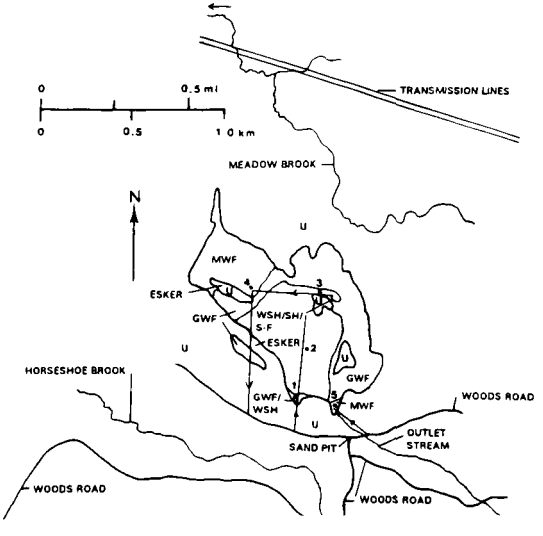

N
WOODS ROAD
GWF
SH-F
U
GWF
MWF
STREAM
GWF/
WSH-F
MWF
GWF
WSH-F
MWF
U
MWF
MAGALLOWAY RIVER
OWF
U
S/ML
SH-F
WSH-F
GWF
LOW
GWF
U
GRAVEL PIT
SH-F
GWF
SH-F
SH-F
MEADOW BROOK
ROAD
U
SH-F
ROUTE 16
SH-F
U
SH-F
GWF
U
GWF
SH-F
0
0.5 mi
0
0.5
1.0 km

63. MARBLE FEN
Hay Lake and Bowlin Brook Quadrangles

Marble Fen, a ~70-ha peatland at the intersection of T6R7, T6R8, and T5R8 WELS townships, is an exceptionally good example (for Maine) of a ribbed fen. The largest of its three ribbed areas has clearly delineated, elongate ribs (ridges) and water-filled flarks. Parts of the peatland are on limestone substrate. Conditions range from circumneutral (rich) fen to very acidic (extreme poor) fen. The result is diverse vegetation and diverse bryophyte and vascular plant floras, with two known rare bryophyte and five known rare vascular plant species, one of the latter threatened (*Juncus stygius* ssp. *americanus*). A detailed description and map of this peatland is provided by Sorenson (1986a and b). This outstanding peatland is protected by The Nature Conservancy.

64. MEADOW BROOK FEN
East Andover and Ellis Pond Quadrangles

This ~100-ha peatland at Meadow Brook on the boundary of Andover and Roxbury Townships in western Maine is largely a very acidic, unpatterned fen. A semi-open to open vegetation of wooded shrub heath and shrub heath with sedges covers the southwestern third of the peatland. The remainder is mostly closed forest, viz. mixed and gymnosperm wooded fen. It is possible that the central and northern parts of the semi-open area are slightly raised, but only the top ~0.5 m of peat is dominated by *Sphagnum* spp. remains. Cameron et al. (1984) indicate that the linear upland islands in the peatland are eskers (or esker fragments). This is an unexceptional peatland in most respects, but peatlands of this size and larger are uncommon in western Maine, and thus it may be worthy of protection.



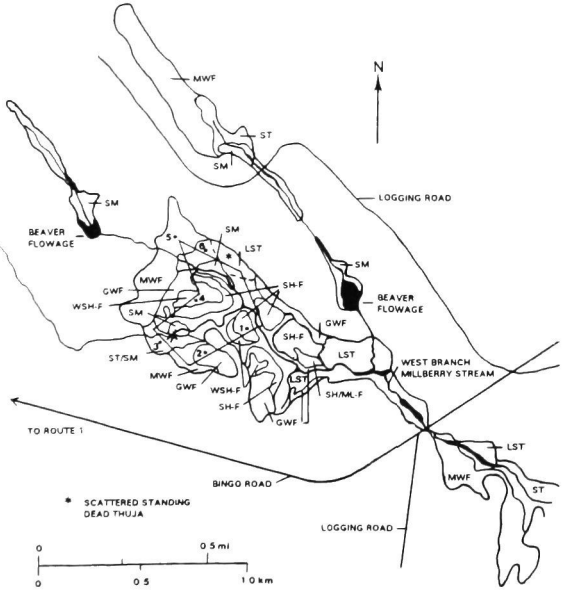
65. MEDDYBEMPS HEATH, 1983
Meddybemps Lake West Quadrangle

Meddybemps Heath is a very large peatland in Alexander, Cooper, and Meddybemps Twps in eastern Maine. The area covered by the peatland remains to be determined accurately. Cameron et al. (1984) reported that 840 ha is underlain by peat with average thickness of 1.8 m or greater. The area of contiguous wetland associated with Meddybemps Heath on the USGS Calais 15' Quadrangle (1929) is about 2000 ha, and on the Meddybemps Lake West 7½' Quadrangle about 1400 ha. An additional confounding factor is the unknown degree to which the eastern part of the peatland has been obscured by dam-raised water level in adjacent Meddybemps Lake (peatland area extending under the lake surface was observed during an overflight). The peatland drains into Meddybemps Lake via Sixteenth and Fifteenth Streams, both of which traverse major parts of the peatland. The two major raised areas, one north of Fifteenth Stream, the other south of it, both have an elongate southwest to northeast axis. Each appears to be coalesced from a pair of peat domes, consisting of a southwest and northeast dome. The four domes have secondary pools atop. Vague concentric pattern is present on the eastern and western slopes of the coalescences. Overflights and aerial photography revealed considerable vegetational diversity. Only eight hours of on-ground study was spent on the peatland (5 Aug 1982), namely at the northeastern dome north of the stream. This work indicated a limited vegetational diversity and a flora adapted to acidic conditions. Some of the shrub heath areas on the domes are dominated by *Gaylussacia* spp. to an unusual degree. An outstanding example of an esker traverses the eastern part of the peatland. Slumping and erosion of peat banks had been occurring along water tracks and tributaries entering Fifteenth Stream, and an abnormal string of secondary pools was present along the lower western slope of the northeastern dome south of Fifteenth Stream. These phenomena may have resulted from raised and/or varying water levels in adjacent Meddybemps Lake. Our evaluation grade for Meddybemps Heath is probably erroneously low due to too few hours spent on so large a peatland. In particular, our floristic data are likely inadequate. Map on page 122.


MEDDYBEMPS LAKE
SIXTEENTH STREAM
FIFTEENTH STREAM
GREEN HILL
N
ST
SH/ST
SH
F
WSH
GWF
SH*/L
U
U*
MH1
MH2
MH3
U*: ESKER
SH*: GAYLUSSACIA COMMUNITY
P = VAGUE CONCENTRIC PATERN (SCHEMATIC)
1km
0.5 mi

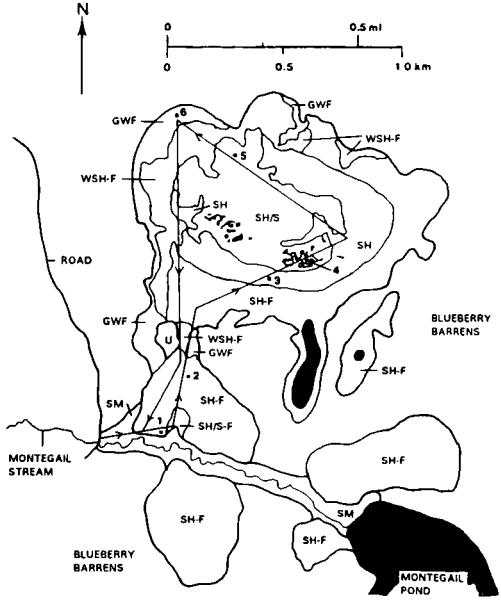
66. MILLBERRY STREAM WEST BRANCH FEN
Simsquish Lake Quadrangle

This peatland in Dyer (T1R2TS) Township in eastern Maine consists of a ~55-ha main fen (extending northwestward from the east-west road from St. Croix River to Waite Twp) surrounding the West Branch of Millberry Stream, and a series of smaller fens surrounding other parts of the stream and its tributaries. All of the small fen areas appear to have developed from ponds formed by beaver dams, but only vestiges of open water remain. The mode of origin of the main fen is not so obvious, but peat stratigraphy suggests that most of it originated by primary mire formation or paludification. In 1988 there was much beaver activity on the streams entering the peatland. Such activity may have caused the die-off of *Thuja occidentalis* trees at the upper reaches of the main fen. Much of the area near the streams was vegetated by low-shrub thickets interspersed with streamside meadows containing *Myrica gale*, *Chamaedaphne calyculata*, *Rubus hispidus*, *Ilex verticillata*, *Spiraea alba* var. *latifolia*, *Alnus incana* ssp. *rugosa*, and large *Carex* spp. Several open and semi-open areas farther from the stream contained ericaceous shrub heath and wooded shrub heath vegetation with abundant *Sphagnum* spp. and *Picea mariana*. The periphery of the peatland was vegetated by gymnosperm- and mixed-wooded fen with abundant *T. occidentalis*, *Acer rubrum*, *Larix laricina*, *A. incana* ssp. *rugosa*, *R. hispidus*, *Osmunda cinnamomea*, *Carex trisperma*, and a wide range of bryophyte species. The abundance of *T. occidentalis* and high species richness of the fen are consistent with the circumneutral pH and modest alkalinity and base cation concentrations in the near-surface peat pore waters. The rare (S1) *Carex vaginata* occurred at a pH 7.4 site.



67. MONTEGAIL POND PEATLAND
Montegail Pond Quadrangle

This multiple-unit peatland is located on both sides of Montegail Stream near its exit from Montegail Pond. Most of the peatland is north of the stream and lake. The geologic setting is glacial till, ice-contact glaciofluvial deposits (not including eskers), and course-grained glaciomarine deposits formed during glacial recession and associated marine inundation. The ovoid raised and near-raised peatland areas occupy what were marine embayments when sea level was at a few tens of feet higher than the present lake. North of the stream, and most removed from it, is a major bog complex lacking concentric pattern, but possessing three sets of secondary pools—a fine example of its geomorphic-hydrologic type. The easternmost set of pools appears to be a "soak." The western and northern sets of pools may be components of water tracks. The northern set (not mapped) largely dries out in summer. The remainder of the peatland is comprised of three slightly raised (transitional) fen units in open basins, fen surrounding the stream, and fen in two kettles with ponds in the glaciofluvial deposits adjacent to south side of the major bog complex. The vegetation of the major bog complex is of interest because of its intermediate character between coastal and inland bogs. The coastal floristic element includes *Gaylussacia dumosa* var. *bigeloviana* and *Sphagnum flavicomans*. A fire had recently (1987 or spring, 1988?) burned over much of the transitional unit just north of the stream. Documentary evidence of other fires affecting areas around the stream has been found. These fires may have originated in the blueberry fields near the peatland.

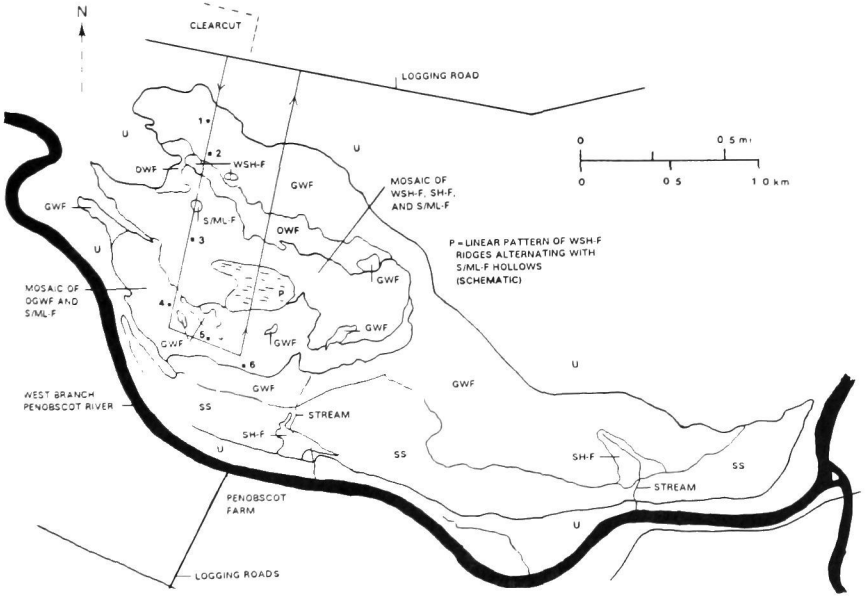


69. NOLLESEMIC KETTLE
Nollesemic Lake Quadrangle

The Kettle in the Bend of Nollesemic Stream in Hopkins Academy Grant Twp is an exceptionally good example of a kettle hole "bog" (extreme poor fen) or schwingmoor in pristine condition, as judged from overflight, aerial photos, and an on-the-ground visit. The kettle is associated with an esker. In 1½ hours spent at the small peatland, 37 species of vascular plants and ground bryophytes and lichens were identified. Although examples of this type of peatland are common in Maine, and no rare species or vegetation types were found (or are likely to occur), this exemplary site is worthy of protection. A map was included by Davis and Anderson (1991).

71. NORTHEAST CARRY FEN
Penobscot Farm and Seboomook Quadrangles

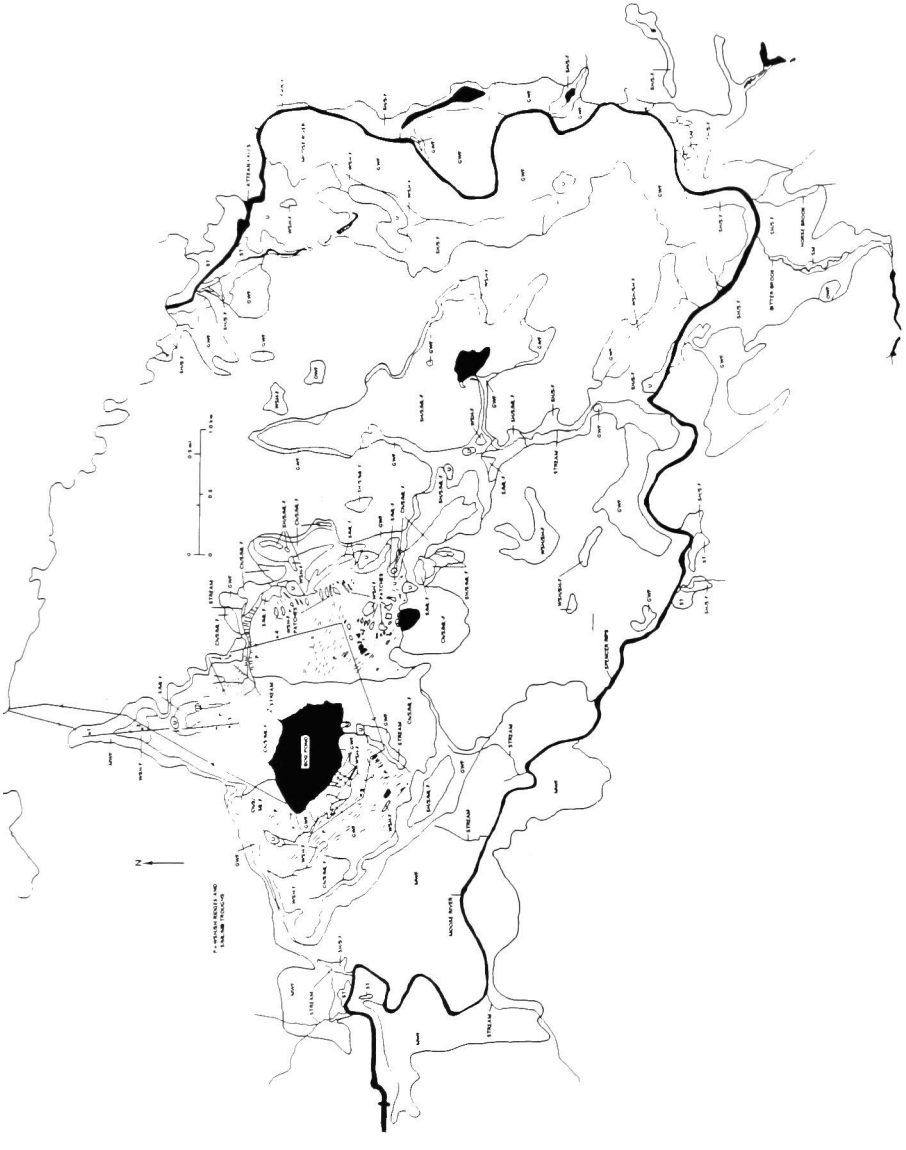
This fen, north of Northeast Carry, is a 500-ha peatland that developed on a glacial lake bed on the north side of what is now the channel of the West Branch of the Penobscot River. The lake bed extends to the south side of the channel, where another peatland (not studied) is present. Northeast Carry Fen is largely unpatterned, but possesses a ribbed area without pools (flarks) near the center of the open expanse. The peatland is moderately acidic (poor) to circumneutral. Floristic diversity is high, and two "unusual/uncommon" species were observed in the 8½ hours of field study: *Symphyotrichum boreale* and *Juncus stygius* ssp. *americanus*.



72. NUMBER 5 BOG

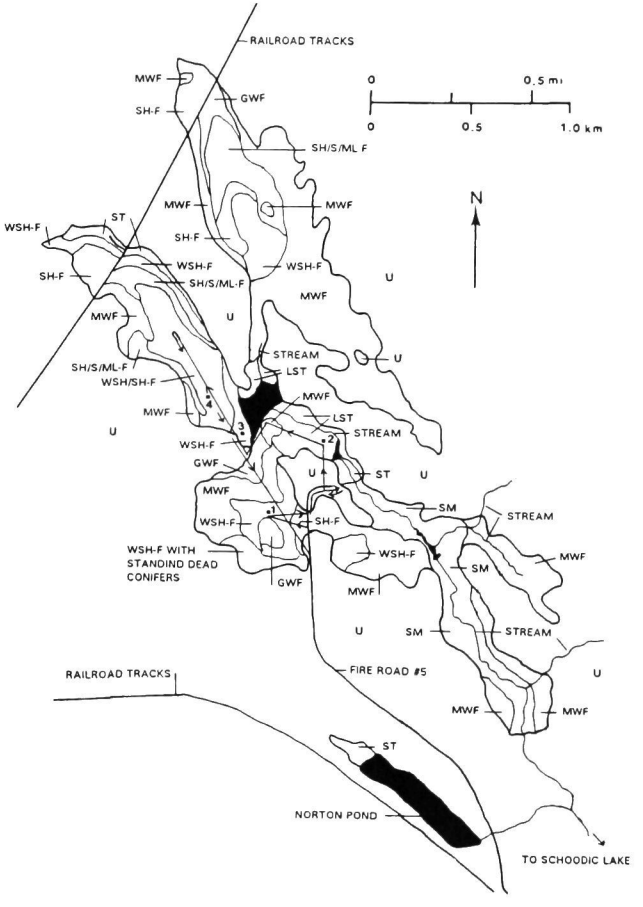
Attean Pond and Catheart Mountain Quadrangles

Number 5 Bog proper, as mapped by Cameron et al. (1984), is a 544-ha multiple-unit peatland (567 ha according to Sorenson 1986a), occupying a late-glacial lake bed in the mountains of western Maine, and is part of a much larger multiple-unit peatland. The peatland is situated at the southeastern foot of Attean Mountain, which provides a scenic backdrop. On the north, the peatland is separated from Attean Pond (lake) by low hills. Two drainage channels run from the peatland between the hills to the lake. On the west, south, and east, the peatland drains into the Moose River. The peatland contains two open expanses. The western and main expanse surrounds the ~38-ha primary "Bog Pond" that may be a remnant of a once larger water body. An additional, smaller primary pond occurs at the southeastern corner of the expanse. This expanse (and its northern wooded periphery) is the only part of the peatland where formal sampling took place (relevés; water and peat samples). The eastern open expanse is roughly a quarter the area of the main expanse and is separated from it by a narrow strait of peatland. It, too, contains a primary pond. Number 5 Bog does not appear to be a true raised bog. Morphology, inferred hydrology, and vegetation and flora of the main expanse indicate that it is an "extreme-poor" to "poor" fen (very acidic to moderately acidic fen according to Anderson and Davis [1997]). The main expanse is characterized by both patterned and unpatterned fen areas, including a broad area southwest of Bog Pond with a unique series of parallel wooded ridges separating moss lawns—most of which lack the open water of typical flarks. The larger multiple-unit peatland of which Number 5 Bog is a part, roughly 1800 ha in all, also includes unpatterned fens on both sides of the Moose River. In addition to being outstanding in its peatland characteristics (Table 14; Appendix G), a disjunct stand of *Pinus banksiana*, worthy of protection in its own right (Tyler and Davis 1982), occupies the large upland near the east end of the peatland.



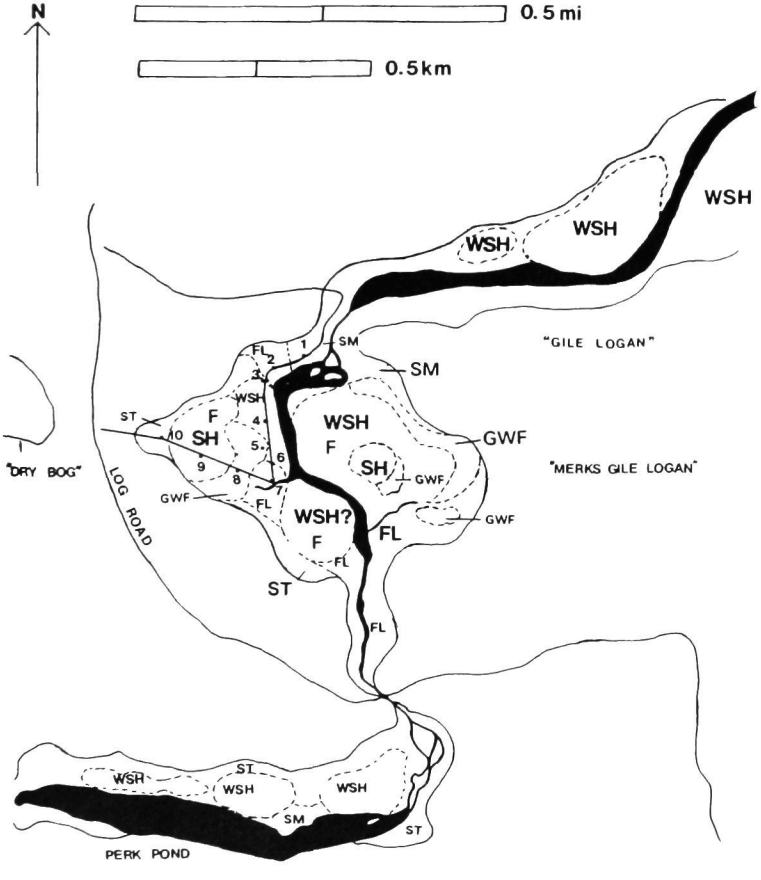
74. ORSON BOG
Seboeis Lake Quadrangle

Orson Bog is a ~290-ha peatland surrounding a stream (and its branches) that enters the western side and broadest area of Schoodic Lake in Brownville Twp. The peatland consists of several complexes in open basins and stream valleys. The main basin complexes have slightly raised areas (transitional), but are not strictly ombrotrophic. The western and northwestern complexes were sampled and found to be very acidic (extreme poor) to moderately acidic (poor) fens with moderately diverse flora. A railroad passes through the two northernmost complexes and has affected the hydrology sufficiently to have altered the vegetation.



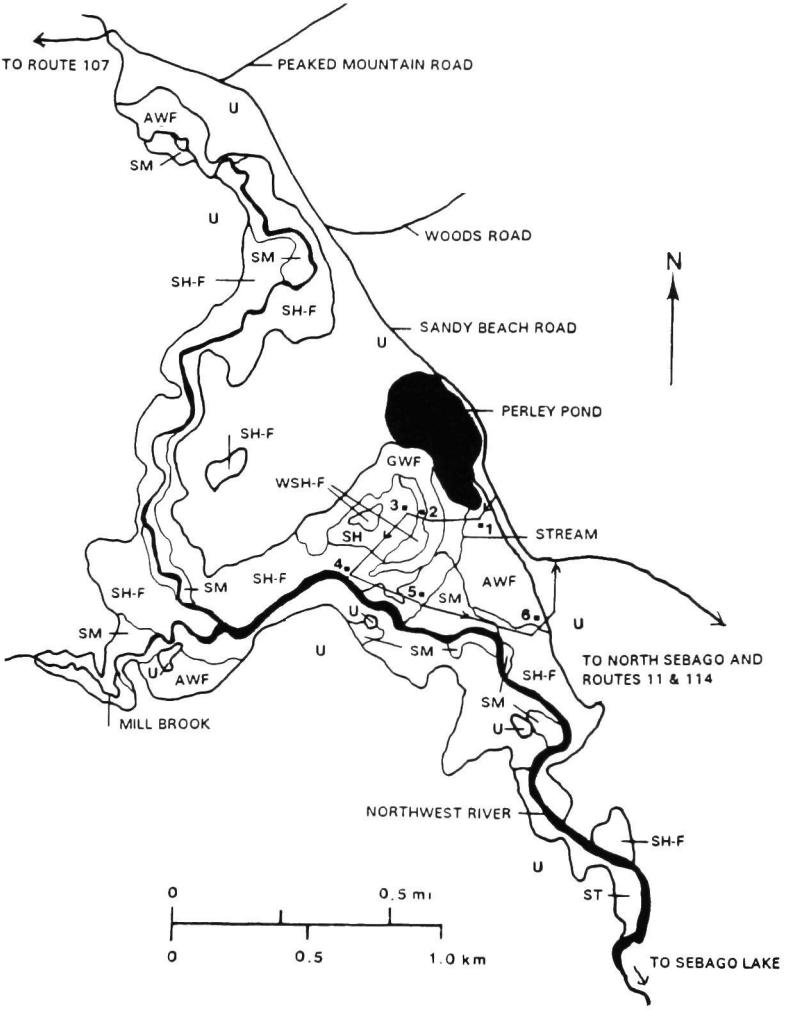
76. PERK POND FLOWAGE FEN, 1983
Kennebago Lake Quadrangle

The peatlands around and north of Perk Pond in Rangeley Twp (with a small area extending northward into Davis Twp) in western Maine appears to be an old, infilled beaver flowage. A series of five large-pond vestiges are surrounded by unpatterned fens, collectively comprising ~150 ha. The lowermost (downstream) pond is Perk Pond. The best developed peatland, and the one studied on the ground, surrounds the next large pond (not counting tiny ones) upstream from Perk Pond. Slightly raised areas appear to be transitional from minerotrophy to ombrotrophy, but the flora indicates that minerotrophy still exists. This string of small peatlands is not unique, being representative of hundreds of old beaver flowages in Maine that have been obliterated by infilling and peatland development.



77. PERLEY POND FEN
North Sebago Quadrangle

This fen in Sebago Twp is located along the Northwest River and in a basin adjacent to Perley Pond[1]—all of which is set in a deposit of ice-contact glaciofluvial sand and gravel. The peatland covers ~160 ha, and apart from the basin fen by the pond, it contains fen units surrounding the river and Mill Brook. The peatland flora is highly diverse for the only moderate peatland area and the largely very acidic (extreme poor fen) and moderately acidic (poor fen) conditions.



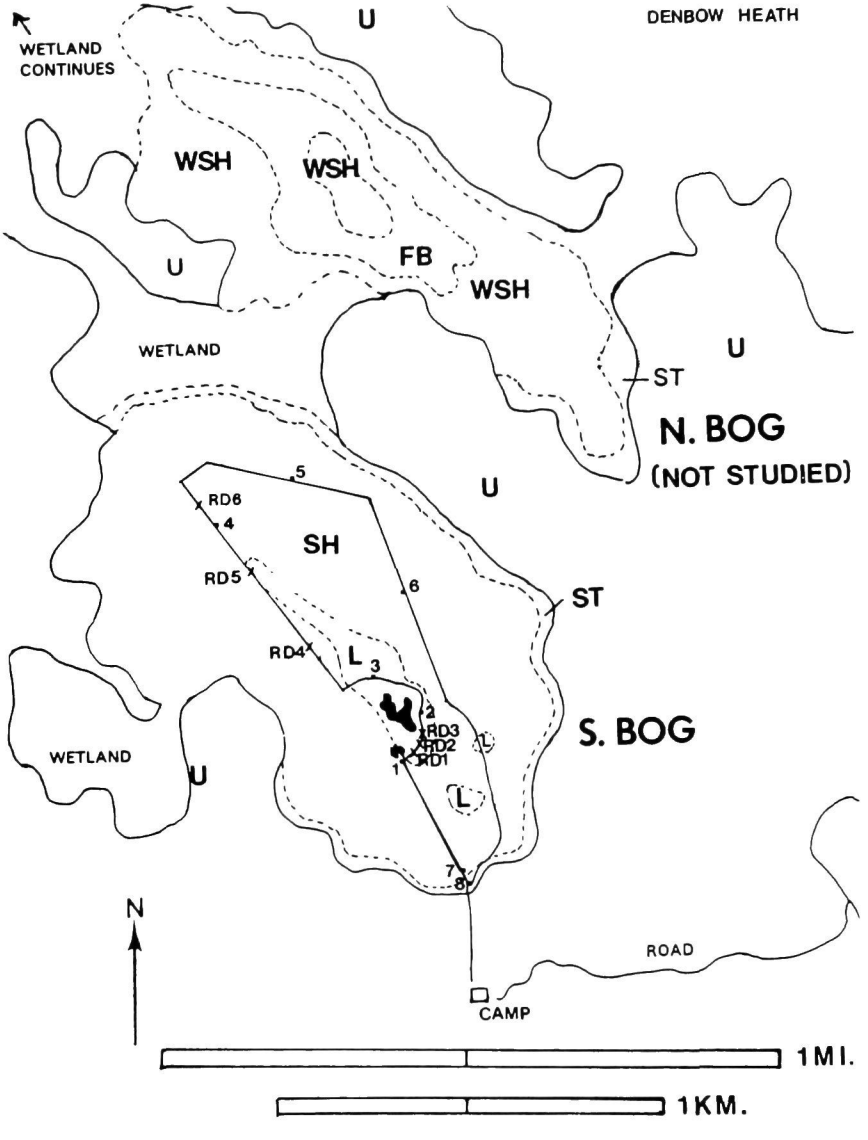
[1]There is another Perley Pond in adjacent Denmark Twp.

78. KETTLE NEAR PICKEREL POND
The Horseback Quadrangle

The kettle along the Horseback near Pickerel Pond in T32MD is occupied by a good example of a schwingmoor fen or "kettle bog." A small pond occupies the center of the ~2-ha peatland. A "horseback," in Maine parlance, is an esker. This small fen is close to two other studied peatlands associated with the same esker: Dollar Pond Fen and Horseback Bog. The kettle is shown on the map of Horseback Bog.

80. ROCK DAM HEATH, 1983
Tunk Mountain Quadrangle

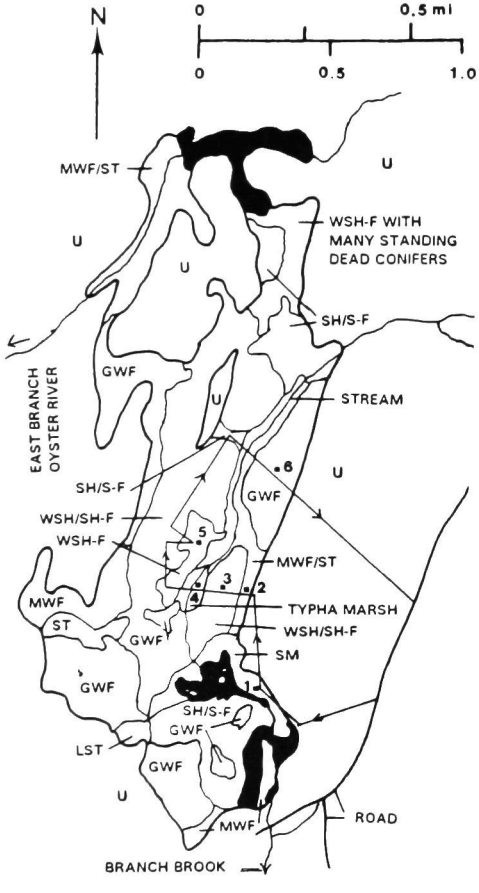
Rock Dam Heath in T16MD Twp is a ~265-ha peatland with two main complexes, north and south. Only the south complex, containing a raised bog without pattern, was studied on the ground. Overall, the vegetation of this acidic complex is quite diverse, but the flora has limited diversity. The open area of the south complex is about 90 ha, and is largely covered by a shrub heath of subcoastal character, with abundant *Gaylussacia dumosa* var. *bigeloviana* and patches of fruticose lichens. The highest part of the main axis of the unit is covered by a *Trichophorum cespitosum* moss lawn, at the southeast end of which is a cluster of secondary pools (a soak?). The northern complex contains a slightly raised center, questionably fully ombrotrophic and largely wooded. Areas of gymnosperm and mixed wooded fens occur around these units, most extensively toward the northwest. The peatland drains toward the northwest into the West Branch of the Narraguagas River. A narrow corridor of wooded fen connects the north complex to Denbo Heath, a large raised bog complex that has been extensively and intensively mined for peat over several decades. Rock Dam Heath does not appear to have been affected by this activity, and remains pristine. Map on page 132.


WETLAND CONTINUES
U
DENBOW HEATH
WSH
WSH
FB
WSH
U
WETLAND
U
ST
N. BOG
(NOT STUDIED)
U
5
RD6
4
SH
RD5
6
ST
RD4
L 3
2
RD3
RD2
RD1
1
S. BOG
WETLAND
U
L
7
8
N
ROAD
CAMP
1MI.
1KM.

81. ROCKLAND BOG

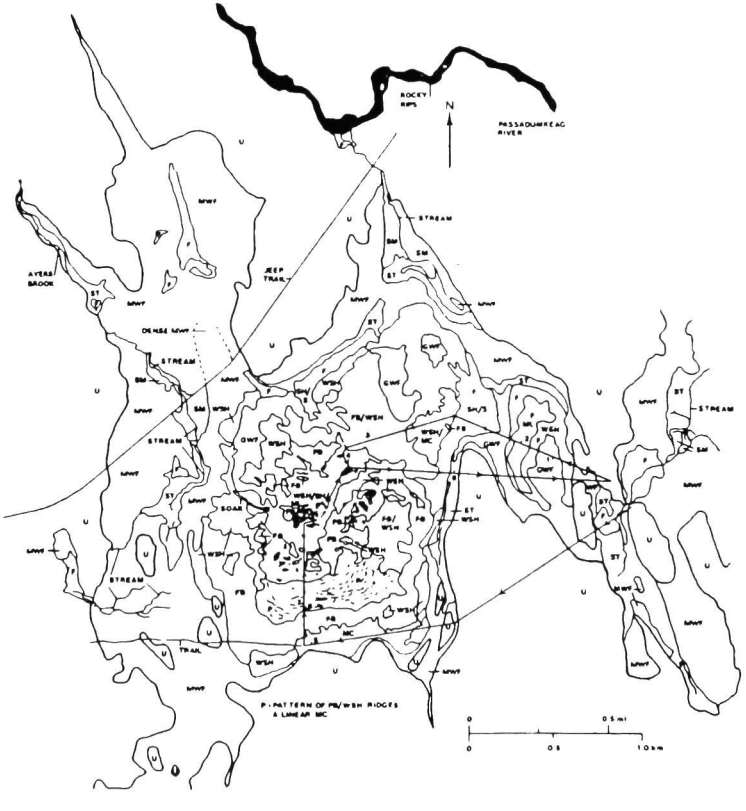
West Rockport and Thomaston Quadrangles

Rockland Bog is a roughly 150-ha peatland in the headwater basin of Branch Brook (which enters the Mill River) and the East Branch of the Oyster River. It is largely a circumneutral and moderately acidic fen, not a true raised bog. We visited it briefly in 1983, and spent a full day studying it in 1988. On both occasions, the Oyster River where it passed through the peatland had beaver dams on it, flooding the northern end of the peatland. Branch Brook at the south end of the peatland, not examined in 1983, had flooded over its banks in 1988. The peatland is unexceptional in most respects, but is floristically quite diverse. *Botrychium lunaria* an endangered fern species in Maine (S1) was found at the peatland in 1985 by St. John Vickery.



82. ROCKY RIPS BOG
Passadumkeag, Burlington, Olamon, and Greenfield Quadrangles

The peatland south of Rocky Rips on the Passadumkeag River in Twp 21ND covers roughly 500 ha, and contains a ~225-ha concentrically patterned domed bog complex with many secondary pools. Radiating out from the raised area are very acidic (extreme poor) and moderately acidic (poor) wooded and unwooded fens. The peatland drains in three directions: (1) east via a tributary of Lower Lord Brook, which flows into the Passadumkeag River; (2) southwest to Smart Brook, which flows into Olamon Stream; and (3) northwest to Ayers Brook, which flows into the Passadumkeag River. A major water track, starting at a soak carries water off the dome to Ayers Brook. The southern slope of the dome has a clear pattern of alternating concentric ridges and troughs. The ridges are vegetated by wooded shrub heath and bog forest, and the troughs by moss-*Chamaedaphne* lawn. The other slopes are more heavily wooded, with a less clear cross-slope pattern, and with a patchwork of bog forest and wooded shrub heath. The top of the dome is more open, with a complex pattern of shrub heath, wooded shrub heath, and moss lawn, and is capped by a large secondary pool. This complex contains one of the finest examples of a domed bog in Maine. The vegetation is highly diverse, but the flora only moderately so.



83. SACO HEATH
Old Orchard Beach Quadrangle

The Heath at Saco is a ~300-ha peatland on glaciomarine clay, silt, and sand. It is at the head of drainage of several streams. On the east it drains into Foxwell Brook (to Cascade Brook), on the south and west to tributaries of Deep Brook (to Saco River), on the northwest to a tributary of Stackpole Creek (to Saco River), and on the north and northeast to Grant and Ricker Brooks (to Nonesuch River).

The Heath is an exceptional peatland for geographic reasons. About half of the central part of the peatland is raised. The Heath is very close to the southern limit of raised bogs in northeastern United States. While other raised bogs may occur slightly farther south in Maine (e.g., both of the following *may* be raised bogs: the Heath North of Merriland Ridge, Wells, and Beaver Dam Peatland, Berwick), the Heath at Saco is certainly the most outstanding example of one so far south. An area of small secondary pools occurs near the center of the raised portion, a feature characteristic of more northern bogs. Although the Heath is unique for its location in being a boreal, ombrotrophic type of peatland, the vegetation covering a large part of it is dominated by a southern species, Atlantic white cedar (*Chamaecyparis thyoides*). This wetland tree species reaches its northern limit in southern Maine and ranges as far south as Florida. An additional feature, unique so far south in Maine, is the patterned fen at the foot of the eastern bog slope. Other, less clearly patterned fens occur elsewhere in this peatland. The closest other documented patterned fens in Maine are about 150 km to the north. Although the Heath is exceptional in terms of geography of peatland types and *Chamaecyparis thyoides*, it is not otherwise exceptional.

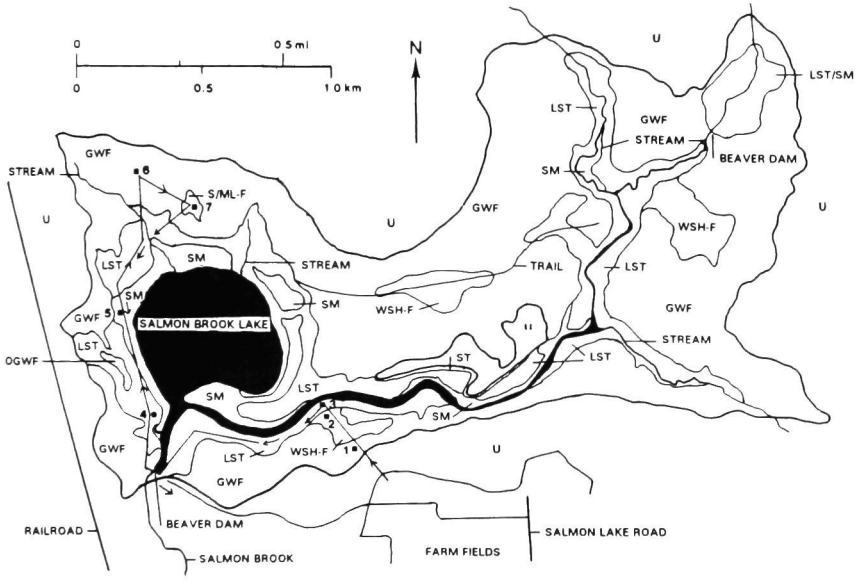
The eastern slope of the bog shows a clear and interesting transition from ombrotrophic bog forest and wooded shrub heath on top, to more open wooded shrub heath and shrub heath on the slope, to patterned fen at the base, and finally to unpatterned shrub heath fen. The patterned fen has cross slope (cross flow) ridges of wooded shrub heath, alternating with troughs of wetter *Chamaedaphne*-moss lawn. Sedges are important components in the more open fen communities in this part of the peatland. The southwestern two-thirds of the peatland is vegetated by a complex pattern of open and semi-wooded communities. The northwestern part is the most consistently heavily wooded area. A small stretch along the northern edge of the peatland has been disturbed by peat excavation and ditching, and logging has occurred on an adjacent area of the peatland. An old drainage ditch was found at the southeastern edge of the peatland, along the northern edge of the upland "peninsula" that juts into the peatland from the southeast, but that ditch has not had a noticeable effect on the peatland. Map on page 136.

Supplemental Notes for Saco Heath Vegetation Map (numbers correspond with circled numbers on map)

1 Patterned fen consists of *Chamaedaphne / Picea mariana* ridges and *Sphagnum rubellum / Gaylussacia dumosa / Rhynchospora alba / Cladonia* cf. *squamosa* troughs. Relevé 1 is in a trough.
2 Gymnosperm wooded fen (GWF) consists of four tree species: *Pinus strobus, Picea mariana, Chamaecyparis thyoides,* and *Larix laricina.*
3 Forested bog quite thick on east edge of pools.
4 Patterned fen consists of wooded shrub heath (WSH) ridges and *Chamaedaphne / Sphagnum rubellum* (MC) troughs.
5 *Rhodora* becomes much more abundant proceeding south in this shrub heath (SH) community.
6 Mixed wooded fen (MWF) with *Pinus rigida;* understory *Rhodora, Nemopanthus, Gaylussacia baccata,* and *Chamaedaphne.* Peat ≤ 0.3 m.
7 *Rhodora* dominant.
8 Logged to some degree.
9 Vegetation is weakly patterned; wooded shrub heath ridges, *Chamaedaphne / Sphagnum rubellum* (MC) troughs.

84. SALMON BROOK LAKE FEN
Mud Lake Quadrangle

Salmon Brook Lake Fen is a ~90-ha peatland surrounding the brook and lake. The fen includes wooded portions, much dominated by *Thuja occidentalis*, and open portions, and ranges from very acidic (extreme poor fen) to circumneutral-alkaline (rich to extreme rich fen). The highest pH and Ca in peat pore water at one of our sample stations was northwest and north of the lake. Although an unexceptional fen in most respects, the flora is exceptionally diverse for so small a peatland in Maine (134 vascular plant + ground bryophyte and lichen species recorded in an 8.75-hour visit). In addition, this flora contains several relatively rare species, one of which (*Nymphaea leibergii*) is on the state list as critically imperiled. Another such species, *Amerorchis rotundifolia*, is reported by Gawler and Vickery (1982, Register of Maine Critical Areas) for "the cedar woods north of the open bog," but we cannot tell from that report whether the cedar woods is part of the peatland.

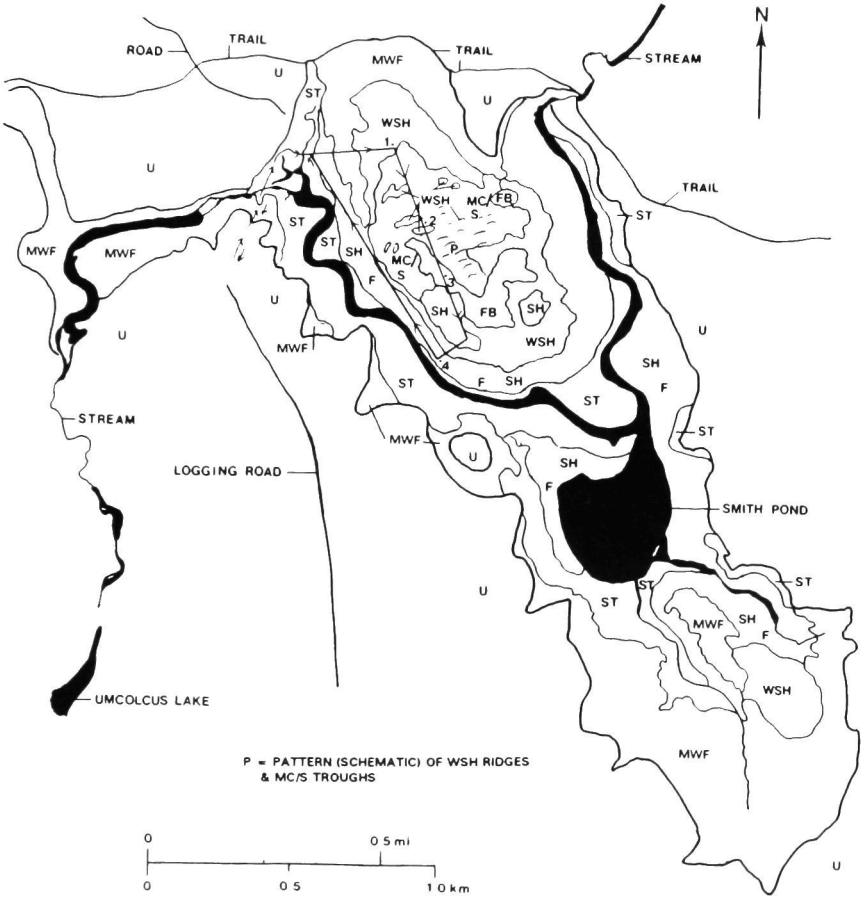


88. SMITH BROOK DEADWATER BOG
Norcross and Millinocket Quadrangles

Smith Brook Deadwater Bog in T1R8 is a ~280-ha multiple-unit peatland with two main eccentric bog complexes and, possibly, two smaller eccentric bog complexes adjacent to, and coalesced with, the larger ones. In addition, the peatland has unpatterned fens associated with Little Smith Pond and the deadwater stream. We did not carry out a formal on-ground survey of this peatland. However, we are able to describe and evaluate it on the basis of overflights and aerial photographs (Davis et al. 1983), a visit for peat coring in 1984, peat studies by Cameron et al. (1984), and vegetational studies by Widoff and Ruffing (1984) and Perkins (1985). A vegetation cover map was published by Widoff and Ruffing (1984). The upper parts of the main eccentric raised bogs have cupolas vegetated by wooded (*Picea mariana)* shrub heath (WSH). On the steeper slopes toward the centers of the units, WSH and shrub heath alternate along the contours, in ridges and troughs, respectively, forming a ladder-like pattern. *Sphagnum fuscum* dominates the ground layer on the ridges and small hummocks. Further down-slope, the units are dominated by moist lawns of *Sphagnum rubellum*, with *Carex pauciflora*, *Chamaedaphne calyculata,* and *S. cuspidatum.* The lawns alternate irregularly with ridges of shrub heath. At the low end, near primary water bodies including streams, tall graminoids including *Calamagrostis canadensis*, and shrubs including *Myrica gale* and *Alnus incana* ssp. *rugosa* are preponderant.

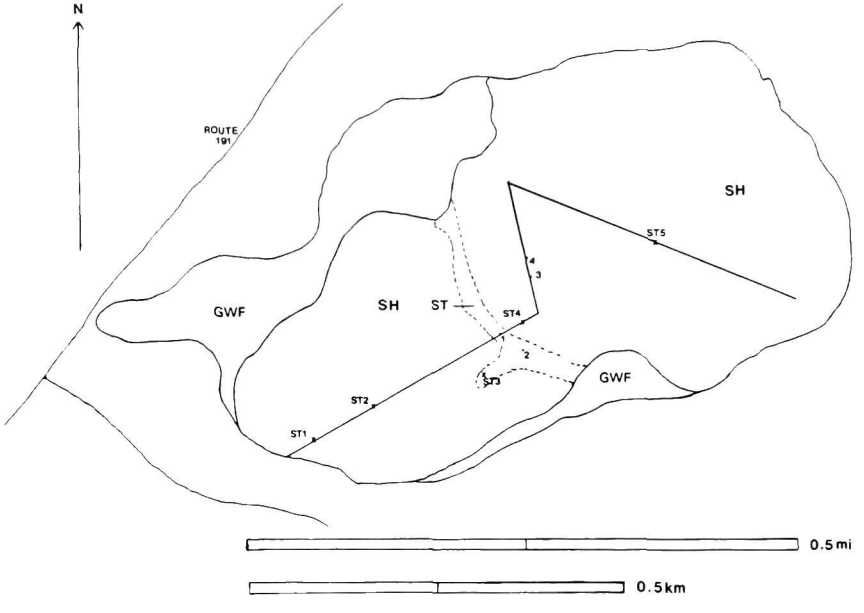
90. SMITH POND PEATLAND
Umcolcus Lake Quadrangle

The Peatland at Smith Pond is located in T8R5WELS in a basin once entirely occupied by a lake. Smith Pond is a small vestige of that lake. The rest of the lake has been replaced by the ~240-ha peatland. The East Branch of Umcolcus Stream takes a sharp southward bow turn through the peatland. At the bow's southern apex, the stream skirts the outlet of the pond. The peatland occurs both within the bow north of the stream (north complex), and south of the bow around the pond and extending ~1.0 km south of the pond (south complex). Two small streams flow through the south complex to the pond. Whether the two complexes contain true raised bogs is problematic and requires further study. The north complex quite possibly contains a low concentric bog, barely beyond the transition from fen, judging by its weakly developed concentric features and its minimal peat depths for a raised bog. A weakly developed linear pattern of wooded shrub heath ridges and sedge-*Chamaedaphne*-moss lawn troughs occur near the center of this complex. The center is ringed by bog forest on the south, and sedge-*Chamaedaphne* moss lawn on the north which, in turn are ringed by wooded shrub heath. Finally, an outer ring of shrub heath fen and shrub thicket borders the stream, with gymnosperm wooded fen bordering the upland to the north. The south complex also has some concentric features (but lacks lineations), and may be slightly raised, but it was not studied on the ground. What appears to be the highest part is vegetated by wooded shrub heath. This part is ringed on the south by spruces (on bog slope?). The northern slope (toward pond) features an elongate wooded tongue (see map). Near Umcolcus Stream and the pond, shrub thicket and shrub heath fen abound. The fens are very acidic (extreme poor) and moderately acidic (poor). Map on facing page.


N
ROAD
TRAIL
TRAIL
TRAIL
STREAM
MWF
U
ST
WSH
MC/S
FB
SH
F
P
STREAM
LOGGING ROAD
SMITH POND
UMCOLCUS LAKE
P = PATTERN (SCHEMATIC) OF WSH RIDGES & MC/S TROUGHS
0
0.5 mi
0
0.5
1.0 km

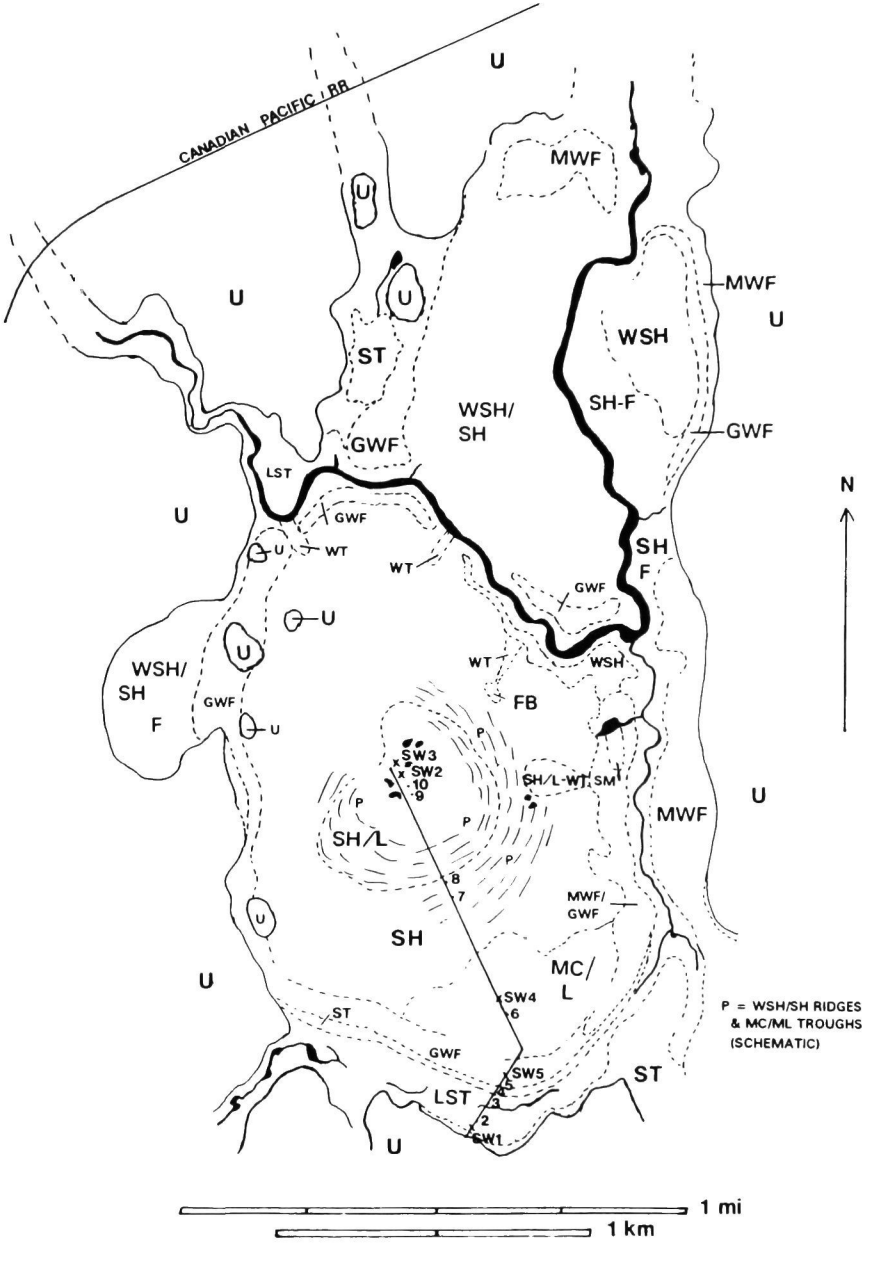
92. SOUTH TRESCOTT HEATH, 1983
West Lubec Quadrangle

The Heath at South Trescott in eastern coastal Maine is a ~35-ha, fair to good example of a plateau bog. It consists of two (east and west) partly coalesced raised parts separated by a moat, and a wooded fen at the north through west periphery of the west part.



95. SWEAT BOG, 1983
Hardy Pond and Seboeis Quadrangles

Sweat Bog, largely in Seboeis Plt, with a small part in Maxfield Twp is a ~500-ha multiple-unit peatland consisting of an exemplary domed, concentrically patterned raised bog complex with secondary pools, two raised complexes without pattern or pools, and several fen areas surrounding streams. Bog Brook and Sweat Bog Brook, and their branches carry drainage to the peatland from the surrounding hills. Sweat Bog Brook passes southeastward across the peatland's center, turns northward near the peatland's eastern border, passes northward between the two northern, unpatterned bog complexes, and finally exits the peatland and continues northward toward Seboeis Stream. The concentrically patterned bog complex constitutes the southern half of the peatland, south of the brook. The pattern is largely absent on the northwest quadrant of the dome, but is extensively present around the other slopes. The pattern consists largely of shrub heath and wooded shrub heath ridges separating moss lawn and *Chamaedaphne* moss lawn hollows. Two small clusters of secondary pools are present near the top of the dome. Well-defined water tracks drain the dome's northern and eastern lower slopes; one eastern track originates from a soak. The peatland contains a wide diversity of vegetation types, but is limited in floristic diversity. The flora suggests that peat pore waters are entirely acidic, but no water chemistry measurements were made. The Canadian Atlantic Railway passes over narrow northern extensions of the peatland. Logging of the uplands around the peatland has been intensive. However, the peatland itself does not appear to have been disturbed. Map on page 142.


CANADIAN PACIFIC RR
U
MWF
ST
WSH/
SH
GWF
LST
WSH
SH-F
SH
F
WT
FB
SW3
SW2
10
9
SW4
6
SW5
5
4
3
2
SW1
SH/L
MC/
L
MWF/
GWF
N
P = WSH/SH RIDGES
& MC/ML TROUGHS
(SCHEMATIC)
1 mi
1 km

96. THOUSAND ACRE HEATH

Spring Lake, Saponic, and Weir Pond Quadrangles

Thousand Acre Heath (1000aH) at T3R1NBPP is among the larger peatlands in Maine. Our plan map includes only 1000aH proper, from the Passadumkeag River on the south, uplands on the west and north, and a prominent esker (nearly undisturbed) on the east—an estimated total of 980 ha. Thus, a more accurate name for the peatland would be "Thousand Hectare Heath." However, even that name would be misleading, as 1000aH proper is part of an extensive multiple-unit peatland extending into Lakeville (T4R1) along the upper reaches of the Passadumkeag River and along its tributary, Taylor Brook, in all (including 1000aH proper) roughly 3000 ha. The rest of this description pertains only to 1000aH proper, as defined above.

The southern two-thirds of the peatland is dominated by a large, oval, concentrically patterned domed bog complex whose highest point is off center toward the northwest and whose northwest slope lacks concentric pattern. We call this bog the south complex. Worley (1981) indicated that this bog's pattern is eccentric. However, it is not an eccentric bog as defined for Maine by Davis and Anderson (in press) and for Scandinavia by authors cited in that publication because the northwest side is not backed against upland. Rather, it slopes and drains down into wooded fens. The rest of the dome, viz. a ~260° arc, is concentrically patterned. The entire dome is centrifugally drained, in contrast to the typically one-sided drainage of an eccentric bog. The peat at the top of the dome is about 7 m deep.

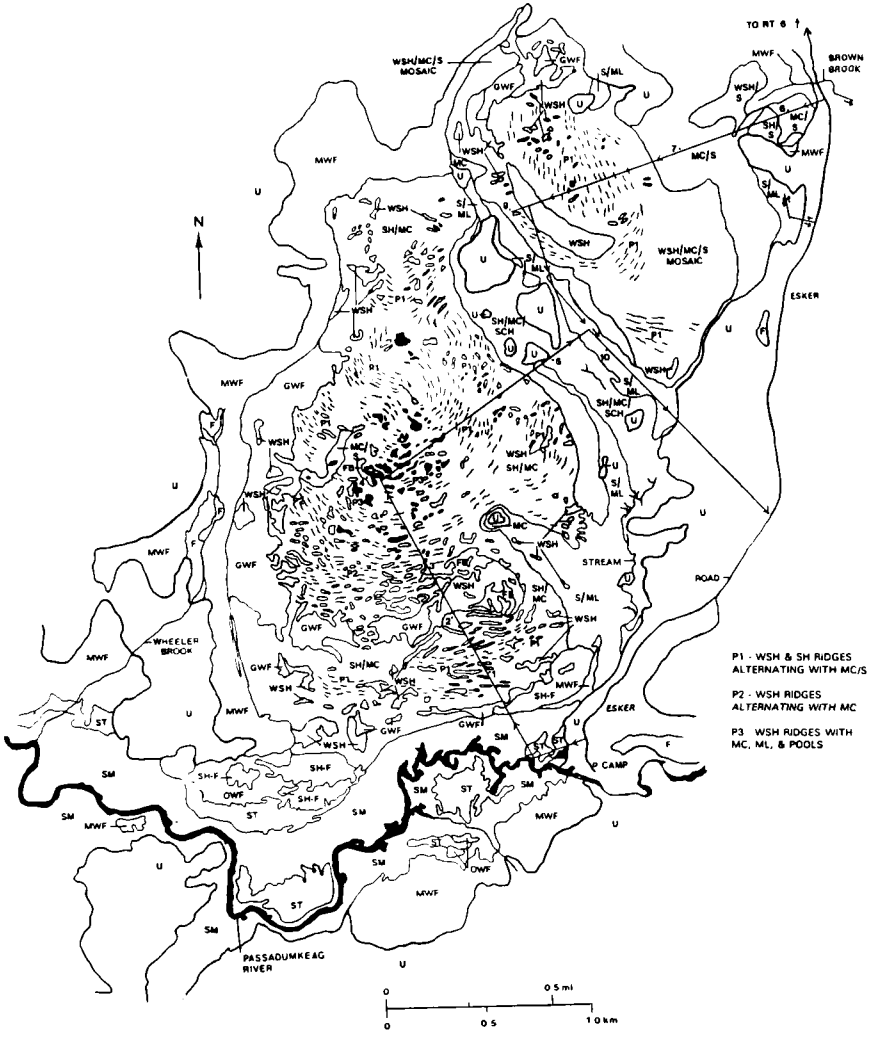
Additional features of the south complex are

1. A complex series of well-developed secondary pools near the top and encircling the top of the dome, on all but the WNW side.
2. A shallow pool/mud bottom complex at the very top of the dome, trailing obliquely down the WNW slope of the dome.
3. A long (1.5–2.5 km) gradual down-slope on the SSW-S side, with cross-slope arc-pattern of alternating ridges and troughs, the ridges with wooded shrub heath, the troughs near the top of the slope with pools, moss lawn, and *Chamaedaphne* moss lawn, and those at mid-slope mostly with *Chamaedaphne* moss lawn, all draining toward the Passadumkeag River.
4. A small upland "island" on the SE side, with a trailing (like a comet tail) sedge moss-lawn water track flowing toward the SE periphery of the peatland.
5. A major fen water track at the NE periphery of the complex, which receives drainage from the NE quadrant of the dome and from the SW and S slopes of the north complex. The track runs southeastward beside and between a string of upland "islands," and is vegetated by moss lawn with abundant *Sphagnum subsecundum*, *S. papillosum*, and sedges (largely *Carex oligosperma*), and also *Scheuchzeria palustris* ssp. *americana* and *Eriophorum* spp. The drainage is deflected southward at the esker to form a stream that is joined by the drainage from the more southerly water track (item 4, above). The drainage then continues to the SSE corner of the complex where it enters the Passadumkeag River.

6. The western slope levels off at the bottom into large areas of wooded fen. These areas are drained southwestward by Wheeler Brook. The north slope drains, at least at its eastern side, into the aforementioned major water track and possibly also (western side) to Turkloin Brook.
7. What appears from aerial reconnaissance to be an old survey line was cut in the wooded fen area along the WNW and W foot of the dome. The vegetation changes abruptly to a more heavily wooded condition on the west side of the line, suggesting that the line has caused a southerly diversion of the drainage off the dome, drying out the side away (W) from the dome. Could the line be an old drainage ditch? This disturbance was not mentioned by Worley (1981), who emphasized the perfect "virgin" condition of the peatland. The feature does not constitute a major departure from the overall pristine character of the peatland.

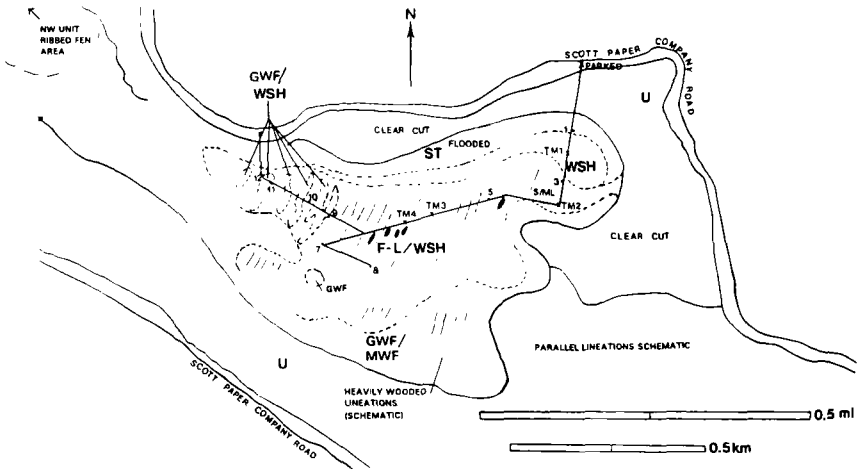
The south complex is separated from a smaller, but still large, less-raised and less boldly patterned north complex by a northwest to southeast string of upland "islands" with shallow peat between, and by a major water track. This complex is, in turn, separated by an upland "peninsula" from a much smaller raised bog near the northern tip of 1000aH proper. This small bog complex is not included in our plan map.

Chemical analyses of peat pore water from the top of the water table on the domes are consistent with ombrotrophic conditions, pH 3.9–4.2 and Ca 0.05–0.14 mg/L. The several open and wooded fen areas sampled all indicate very acidic (extreme poor) conditions (pH $\leq$ 4.3; Ca $\leq$ 2 mg/L). The lack of chemical diversity is reflected by only moderate floristic diversity for so large a peatland, although vegetational diversity is very high, reflecting the wide range of morphological and hydrological conditions.


TO RT 6
BROWN BROOK
WSH/MC/S MOSAIC
MWF
GWF
S/ML
WSH
U
MC/S
SH/MC
SH/MC/ SCH
N
ESKER
STREAM
ROAD
WHEELER BROOK
SH-F
OWF
ST
SM
CAMP
PASSADUMKEAG RIVER
P1 - WSH & SH RIDGES ALTERNATING WITH MC/S
P2 - WSH RIDGES ALTERNATING WITH MC
P3 WSH RIDGES WITH MC, ML, & POOLS
0 0.5 mi
0 0.5 1.0 km

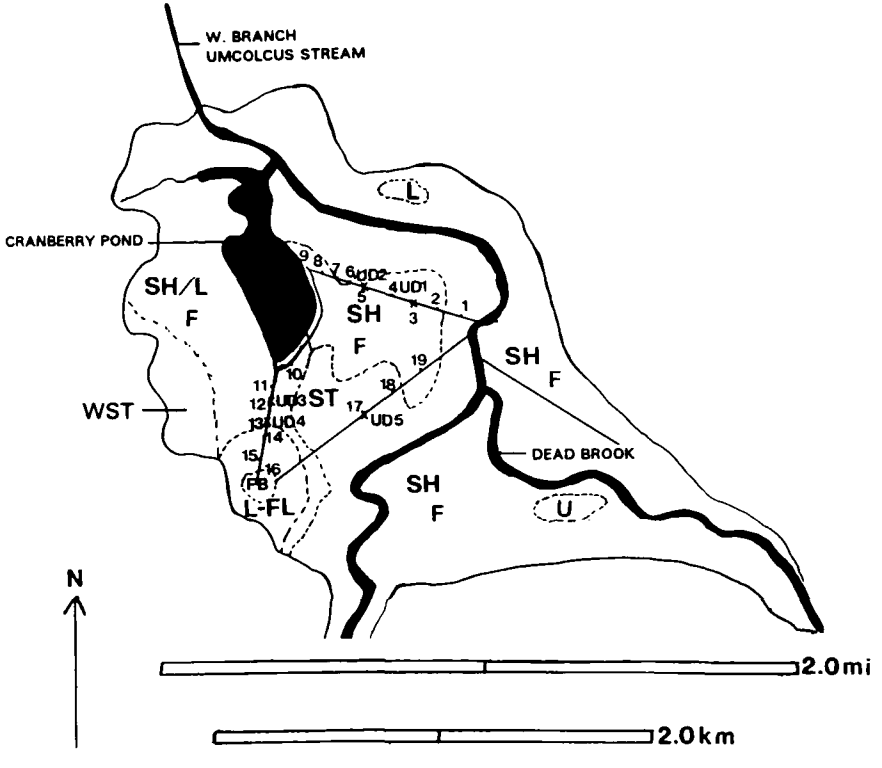
97. TWELVEMILE BOG, 1983
Churchill Stream Quadrangle

Twelvemile Bog in T3R1 NBKP (Long Pond) Twp is not a bog at all, but is a pair of ribbed fens. The two fens, combined, occupy ~110 ha in a northwest to southeast valley into which small Twelvemile Brook enters from the northwest. The stream maintains a channel through the northwestern fen, but drainage disperses through the southeastern fen. The stream reappears at the east end where it exits the peatland. The peatland also appears to be drained from near its western end—southward toward Long Pond. Both fens were studied by overflight and photography, but only the southeastern fen was mapped and studied on the ground. The northwestern fen is more heavily wooded than the other, and appears to lack permanent open water in the troughs between the wooded ridges. The southeastern fen is wetter with flark pools. The ridges and troughs at the western end are distinct, the ridges heavily wooded, but toward the center of the fen, the parallel pattern is more irregular, and the ridges are semi-open (wooded shrub heath and shrub heath). An expanse of sedge moss lawn occupies the eastern end of the fen. When we studied the peatland in 1982, the forest around the north and eastern sides had recently been clearcut, right to the edge of the peatland. One local correspondent indicated that logs may have been moved over the frozen peatland surface in winter. It is possible that this activity had disturbed the surface pattern in the center of the southeastern fen.



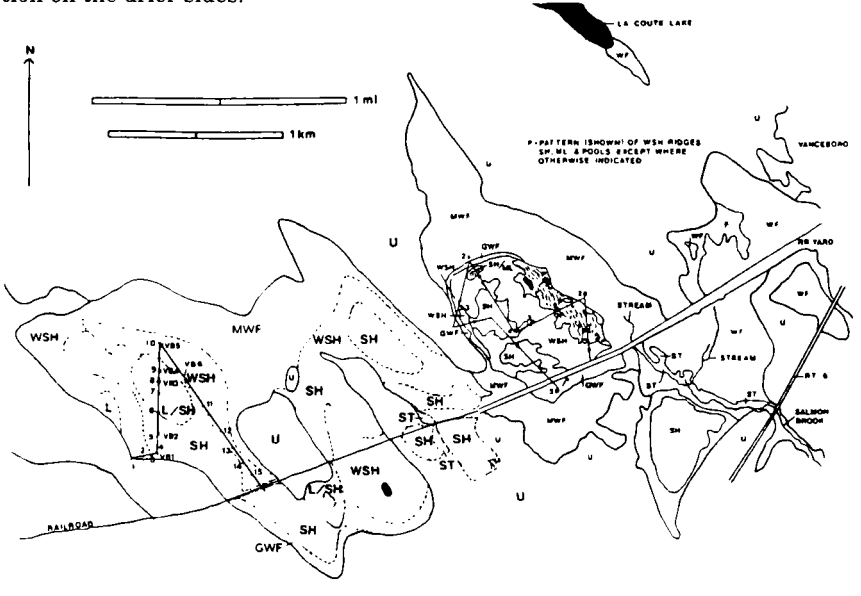
98. UMCOLCUS DEADWATER FEN, 1983
La Pomkeag and Umcolcus Lake Quadrangles

Umcolcus Deadwater Fen, covering ~170 ha in T8R6 Twp in northern Maine, is comprised of fens around Cranberry Pond and the associated deadwater. The vegetation consists largely of shrub heath fens, shrub heath-moss lawn, and *Carex*-moss lawn fens, surrounded by shrub thickets and wooded fens. The deadwater may be due in part to a log driving dam that once existed at its downstream end. The peatland is rather ordinary in all respects.



99. VANCEBORO RAILROAD PEATLAND, 1983[1]
Vanceboro and Lambert Lake Quadrangles

This ~760-ha multiple-unit peatland in Vanceboro Twp in eastern Maine begins at Vanceboro village and extends 6 km westward.[2] This description summarizes information in Davis et al. (1983) and Davis and Anderson (1991), and adds additional information. The western parts of the peatland drain northwestward into Walker Brook, which flows into Spednik Lake (St. Croix drainage). The eastern parts drain southeastward into Salmon Brook, which empties directly into the St. Croix River. The peatland has multiple arms oriented northwest to southeast, as determined by the valley and ridge topography of that part of Maine. The peatland is dissected by the Maine Central Railroad embankment which runs west-southwestward from the railroad yard at the village. The multiple-unit peatland is made up of several raised bog complexes with peripheral gymnosperm and mixed-wooded fens. Raised bog complexes in a western coalescence include two domes with concentric pattern (lacking pools), a gently convex bog with pools and one without pools. Raised bog complexes to the east include two domes with concentric pattern (lacking pools); gently convex bogs, one with pools; and an eccentric bog complex with pools (described by Davis and Anderson 1991) north of the railroad and near the east end of the peatland. This peatland contains an impressive variety of raised bog complexes and vegetation types, but is floristically rather poor. The railroad embankment appears to have altered drainage, increasing woodedness of vegetation on the drier sides.

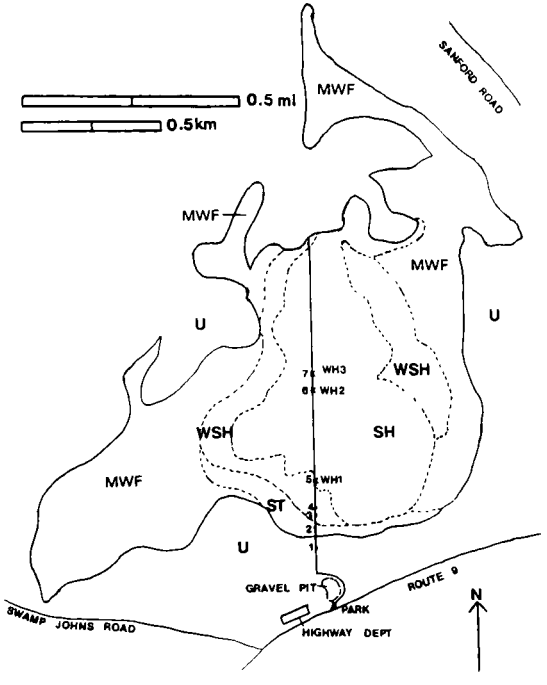


[1]The western part of the accompanying map by Davis et al. (1983) is previously unpublished. The eastern part, containing an eccentric bog unit is republished from Davis and Anderson (1991).

[2]The studied peatland is part of an even larger set of peatlands which continue southward along the west side of the St. Croix River.

101. WELLS HEATH, 1983
North Berwick Quadrangle

The Heath in Wells, a ~180-ha peatland in extreme southwestern Maine and 7 km from the coast, is questionably a raised bog complex. Near its center, The Heath has peat depths of only 3.0 m, and depths diminish away from the center (Cameron et al. 1984). Whether this pattern reflects surface topography or basin topography, or a combination of the two, remains to be determined. Hydrological and chemical studies could also shed light on whether the peatland is ombrotrophic or minerotrophic near the center. If the center of the complex is raised, it would be the southernmost raised bog in Maine, and perhaps the southernmost in North America.[1] A large area of shrub heath and wooded shrub heath dominates the center of the peatland. This area is circled by wooded fens, and wooded fens are especially extensive along the long northwest border of The Heath. Air photos taken during an overflight and a brief on-ground survey suggest that vegetational and floristic diversity is not great for a peatland complex of this size. Coastal bog floristic elements include *Gaylussacia dumosa* var. *bigeloviana* and *Sphagnum flavicomans*. The Heath is bordered on the south by Merriland Ridge, an end moraine unique to the area. The moraine has been extensively mined for gravel, but The Heath itself is remarkably undisturbed for so populated an area of Maine.

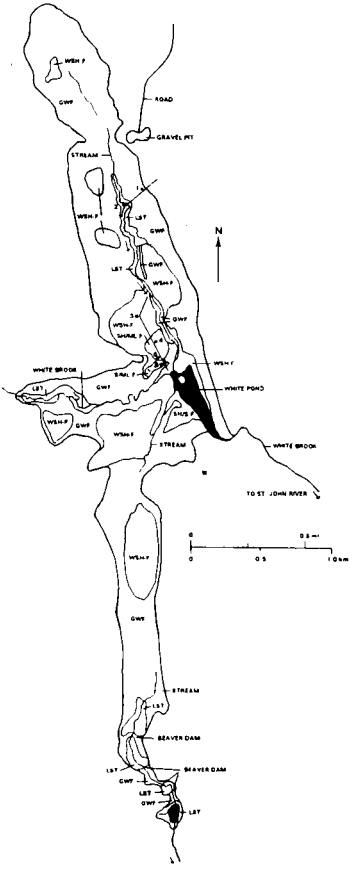


[1]Except that some of the pocosins of the Carolina coastal plain appear to be raised (Sharitz and Gibbons 1982).

102. WHITE POND FEN

Houlton Pond and Seven Islands Quadrangles

White Pond Fen in T14R15 WELS, a ~220-ha peatland in far northwestern Maine, is an unpatterned fen in the elongate north-south valley of White Brook. The narrow peatland is 6 km long. The small (~0.5-km-long) White Pond is located equidistantly between the north and south ends of the peatland. Only the part north of the pond was studied on the ground. The peatland is unexceptional in form and hydrology, but outstanding in floristic diversity because of the wide range of chemical conditions, ranging from alkaline (rich) to very acidic (extreme poor) fen. Two-hundred and six species were identified in a nine-hour survey, including 130 species of vascular plants, 74 species of ground bryophytes, and two species of ground lichens. The flora contains at least nine vascular plant species that are rare in Maine, three of which are critically imperiled (S1) (*Selaginella selaginoides*, *Carex vaginata*, and *Drosera anglica*) and five imperiled (S2) in the state.



APPENDIX C

Appendix C. Floristic diversity, index of species richness (D_c), numbers of rare species (definitions of S1, S2, and S3 are given in the text and by Maine Natural Areas Program [1998]), number of hours spent searching the peatland, and pristine character at 101 Maine peatlands. Floristic lists for individual peatlands are available from the authors.

Number	Name	N	Dc	S1/S2	S3	Search hours[1]	Pristine Character (level)[2]
1	Alton Bog	73	34	0	0	8.5	5
2	Belgrade Kettles	79	38	0	0	8	4
3	Big Bog	58	30	0	0	7	2
4	Big Meadow Bog	58	30	0	0	7	
5	Big Ten Peatland	50		1	0		
6	Black Brook Pond	61	31	0	1	7	5
7	Black Pond Fen	115	54	0	0	8.5	2
8	Bog and Union River	35	17	0	0	8	4
9	Burntland Brook Fen	84	42	0	2	7.5	2
10	Burpee Brook Ptld	38	20	0	0	7	3
11	Call Bog	47	24	0	0	7	
12	Caribou Bog	126	32	0	5	54	3
13	Caribou Bog, Indian	28	31	0	0	2.5	5
14	Carlton Pond East	50	26	0	0	7	
15	Carlton Pond West	65	33	0	0	7	
16	Carter Brook Fen	66		2	0		
17	Cedar Mt N Ptld	57	32	0	0	6	2
18	Chamberlain Fen	66		0	0		
19	Chemo Bog	53	26	0	0	8	3
20	Chimenticook Fen	73	38	0	0	7	1
21	Clifford Stream Fen	89	43	0	0	8	2
22	Coffin Bog	69	37	0	0	6.5	2
23	Cold Stream Ptld	188	55	0	0	30.5	3
24	Crawford Lake Bog	56	30	0	0	6.5	
25	Cross Lake Fen	63	29	0	4	8.5	1
26	Crossuntic Stream	69	35	0	0	7	2
27	Crystal Bog	171[3]	42	6	13	56.5	2
28	Curtis Corner Fen	101	50	0	0	7.5	2
29	Deer Lake Fen	87	38	0	3	8	2
30	Dollar Pond Fen	40	58	0	0	2	2
31	Dottle Brook Fen	98	44	0	0	9.5	2
32	E Birch Stream Bog	60	31	0	1	7	1
33	Eastman Brook Fen	45		0	0		
34	Elevenmile Lake	86	44	0	0	6.5	2
35	Eliot Heath	66	37	0	0	6	3
36	Ellis Bog	55	29	0	1	10.5	2
37	Etna Bog	65	36	0	0	6	

Number	Name	N	Dc	S1/S2	S3	Search hours	Pristine Character (level)
38	Flinn Pond Ptlds	75	40	0	0	6.5	2
39	Fourth Machias Lake	53	42	0	0	3.5	
40	Fowler Bog	107	46	0	0	10	3
41	Great Cranberry Hth	107	45	0	2	11	3
42	Great Heath	112	27	1	2	60	3
43	Great Sidney Bog	84	47	0	0	6	2
44	Greenlaw Stream	102	54	0	0	6.5	2
45	Greenville Jct Ptld	49	25	0	0	7	4
46	Hatham Bog	58	36	0	0	5	2
47	Hermon Bog	49	25	0	1	7	4
48	Holland Pond Ptld	38	27	0	0	4	
49	Horseback Bog	89	46	0	0	7	2
50	Inman Bog	54	29	0	0	6.5	2
51	International Ptld	48		1	0		
52	Island Fen	55		1	0		
53	Jonesport Heath	76	35	0	1	9	4
54	Kanokolus Bog	71	40	0	0	6	2
55	Kezar Bog	100	43	0	0	10	4
56	Lambert Lake Ptld	69	39	0	0	6	2
57	Lamb's Dwtr Bog	48	27	0	0	6	
58	Limestone NE Bog	39	28	0	0	4	
59	Lindsey Brook Ptld	68	35	0	0	7	2
60	L Norridgewock	104	50	0	0	8	3
61	Macwahoc Stream	116	56	0	0	8	2
62	Magalloway River	70	32	0	0	9	3
63	Marble Fen	96	39	1	4	12	1
64	Meadow Brook Fen	76	38	0	0	7.5	3
65	Meddybemps Heath	60	29	0	0	8	5
66	Millberry Stream	133	62	1	0	8.5	3
67	Montegail Pond	101	46	0	1	9	4
68	Moose Fen	52		0	0		
69	Nollesemic Kettle	37	91	0	0	1.5	1
70	Nollesemic Stream	37	22	0	0	5.5	2
71	Northeast Carry Fen	129	60	0	2	8.5	2
72	Number 5 Bog	128	53	0	2	11.3	1
73	Orchard Bog	51	37	0	0	4	
74	Orson Bog	78	36	0	0	8.5	4
75	Otter Brook Bog	51		0	1		
76	Perk Pond Flow Fen	29	16	0	1	6	2
77	Perley Pond Fen	119	57	0	0	8	3
78	Pickerel Pond Kettle	62	45	0	0	4	2
79	Pierce Lake NW Bog	53	33	0	0	5	
80	Rock Dam Heath	57	27	0	0	8	2
81	Rockland Bog	119	51	1	1	10.2	3
82	Rocky Rips Bog	102	35	0	0	18	1
83	Saco Heath	82	30	0	1	16	4
84	Salmon Brook Lake	134	62	1	7	8.7	3

Number	Name	N	Dc	S1/S2	S3	Search hours	Pristine Character (level)
85	Sargent Bog	62	32	0	0	7	
86	Sawtelle Heath	95	49	0	0	7	
87	Slight Depression	43		0	0		
88	Smith Brook Dwtr	68	33	0	1	8	1
89	Smith Brook Fen	64		0	0		
90	Smith Pond Ptld	38	24	0	0	5	1
91	S Princeton NE Bog	44	27	0	0	5	
92	S Trescott Heath	51	27	0	1	6.5	2
93	Stetson Mt Ptld	102	48	0	1	8.5	2
94	Sunkhaze Stream					6	
95	Sweat Bog	60	34	0	1	6	2
96	Thousand Acre Hth	117	41	0	1	17	3
97	Twelvemile Bog	57	29	0	1	7	3
98	Umcolcus Dwtr Fen	58	36	0	1	5	3
99	Vanceboro RR Ptld	77	30	0	0	13.5	4
100	Wadleigh Bog	65	32	0	0	7.5	2
101	Wells Heath	30	22	0	0	4	2
102	White Pond Fen	206	92	3	7	9	2

[1]Includes only the period of species search (traverses, releves and releve vicinities) on the peatland itself.
[2]See Table 11.
[3]210 species if literature reports are included.

APPENDIX D

Appendix D. Typology of 92 Maine peatlands. A large majority of these peatlands are multiple-unit peatlands with complexes of more than one type (Davis and Anderson in press). See Table 1 for definitions of type numbers and Table 7 for data sources.

		Peatland types									No. different
No.	Name	1	2	3	4	5a	5b	6	7a	7b	8	types
1	Alton Bog	1	1									2
2	Belgrade Kettles			3								1
3	Big Bog	2	1					1				3
4	Big Meadow Bog											3
6	Black Brook Pond	1	1									2
7	Black Pond Fen	1	1									2
8	Bog and Union River	1				1						2
9	Burntland Brook Fen		1		1							2
10	Burpee Brook Ptld	4				1						2
11	Call Bog											3
12	Caribou Bog	3	4		1	7	1	1	1			7
13	Caribou Bog, Indian		1							1		2
14	Carlton Pond East											2
15	Carlton Pond West											2
17	Cedar Mt N Ptld	1								1		2
19	Chemo Bog	1	1			2	1					4
20	Chimenticook Fen		1		1							2
21	Clifford Stream	1										1
22	Coffin Bog	1	1					2				3
23	Cold Stream Ptld	5						2				2
24	Crawford Lake Bog											3
25	Cross Lake Fen		2		3							2
26	Crossuntic Stream	4	2					1				3
27	Crystal Bog	2	1						1	1		4
28	Curtis Corner Fen	1										1
29	Deer Lake Fen		1		3	1						3
30	Dollar Pond Fen	1										1
31	Dottle Brook Fen	1										1
32	E Birch Stream Bog	1	1							1		3
34	Elevenmile Lake	1	1			2		2				4
35	Eliot Heath		1									1
36	Ellis Bog	1	3		3	1						4
37	Etna Bog											2
38	Flinn Pond Ptlds	1	1					2				3
39	Fourth Machias Lake											2
40	Fowler Bog	1										1
41	Great Cranberry Hth										1	1
42	Great Heath	8	6			10	6		2	4		6
43	Great Sidney Bog	1	1									2
44	Greenlaw Stream	1	1									2
45	Greenville Jct Ptld	2						2				2
46	Hatham Bog						1	2				2

No.	Name	Peatland types 1	2	3	4	5a	5b	6	7a	7b	8	No. different types
47	Hermon Bog	1	1			2	1					4
48	Holland Pond Ptld											3
49	Horseback Bog	1	1			3						3
50	Inman Bog							1				1
53	Jonesport Heath	1									4	2
54	Kanokolus Bog	1						1				2
55	Kezar Bog		1									1
56	Lambert Lake Ptld		1					1				2
57	Lamb's Dwtr Bog											5
58	Limestone NE Bog											1
59	Lindsey Brook Ptld	3						1				2
60	L Norridgewock	1	1			1						3
61	Macwahoc Stream	3				3		2		1		4
62	Magalloway River	1	1									2
63	Marble Fen		1		3							2
64	Meadow Brook Fen		1									1
65	Meddybemps Heath	5	2						1	4		4
66	Millberry Stream	1										1
67	Montegail Pond	1	1	1			1					4
69	Nollesemic Kettle	1		1								2
70	Nollesemic Stream	2	2						1			3
71	Northeast Carry	1	1		1							3
72	Number 5 Bog	1	1		4							3
73	Orchard Bog											3
74	Orson Bog	1	1									2
76	Perk Pond Flow Fen	1										1
77	Perley Pond Fen	1	1									2
78	Pickerel Pond Kettle			1								1
79	Pierce Lake NW Bog											1
80	Rock Dam Heath		1			1	1					3
81	Rockland Bog	1	1									2
82	Rocky Rips Bog	1	1							1		3
83	Saco Heath		1		1		1					3
84	Salmon Brook Lake	1	1									2
85	Sargent Bog											2
86	Sawtelle Heath											4
88	Smith Brook Dwtr	2	1					2				3
90	Smith Pond Ptld	1	1						1			3
91	S Princeton NE Bog											3
92	S Trescott Heath		1								2	2
93	Stetson Mt Ptld					1		2				2
94	Sunkaze Stream	3										
95	Sweat Bog	4	1			2				1		4
96	Thousand Acre Hth	1				1			1	1		4
97	Twelvemile Bog	1	1		2							3
98	Umcolcus Dwtr Fen		1									1
99	Vanceboro RR Ptld	3	3			1	2	1	4			6
100	Wadleigh Bog	4				1						2
101	Wells Heath		1			1						2
102	White Pond Fen	1										1

APPENDIX E

Appendix E. Vegetation types at 76 Maine peatlands. See Table 3 for definitions of type numbers and Table 7 for data sources.

Number	Name	Vegetation types 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Number different types
1	Alton Bog												1			1	1	1	1	1		6
2	Belgrade Kettles		1	1									1				1	1				5
3	Big Bog	1	1	1				1	1	1	1	1	1			1	1	1		1	1	14
6	Black Brook Pond								1	1	1						1	1	1	1		7
7	Black Pond Fen												1		1		1		1	1		5
8	Bog and Union River			1								1	1			1	1	1		1		7
9	Burntland Brook Fen		1							1	1	1			1	1	1	1	1	1	1	11
10	Burpee Brook Ptld	1	1	1				1				1			1	1	1	1				9
12	Caribou Bog	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	17
13	Caribou Bog, Indian	1	1	1				1	1	1	1	1	1		1		1	1		1	1	14
17	Cedar Mt N Ptld			1				1	1		1	1	1				1	1	1	1	1	11
19	Chemo Bog	1	1	1				1	1			1	1				1	1	1	1	1	12
20	Chimenticook Fen								1	1	1	1				1			1		1	7
21	Clifford Stream Fen											1	1	1		1	1	1	1			7
22	Coffin Bog		1	1				1	1	1	1	1	1		1	1	1	1			1	13
23	Cold Stream Ptld	1	1	1				1	1		1	1	1	1	1	1	1	1	1	1	1	16
25	Cross Lake Fen									1	1	1			1	1	1	1	1	1	1	10
26	Crossuntic Stream		1	1				1	1		1	1	1				1	1		1	1	11
27	Crystal Bog	1	1	1			1	1	1	1	1	1	1		1	1	1	1	1	1	1	17
28	Curtis Corner Fen											1	1			1		1	1	1		6
29	Deer Lake Fen		1					1	1	1	1	1			1			1	1		1	10
30	Dollar Pond Fen		1	1								1						1				4
31	Dottle Brook Fen									1		1			1	1		1	1	1		7
32	E Birch Stream Bog	1	1	1				1	1	1	1	1	1		1	1	1	1		1	1	15
34	Elevenmile Lake	1	1	1				1	1	1	1	1	1		1	1	1	1			1	14
35	Eliot Heath													1	1	1			1			4

Number	Name	Vegetation types 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Number different types
36	Ellis Bog		1					1	1	1	1	1			1		1	1	1	1	1	12
38	Flinn Pond Ptlds	1	1	1				1	1		1	1	1		1	1		1			1	12
40	Fowler Bog											1	1	1			1	1	1	1		7
41	Great Cranberry Hth		1	1		1			1			1				1	1		1			8
42	Great Heath	1	1	1	1	1		1	1		1	1	1		1	1	1	1		1	1	16
43	Great Sidney Bog		1	1							1	1	1	1	1			1	1			9
44	Greenlaw Stream											1	1		1	1			1	1		6
45	Greenville Jct Ptld		1	1				1	1		1	1			1	1		1	1	1	1	12
46	Hatham Bog	1	1	1				1	1	1	1	1	1		1	1		1			1	13
47	Hermon Bog	1	1	1				1	1	1		1	1	1	1	1	1		1		1	14
49	Horseback Bog		1	1				1			1	1	1		1		1	1		1		10
50	Inman Bog	1	1	1				1				1	1		1	1		1				9
53	Jonesport Heath			1		1						1					1	1	1	1		7
54	Kanokolus Bog	1	1	1				1	1		1	1	1			1	1	1		1	1	13
55	Kezar Bog												1	1		1	1	1	1	1	1	8
56	Lambert Lake Ptld	1	1	1				1	1		1	1	1		1	1		1			1	12
59	*Lindsey Brook Ptld*	1	1	1				1	1		1	1	1		1		1	1		1	1	13
60	L Norridgewock											1	1	1	1	1	1	1	1	1		9
61	Macwahoc Stream	1	1	1				1	1	1	1	1	1		1			1		1	1	13
62	Magalloway River							1		1		1			1	1		1	1			7
63	Marble Fen		1					1	1	1	1	1	1		1	1	1	1			1	12
64	Meadow Brook Fen											1	1		1	1	1	1				6
65	Meddybemps Heath	1	1	1				1	1		1	1	1			1	1	1	1	1	1	14
66	Millberry Stream											1	1		1	1	1	1	1	1		8
67	Montegail Pond			1		1		1				1	1			1		1	1	1	1	10
69	Nollesemic Kettle		1	1				1	1			1										5

Number	Name	Vegetation types 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Number different types
70	Nollesemic Stream		1	1				1	1			1	1			1	1			1		9
71	Northeast Carry Fen		1							1		1			1	1	1	1	1			8
72	Number 5 Bog							1	1	1	1	1	1		1	1	1	1	1		1	12
74	Orson Bog											1	1		1	1	1	1	1	1		8
76	Perk Pond Flow Fen											1	1		1	1	1	1	1	1		8
77	Perley Pond Fen							1	1			1		1	1		1	1	1	1	1	10
78	Pickerel Pond Kettle		1					1										1				3
80	Rock Dam Heath	1	1	1		1		1	1		1	1	1		1	1	1				1	13
81	Rockland Bog											1	1		1	1	1	1	1	1		8
82	Rocky Rips Bog	1	1	1				1	1		1	1	1		1	1	1		1	1	1	14
83	Saco Heath	1	1	1				1	1		1		1		1	1	1	1	1	1	1	14
84	Salmon Brook Lake						1					1			1	1	1	1	1	1		8
88	Smith Brook Dwtr		1	1				1	1	1	1	1	1		1	1	1			1	1	13
90	Smith Pond Ptld	1	1	1				1		1		1					1	1				8
92	S Trescott Heath			1								1	1			1	1	1				6
93	Stetson Mt Ptld	1	1	1				1	1		1	1	1					1			1	10
95	Sweat Bog	1	1	1				1	1		1	1	1				1	1	1	1	1	13
96	Thousand Acre Hth	1	1	1				1	1	1	1	1	1		1	1	1	1	1	1	1	16
97	Twelvemile Bog							1	1	1	1	1	1		1	1	1	1			1	11
98	Umcolcus Dwtr Fen							1		1		1			1	1	1	1	1	1		9
99	Vanceboro RR Ptld	1	1	1		1		1	1		1	1	1	1		1	1	1		1	1	15
100	Wadleigh Bog	1	1	1				1	1		1	1	1		1	1		1		1	1	13
101	Wells Heath		1	1				1				1	1	1			1	1				8
102	White Pond Fen						1			1	1	1			1	1	1	1	1	1		10

APPENDIX F

Appendix F. Scoring Sheets for Cold Stream Peatland and Twelvemile Bog.

Peatland name Cold Stream **Scoring date** 17-Aug-89

Geogr Level (GL)			Level	% Score	Total % Scores
RARITY			**R**		
Peatland type					
	Tot.r value				
G1	0.5		4	0.5	
G2	1.5		3	1.5	
G3	1.5		3	1.5	
G4	1.0		3	1.5	5.0
Other geology					
G1	4.0		1	0.25	
G2	4.0		1	0.25	
G3	3.5		2	0.15	
G4	3.5		2	0.15	0.8
Vegetation					
G3	1.5		3	0.6	
G4	1.5		3	0.6	1.2
Flora					
	S1/S2 spp.	**S3 spp.**			
G1	0	0	5	0	
G2	0	0	5	0	
G3	0	0	5	0	
G4	0	0	5	0	0

Geogr Level (GL)			Level	% Score	Total % Scores
EXEMPLARINESS			**E**		
Peatland type					
	G1		2	3.0	
	G2		1	4.5	
	G3		1	4.5	
	G4		1	4.5	16.5
Other geology					
	G1		2	0.3	
	G2		2	0.3	
	G3		2	0.3	
	G4		2	0.3	1.2
Vegetation					
	G3		2	1.4	
	G4		2	1.4	2.8
DIVERSITY			**D**		
	# diff. types/ features				
Peatland type	2		4		1.0
Other Geology	5		3		0.6
Vegetation	15		2		4.0
Flora					
(Dc)	**#spp.**				
(55)	188	(2)	1	(8.0)	12.0
PEATLAND AREA	1673 ha		1		5.0
PRISTINE CHARACTER			3		2.5
TOTAL EVALUATION GRADE				(48.6)	52.6

Peatland name *Twelvemile Bog* **Scoring date** *25-July-98*

Geogr Level (GL)			Level	% Score	Total % Scores
RARITY			R		
Peatland type					
	Tot.r value				
G1	0.0		5	0.0	
G2	1.0		3	1.5	
G3	1.5		3	1.5	
G4	2.0		2	3.0	6.0
Other geology					
G1	0.5		5	0.0	
G2	0.5		5	0.0	
G3	0.5		5	0.0	
G4	0.5		5	0.0	0.0
Vegetation					
G3	1.25		3	0.6	
G4	1.25		3	0.6	1.2
Flora					
	S1/S2 spp.	S3 spp.			
G1	0	0	5	0	
G2	0	0	5	0	
G3	0	1	4	0.5	
G4	0	1	4	0.5	1.0

Geogr Level (GL)			Level		% Score	Total % Scores
EXEMPLARINESS			**E**			
Peatland type						
	G1		4		0.5	
	G2		3		1.5	
	G3		3		1.5	
	G4		2		3.0	6.5
Other geology						
	G1		4		0.05	
	G2		4		0.05	
	G3		3		0.15	
	G4		3		0.15	0.4
Vegetation						
	G3		3		0.6	
	G4		3		0.6	1.2
DIVERSITY			**D**			
	# diff. types/ features					
Peatland type	2		4			1.0
Other Geology	1		5			0.0
Vegetation	11		3			2.0
Flora						
(Dc) (29.3)	#spp. 57	(4)	4		(1.5)	1.5
PEATLAND AREA	112 ha		3			1.5
PRISTINE CHARACTER			3			2.5
TOTAL EVALUATION GRADE					(24.8)	24.8

APPENDIX G

Appendix G. Evaluation percentages and grades for 76 peatlands. Two grades are given for those peatlands that have different percentages for index of species richness (D_c) and species richness (N): D_c/N.

	Rarity															Exemplariness										Diversity							
	Ptld Types				Other Geol				Veg		Flora					Ptld Types				Other Geol				Veg							Flora			
Name	G1	2	3	4	G1	2	3	4	G3	4	G1	2	3	4	Σ	G1	2	3	4	G1	2	3	4	G3	4	Σ	T[1]	G[2]	V[3]	Dc	N	Σ	A[4]	P[5]	Σ
Max. Score	**4.5**	**4.5**	**4.5**	**4.5**	**.25**	**.25**	**.25**	**.25**	**2**	**2**	**4**	**4**	**4**	**4**	**39**	**4.5**	**4.5**	**4.5**	**4.5**	**.5**	**.5**	**.5**	**.5**	**2**	**2**	**24**	**8**	**2**	**6**	**12**	**12**	**28**	**5**	**4**	**100**
Alton Bog	0	0	0	0	.15	.15	.08	.08	0	0	0	0	0	0	0.46	1.5	1.5	3	3	.15	.15	.05	.05	.6	.6	10.60	1	.60	0	1.5	1.5	3.10	5	0	19.2
Belgrade Kettles	0	0	0	0	.15	.15	.08	.08	0	0	0	0	0	0	0.46	1.5	1.5	1.5	1.5	.3	.3	.5	.5	.6	.6	8.80	0	.20	0	1.5	1.5	1.70	0	1.5	12.5
Big Bog	.5	1.5	1.5	.5	.25	.25	.15	.15	.6	.6	0	0	0	0	6.00	1.5	4.5	4.5	4.5	.3	.3	.3	.3	.6	1.4	18.20	3	.60	4	1.5	1.5	9.10	1.5	3	37.8
Black Brook Pond	0	0	0	0	.03	.03	.03	.03	.2	.2	5	.5	.5	.5	2.52	0	0	0	0	0	.05	.05	.05	0	0	0.15	1	.20	.6	1.5	1.5	3.30	1.5	0	7.5
Black Pond Fen	0	0	0	.5	.08	.08	.08	.08	.0	.0	0	0	0	0	0.82	.5	.5	.5	1.5	.05	.05	.05	.15	.2	.6	4.10	1	.60	0	8	8	9.60	1.5	2.5	18.5
Bog and Union R.	0	.5	1.5	1.5	.03	.03	.03	.03	0	0	0	0	0	0	3.62	0	.5	.5	.5	0	0	.05	.05	.2	0	1.80	1	.20	.6	0	0	1.80	1.5	1.5	10.2
Burntland Brook	0	.5	1.5	1.5	.03	.03	.03	.03	.6	.6	0	0	.5	.5	5.82	0	.5	3	3	.05	.05	.15	.15	1.4	.6	8.90	1	.20	2	4	4	7.20	.5	3.5	25.9
Burpee Brook	0	.5	.5	1.5	.03	.03	.03	.03	0	0	0	0	0	0	2.62	.5	1.5	.5	1.5	.05	.05	.05	.05	.6	.6	5.40	1	0	2	0	0	3.00	1.5	2.5	15.0
Caribou Bog	.5	4.5	4.5	4.5	.25	.25	.25	.25	2	2	0	0	2.5	2.5	24.00	3	4.5	4.5	4.5	.15	.5	.5	.5	2	2	22.15	8	.60	6	1.5	8	16.10/ 22.60	5	2.5	69.7/ 76.2
Caribou, Indian	.5	1.5	1.5	1.5	.15	.15	.15	.15	.6	.6	0	0	0	0	6.30	0	.5	.5	.5	.05	.15	.3	.3	.2	.2	2.70	1	.60	4	1.5	0	5.60/ 7.10	1.5	0	16.1/ 17.6
Cedar Mountain	.5	1.5	1.5	1.5	.03	.03	.03	.03	.2	.2	0	0	0	0	5.52	.5	3	3	3	.15	.3	.3	.3	1.4	1.4	13.35	1	0	2	1.5	1.5	4.50	.5	4	27.9
Chemo Bog	0	1.5	1.5	1.5	.03	.03	.03	.03	.2	.2	0	0	0	0	5.02	1.5	4.5	3	4.5	.15	.15	.15	.15	.6	.6	15.30	5	0	2	0	1.5	7.00/ 8.50	3.5	2.5	33.3/ 34.8
Chimenticook Fen	0	.5	1.5	1.5	0	0	0	0	.6	.6	0	0	0	0	4.70	1.5	1.5	4.5	3	0	0	0	0	.6	1.4	12.50	1	0	0	1.5	1.5	2.50	0	4	23.7
Clifford Stream	0	0	0	0	.03	.03	.03	.03	0	0	0	0	0	0	0.12	0	.5	.5	.5	.05	.05	.15	.05	.2	2	2.20	0	0	.6	4	4	4.60	1.5	3	11.4
Coffin Bog	.5	1.5	1.5	3	.03	.03	.03	.03	.2	.2	0	0	0	0	7.02	3	4.5	4.5	4.5	.3	.15	.05	.05	1.4	1.4	19.85	3	.20	2	1.5	1.5	6.70	1.5	3	38.1
Cold Stream	.5	1.5	1.5	1 5	.25	.25	.15	15	.6	.6	0	0	0	0	7.00	3	4.5	4.5	4.5	.3	3	.3	.3	1.4	1.4	20.50	1	.60	4	8	12	13.60/ 17.60	5	2.5	48.6/ 52.6
Cross Lake	0	1.5	3	3	0	0	0	0	.2	.2	1.5	1.5	2.5	2.5	15.90	.5	3	4.5	4.5	.15	.15	.15	.15	1.4	1.4	15.90	1	0	2	1.5	1.5	4.50	3.5	4	43.8
Crossuntic Stream	.5	1.5	1.5	.5	.15	.15	.15	.15	.2	.2	0	0	0	0	5.00	.5	1.5	1.5	1.5	.15	.15	.15	.15	.6	.6	6.80	3	.20	2	1.5	1.5	6.70	1.5	3	23.0
Crystal Bog	.5	1.5	1.5	1.5	.15	.15	.25	.25	2	2	4	4	4	4	25.80	4.5	4.5	4.5	4.5	.3	.3	.3	.3	1.4	1.4	22.00	5	.60	6	4	12	15.60/ 23.60	5	3	71.4/ 79.4
Curtis Corner	0	0	0	0	.08	.08	.03	.03	0	0	0	0	0	0	0.22	.5	1.5	.5	1.5	.15	.15	.05	.05	.6	.6	5.60	0	.20	0	6	4	6.20/ 4.20	3.5	3	18.5/ 16.5

	Rarity															Exemplariness										Diversity							
	Ptld Types				Other Geol				Veg		Flora					Ptld Types				Other Geol				Veg							Flora			
Name	G1	2	3	4	G1	2	3	4	G3	4	G1	2	3	4	Σ	G1	2	3	4	G1	2	3	4	G3	4	Σ	T[1]	G[2]	V[3]	Dc	N	Σ	A[4]	P[5]	Σ
Deer Lake	0	3	3	3	.15	.15	.25	.15	.6	.6	.5	.5	1.5	1.5	14.90	0	0	1.5	.5	.15	.15	.15	.15	1.4	1.4	5.40	3	.60	2	1.5	4	7.10/ 9.60	1.5	3	32.0/ 34.4
Dollar Pond	0	0	0	0	.08	.08	.03	.03	0	0	0	0	0	0	0.22	0	0	.5	.5	.3	.3	.15	.15	.2	.2	2.30	0	.60	0	8	0	8.60/ 0.60	.5	3	14.6/ 6.6
Dottle Brook	0	0	0	0	.03	.03	.03	.03	.2	.2	0	0	0	0	0.52	.5	1.5	1.5	1.5	.15	.15	.15	.15	.6	.6	6.80	0	.20	.6	4	4	4.80	1.5	3	16.6
E. Birch Stream	.5	1.5	1.5	1.5	.15	.15	.15	.15	.6	.6	0	0	.5	.5	7.80	.5	3	3	3	.15	.15	.15	.15	1.4	1.4	12.90	3	.60	4	1.5	1.5	9.10	3.5	4	37.3
Elevenmile Lake	.5	3	3	3	.03	.03	.03	.03	.2	2	0	0	0	0	10.02	0	.5	.5	.5	0	.15	.15	.15	.6	.6	3.15	4	.20	4	4	4	12.20	1.5	3	30.0
Eliot Heath	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0	0	0	.5	0	0	0	.05	.2	.2	0.95	0	0	0	1.5	1.5	1.50	.5	2.5	5.4
Ellis Bog	0	1.5	3	3	.03	.03	.03	.03	.2	.2	0	0	.5	.5	9.02	.5	1.5	1.5	3	.05	.05	.05	.05	.6	.6	7.90	5	.20	2	1.5	1.5	8.70	3.5	3.5	32.6
Flinn Pond	.5	1.5	1.5	3	.08	.08	.03	.03	.2	.2	0	0	0	0	7 12	0	1.5	1.5	1.5	.3	.3	.3	.3	.6	.6	6.90	3	.20	2	2.5	1.5	7.70/ 6.78	1.5	3	26.2/ 25.2
Fowler Bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	0	.5	.5	1.5	.05	.05	.05	.05	.2	.2	3.10	0	.20	.6	4	4	4.80	3.5	2.5	13.9
Great Cranberry	.5	.5	.5	.5	.08	.08	.08	.08	.6	.6	0	0	1.5	1.5	6.52	.5	1.5	1.5	1.5	.15	3	.3	.3	.6	1.4	8.75	0	.20	.6	4	4	4.80	.5	2.5	22.4
Great Heath	3	4.5	4.5	4.5	.25	.25	.25	.25	2	2	0	1.5	4	4	31.00	3	4.5	4.5	4.5	.5	.5	.5	.5	2	2	22.50	8	2	6	1.5	8	17.50/ 24.00	5	2.5	79.3/ 85.0
Great Sidney Bog	0	1	1	1.5	.03	.03	.03	.03	.2	.2	0	0	0	0	4.02	1.5	3	1.5	4.5	.05	.05	.05	.15	.6	1.4	12.80	1	.20	.6	4	4	5.80	2.5	3	28.1
Greenlaw Stream	0	0	0	0	.03	.03	.03	.03	0	0	0	0	0	0	0.12	.5	.5	.5	1.5	.05	.05	.05	.05	.6	.6	4.40	1	.20	0	8	4	9.20/ 5.20	1 5	3	18.2/ 14.2
Greenville Jct.	.5	3	3	3	.08	.08	.03	.03	.2	.2	0	0	0	0	10.12	0	0	0	.5	.05	.15	.05	.05	.6	.6	2.00	1	.20	2	0	0	3.20	1.5	1.5	18.3
Hatham Bog	1	3	3	3	.25	.25	.25	.25	.6	.6	0	0	0	0	12.20	4.5	4.5	4.5	4.5	.3	.3	.3	.3	1.4	1.4	22.00	1	.6	4	1.5	1 5	7.10	1.5	3	45.8
Hermon Bog	0	.5	1.5	3	.03	.03	.03	.03	.6	.6	0	0	.5	.5	7.32	5	1.5	1.5	.5	.05	.05	.05	.15	.6	.2	5.10	4	.20	4	0	0	8.20	3.5	1.5	25.6
Horseback Bog	0	1.5	1.5	1.5	.15	.15	.15	.15	0	0	0	0	0	0	5.10	.5	1.5	1.5	1.5	.3	.3	.15	.15	6	.6	7.10	3	.20	2	4	4	9.20	1.5	3	25.9
Inman Bog	.5	1.5	1.5	1.5	.03	.03	.03	.03	.2	.2	0	0	0	0	6.60	0	0	0	0	.3	.3	.15	.15	.6	.6	2.10	0	.20	.6	1.5	1.5	2.30	1.5	3	15.5
Jonesport Heath	1.5	3	3	1.5	.03	.03	.03	.03	1.4	1.4	0	.5	.5	.5	13.42	.5	3	3	3	.05	.15	.15	.15	1.4	1.4	12.80	1	.20	.6	1.5	1.5	3.30	1.5	1.5	32.5
Kanokolus Bog	0	.5	1.5	1.5	.03	.03	.03	.03	.2	.2	0	0	0	0	4.02	.5	1.5	3	4.5	0	0	.05	.05	.6	2	12.20	1	.20	4	2	1.5	7.20/ 6.70	1.5	3	27.9/ 27.4
Kezar Pond	0	0	0	0	.03	.08	.08	.08	.2	.2	0	0	0	0	0.67	.5	.5	1.5	.5	.05	.05	.05	.05	.6	6	4.40	0	.20	.6	4	4	4.80	3.5	1.5	14.9
Lambert Lake	.5	1.5	1.5	1.5	.08	.08	.08	.08	.2	.2	0	0	0	0	5.72	1.5	3	3	3	.15	.15	.15	.15	.6	.6	12.30	1	.20	2	1.5	1.5	4.70	1.5	3	27.2
Lindsey Brook	.5	1.5	1.5	1.5	.03	.03	.03	.03	.2	.2	0	0	0	0	5.52	0	1.5	1.5	.5	.05	.15	.15	.15	.6	.6	5.70	1	.20	2	1.5	1.5	4.70	1.5	3	20.4
L. Norridgewock	0	0	.5	1.5	.15	.15	.08	.08	0	0	0	0	0	0	2.46	.5	.5	.5	1.5	.3	.3	.3	.3	.6	.6	5.40	3	.60	.6	4	4	8.20	3.5	2	21.6
Macwahoc Stream	1.5	4.5	4.5	4.5	.15	.15	.15	.15	.2	.2	0	0	0	0	16.00	1.5	4 5	4.5	4.5	.05	.15	.15	.15	2	2	19.50	5	.20	4	8	8	17.20	3.5	3	59.2
Magalloway R.	0	0	0	0	.08	.08	.08	.08	.2	.2	0	0	0	0	0.72	1.5	1.5	1.5	3	.15	.15	.15	.3	.6	.6	9.45	1	.20	.6	1.5	1.5	3.30	1.5	2.5	17.5
Marble Fen	0	.5	1.5	1.5	.08	.08	.08	.08	.6	.6	1.5	1.5	4	4	16.02	1.5	3	4.5	4.5	.15	.15	.15	.3	2	2	18.25	1	.20	2	1.5	4	4.70/ 7.20	.5	4	43.5/ 46.0

	Rarity															Exemplariness										Diversity							
	Ptld Types				Other Geol				Veg		Flora					Ptld Types				Other Geol				Veg							Flora			
Name	G1	2	3	4	G1	2	3	4	G3	4	G1	2	3	4	Σ	G1	2	3	4	G1	2	3	4	G3	4	Σ	T[1]	G[2]	V[3]	Dc	N	Σ	A[4]	P[5]	Σ
Meadow Brook	0	0	0	.5	.08	.08	.08	.08	0	0	0	0	0	0	0.82	5	1.5	1 5	1.5	.05	.15	05	.05	.6	6	6.50	0	.20	0	1.5	1.5	1.70	1	2.5	12.5
Meddybemps Heath	1.5	3	4.5	4.5	.25	.25	.25	.25	2	2	0	0	0	0	14.90	.5	1.5	1 5	1.5	3	.3	.3	.3	6	.6	7.40	5	.60	4	1.5	1.5	11.10	5	0	38 4
Millberry Stream	0	0	0	0	0	0	0	0	0	0	0	0	4	4	8.00	.5	1.5	.5	.5	05	.05	.05	.05	.6	.6	4.40	0	0	.6	12	8	12.60/ 8.60	.5	2.5	28.0/ 24.0
Montegail P. Bog	0	1.5	1.5	1.5	.15	.15	.15	.15	.6	.6	0	0	.5	.5	7.30	1.5	3	3	3	.15	.3	15	.3	1 4	1.4	14.20	6	.60	2	4	4	12.60	1.5	1.5	37.1
Nollesemic Kettle	0	0	0	0	.08	.08	.08	.08	.2	.2	0	0	0	0	0.32	4.5	4.5	4 5	4.5	.3	.3	15	15	.6	.6	20.10	1	.60	0	12	0	13.60/ 1.60	.5	4	38.5/ 26.5
Nollesemic Stream	.5	1.5	1.5	1.5	.15	.15	.15	.15	.2	.2	0	0	0	0	6.00	0	.5	.5	.5	.3	.3	3	.3	.6	.6	3.90	3	.60	.6	0	0	4.2	1.5	3	18.6
Northeast Carry	0	.5	1.5	1.5	.03	.03	.03	.03	.2	.2	.5	.5	1.5	1.5	8.02	.5	.5	.5	1.5	.05	.05	.05	.15	.6	6	4.50	3	.20	.6	10	8	13.80/ 11.80	3.5	3	32.8/ 30.8
Number 5 Bog	0	3	3	4.5	.25	.25	.25	.25	.6	.6	0	0	1.5	1.5	15.70	.5	1.5	3	3	15	.15	.3	3	2	2	12.90	3	1.4	2	8	8	14 40	3.5	4	50.5
Orson Bog	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00	.5	.5	1.5	1.5	.05	.05	.05	.05	.2	.6	5.00	1	0	.6	1 5	1.5	3.10	1.5	1.5	11 1
Perk Pond	0	0	0	0	.03	.03	.03	.03	0	0	.5	5	.5	.5	2.12	.5	.5	1.5	1.5	.06	.06	.06	.06	.6	.6	5.44	0	0	.6	0	0	0.60	1.5	3	12.7
Perley Pond	0	0	0	0	.03	.03	.03	.03	.2	.2	0	0	0	0	0.52	.5	.5	.5	1.5	.05	.05	.05	.15	.6	.6	4.50	1	.20	2	8	8	11.20	1.5	2.5	20.2
Pickerel Pond	0	0	0	0	.08	.08	.03	.03	0	0	0	0	0	0	0.22	3	3	3	3	.3	.3	.15	.15	.6	.6	14.10	0	.20	0	4	1.5	4.20/ 1.70	0	3	21.5/ 19.0
Rock Dam Heath	.5	1 5	1.5	1.5	0	0	0	0	2	2	0	0	0	0	9.00	1.5	1.5	1.5	1.5	0	0	0	0	1.4	.6	8.00	3	0	4	1.5	1.5	8.50	1.5	3	30.0
Rockland Bog	0	0	0	0	.03	.03	.03	.03	0	0	0	0	4	4	8.12	0	0	.5	.5	0	.05	.05	05	.2	.2	1.55	1	.20	.6	8	8	9,80	1.5	2.5	23.5
Rocky Rips	0	1.5	1.5	1.5	.25	.25	.25	.25	.2	.2	0	0	0	0	5.90	1.5	1.5	1.5	1.5	.15	.3	.3	.3	.6	.6	8.25	3	.60	4	1.5	4	9.10/ 11.60	3 5	4	30 7/ 33.2
Saco Heath	0	1.5	1.5	3	.03	.03	.03	.03	.2	.2	0	0	.5	.5	7.52	.5	.5	1.5	4.5	0	.05	.05	.15	2	2	11.25	3	0	4	1.5	4	8.50/ 11.00	1.5	1.5	30.3/ 32.8
Salmon Brook L.	0	0	0	0	.03	.03	.08	.08	.2	.2	.5	1.5	4	4	10.62	.5	.5	1.5	1.5	0	.05	.3	.15	.6	.6	5.70	1	.20	6	12	8	13 80/ 9.80	.5	2.5	33.1/ 29.1
Smith Brook	.5	3	3	3	.08	.08	.08	.08	.2	.2	0	0	0	0	10.22	0	1.5	.5	1.5	.15	.15	.15	.15	1.4	1.4	6.90	3	.20	4	1.5	1.5	8.70	1.5	4	31.3
Smith Pond	.5	5	1.5	1.5	.03	.03	.03	.03	.2	.2	0	0	0	0	4.52	.5	1.5	1.5	1.5	.05	.05	.05	.05	.2	.2	5.60	3	.20	.6	0	0	3.80	1.5	4	19.4
S. Trescott	1.5	1.5	1.5	.5	0	0	0	0	0	0	0	0	.5	.5	6.00	.5	1.5	1.5	.5	0	.05	0	0	.6	.2	4.85	1	0	0	1.5	1.5	2.50	.5	3	16 8
Stetson Mt.	.5	3	3	1.5	.08	.08	.08	.08	.6	6	.5	.5	.5	.5	11.52	.5	1.5	1.5	1.5	.15	.5	.5	.5	.6	.6	7.85	1	.20	2	4	4	7.20	1.5	3	31.1
Sweat Bog	.5	1.5	3	1.5	.25	.25	.25	.25	2	2	0	0	.5	.5	8.90	1.5	4.5	4.5	3	.15	3	.5	.3	1.4	1 4	17.55	5	.60	4	1.5	1.5	11.10	3.5	3	44.0
Thousand Acre	.5	1.5	3	3	.25	.25	.25	.25	.6	.6	0	0	.5	.5	11.20	3	4.5	4.5	4.5	.5	.5	.5	.5	2	2	22.50	5	.6	6	4	8	15.60/ 19.60	3.5	2.5	55.3/ 59 3
Twelvemile Bog	0	1.5	1.5	3	0	0	0	0	.6	.6	0	0	.5	.5	8.20	.5	1.5	1.5	3	.05	.05	.15	.15	.6	.6	8.10	1	0	2	1.5	1.5	4.50	1.5	2.5	24.8

	Rarity															Exemplariness										Diversity								
	Ptld Types				Other Geol				Veg		Flora					Ptld Types				Other Geol				Veg						Flora				
Name	G1	2	3	4	G1	2	3	4	G3	4	G1	2	3	4	Σ	G1	2	3	4	G1	2	3	4	G3	4	Σ	T[1]	G[2]	V[3]	Dc	N	Σ	A[4]	P[5]	Σ
Umcolcus Ddwtr	0	0	0	0	.03	.03	.03	.03	2	.2	0	0	.5	.5	1.52	.5	1.5	1.5	1.5	.15	.15	.15	.15	.6	.6	6.70	0	.20	.6	1.5	1.5	2.30	1.5	2.5	14.5
Vanceboro RR	.5	4.5	4.5	4.5	.15	.15	.08	.08	1.4	1.4	0	0	0	0	17.26	1.5	1.5	1.5	1.5	.15	.15	.30	.30	.6	.6	8.10	8	.20	4	1.5	1.5	13.70	3.5	1.5	44.1
Wadleigh Bog	.5	1.5	1.5	1.5	0	0	0	0	.2	.2	0	0	0	0	5.40	.5	3	3	3	.05	.15	.15	.15	.6	.6	11.20	1	0	4	1.5	1.5	6.50	1.5	3	27.6
Wells Heath	0	.5	.5	1.5	.03	.03	.03	.08	0	0	0	0	0	0	2.64	0	0	.5	3	.15	.15	.15	.5	.6	1.4	6.45	1	0	.6	0	0	1.60	1.5	3	15.2
White Pond Fen	0	0	0	0	0	0	0	0	1.4	1.4	.5	1.5	4	4	12.30	.5	.5	1.5	1.5	.05	.05	.15	.15	1.4	1.4	7.20	0	.20	2	12	12	14.20	1.5	2.75	38.0

[1]T = Peatland type.
[2]G = *Other geological features.*
[3]V = Vegetation.
[4]A = Area.
[5]P = Pristineness.