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### Guide to a field description of muskeg (Based on the Radforth Classification System)

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## Guide to a Field Description of Muskeg

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**MacFarlane, I.C.**

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Section 6

GUIDE  
to a  
FIELD DESCRIPTION OF  
MUSKEG  
(Based on the Radforth Classification System)

## Section 6

### Foreword

Muskeg (or "Organic Terrain") comprises about 12 per cent of the terrain of Canada. It creates considerable difficulties for surface transportation and often interferes with engineering works. As a start in the solution of the problems caused by muskeg, it is desirable that everyone use the same terms to refer to this type of terrain. Standardization of terminology can best be furthered by an adequate classification or description of the terrain. Dr. N.W. Radforth, Professor of Botany, McMaster University, has developed a descriptive system for muskeg; this booklet is a condensed version of information contained in several technical papers authored by Dr. Radforth. These papers are listed on the inside back cover of this booklet and may be obtained from the National Research Council.

The Associate Committee on Soil and Snow Mechanics is anxious to assist in the standardization of muskeg terminology and methods in muskeg research and practice; this publication is but one step toward this goal. It is hoped that the descriptive system will be widely used by those engaged in engineering practice in muskeg areas in Canada. This booklet is issued in a preliminary form to permit revision as the need arises. Comments on its usefulness would be appreciated by the Associate Committee.

## Section 6

### 1. What is Meant by "Organic Terrain" and "Organic Material"

"Organic terrain" is a term used to describe what is commonly known as "muskeg". The surface of this terrain is composed of a living organic mat of mosses, sedges and/or grasses, with or without tree and shrub growth. Underneath the surface there is a mixture of partially decomposed and disintegrated organic material, commonly known as "peat" or "muck". As a rule, this subsurface material is highly compressible compared to most mineral soils. Organic terrain is characterized by its very high water content and its extremely low bearing capacity.

### 2. Basis of the Descriptive System

Because of its biological origin, organic terrain is extremely complex. Owing to this complexity it was thought at first that perhaps no constant relationship existed between various factors of the terrain. However, extensive examination of the fossilized pollen and spores preserved in peat samples from various locations across Canada proved that certain qualitative relationships do exist and this furnished a basis for the development of the descriptive system.

This descriptive system attempts to record a three-dimensional problem and is based on surface vegetation which occurs above the ground, topographic features which occur along the ground, and on composition and structure of the subsurface material which occurs in the ground. All of these factors must be taken into account to obtain a reasonable evaluation of the terrain. Tables IV and V at the end of this booklet show the relationship between these various factors.

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### 3. Pattern of Surface Vegetation

Surface vegetation is the first factor to be observed in a particular muskeg area and is also the easiest factor to assess.

Table I presents the necessary information to describe nine vegetal coverage classes. Photographs depicting these classes appear in Figures 1 to 9. Note that the properties mentioned in Table I do not refer to species of plants but rather to qualities of vegetation such as stature, degree of woodiness, external texture, and certain easily recognized growth habits.

Pure classes seldom exist by themselves but rather are in combination with other classes. Only 18 such combinations occur most frequently in Northern Canada and are listed in Table V. The complete description of a particular area may be given by two or three letters, never by four. If one coverage class property is not present to the extent of 25 per cent of the terrain, it is not abundant enough to be included in the composite cover description. In the combination of letters, that letter which represents the most prominent set of properties is placed first, and other letters involved follow in order of prominence.

This system can be applied to a complex area consisting of several distinctly different combinations of vegetative classes and equally well to an area of uniform coverage made up of two or three vegetative classes.

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Fig. 1 Class "A" - Woody; 15 feet  
or over



Fig. 2 Class "B" - Woody; 5 feet  
to 15 feet

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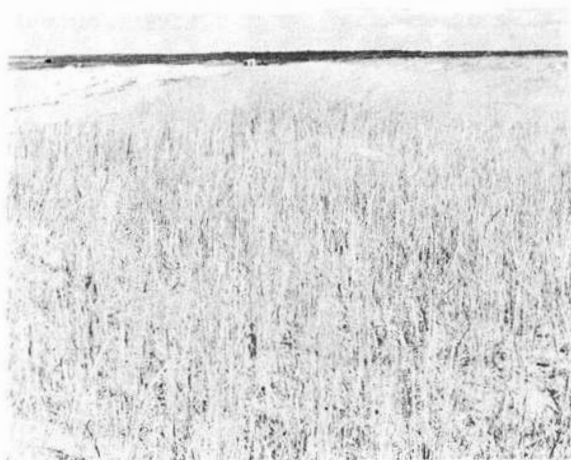


Fig. 3 Class "C" - Non-woody; 2  
feet to 5 feet

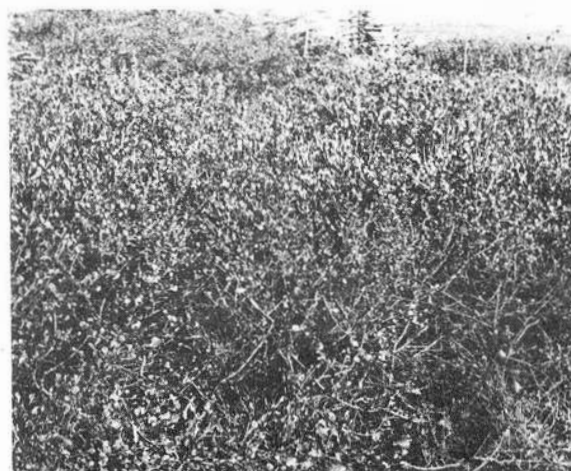


Fig. 4 Class "D" - Woody; 2 feet  
to 5 feet



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Fig. 5 Class "E" - Woody; up to  
2 feet



Fig. 6 Class "F" - Non-woody; up  
to 2 feet

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Fig. 7 Class "G" - Non-woody; up  
to 2 feet



Fig. 8 Class "H" - Non-woody; up  
to 4 inches

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Fig. 9 Class "I" - Non-woody; up  
to 4 inches

## Section 6

### 4. Topographic Features

Terrain unevenness is important in the appraisal of organic terrain. Changes in topography are sometimes caused by irregularities in the mineral substrata but much of the unevenness of the surface is due to structural changes within the organic material itself. Table II gives the descriptive information for identifying topographic features of organic terrain. Several of these features are not peculiar to muskeg areas, but do occur and therefore should be described.

### 5. Subsurface Characteristics

In addition to describing muskeg by its surface features, it is equally necessary to describe the subsurface material (i.e. peat). Based on examination of peat samples from various sites, sixteen categories of peat were established. These categories vary in accordance with variation in the organic terrain (see Table V). The description of organic material is based on the extent to which wood and fibres are present. Organic material can be roughly grouped into three types:

- (1) Material composed chiefly of soils of an amorphous-granular base;
- (2) Material chiefly made up of fine fibres. These fibres may be woody or non-woody;
- (3) Material predominantly of wood particles and coarse fibres. The coarse fibres are always woody.

Table III lists these sixteen categories. Figures 10 to 25 show photographically the general appearance of these sixteen categories of organic material.

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These categories are qualitative only. Therefore, a successful application of this system will necessarily involve comparing a particular peat sample with the photographs and selecting the appropriate category.

### 6. Application of the System

To integrate all the information that has been collected on muskeg and peat from field observations, all details should be recorded on data sheets. Suggested sheets for recording surface and subsurface investigations are included in this booklet. They include most of the specific details required; other pertinent information may be added. Naturally the amount and type of information required will depend largely upon the use for which it is intended.

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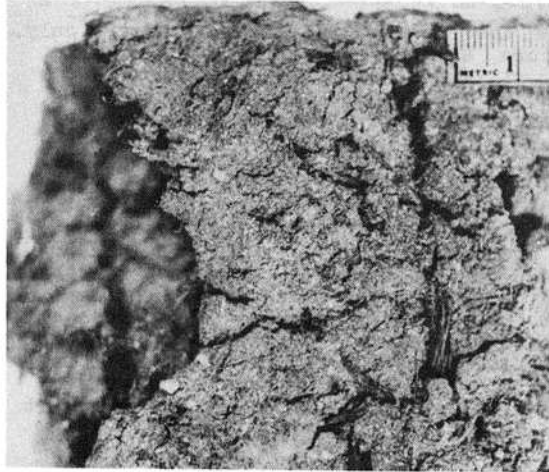


Fig. 10 Category 1



Fig. 11 Category 2

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Fig. 12 Category 3

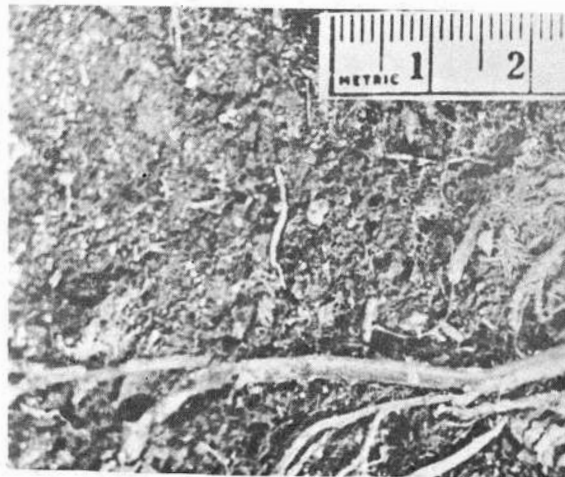


Fig. 13 Category 4

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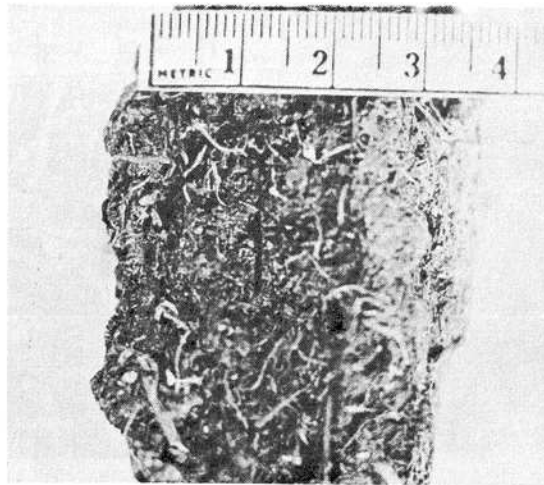


Fig. 14 Category 5

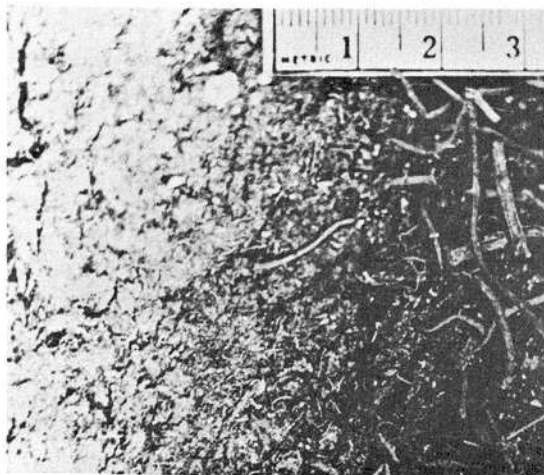


Fig. 15 Category 6



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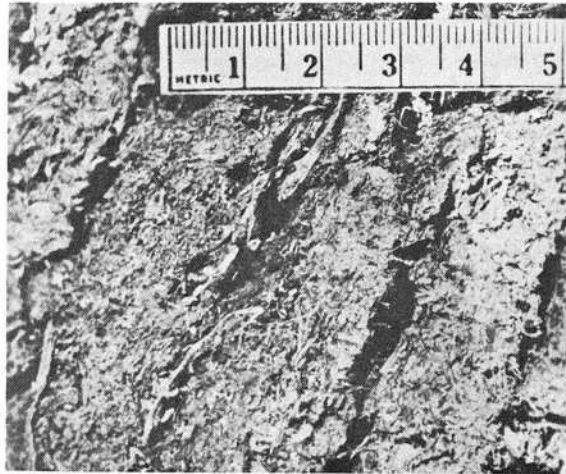


Fig. 16 Category 7

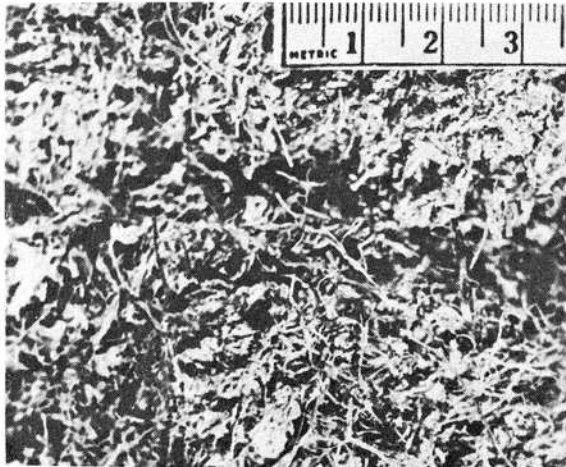


Fig. 17 Category 8

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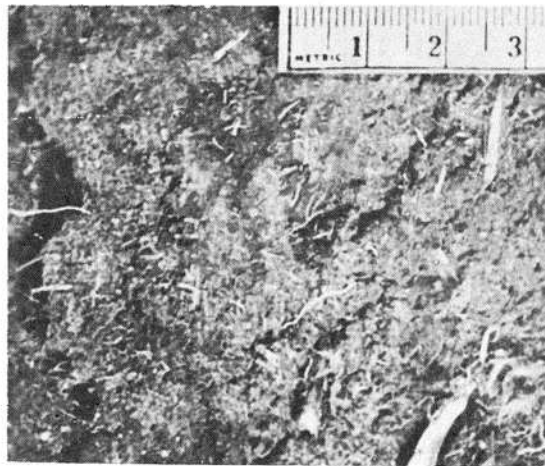


Fig. 18 Category 9

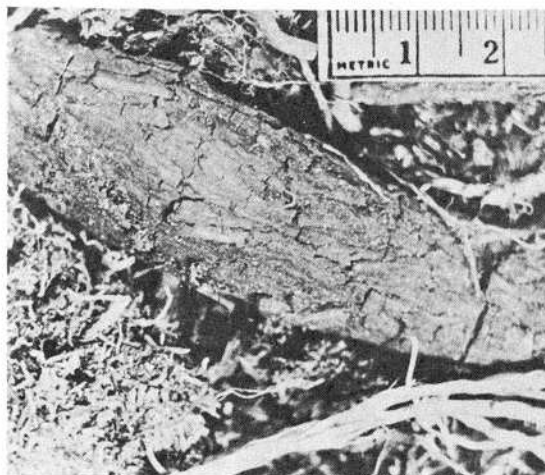


Fig. 19 Category 10

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Fig. 20 Category 11



Fig. 21 Category 12

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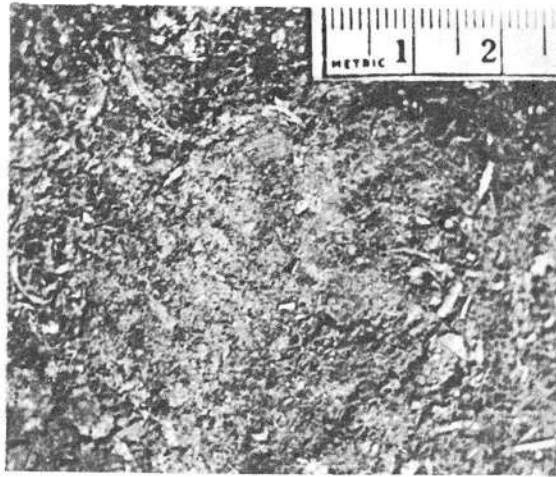


Fig. 22 Category 13

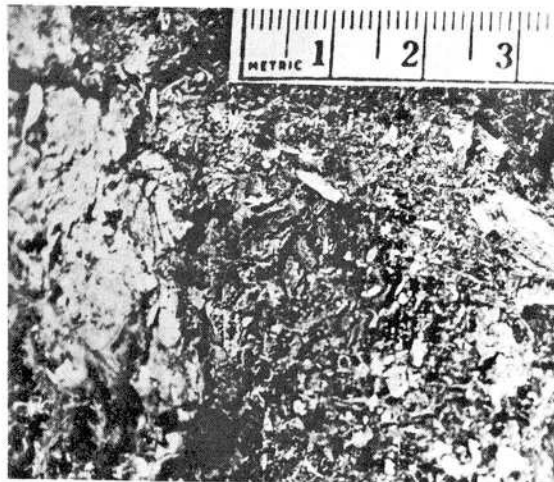


Fig. 23 Category 14

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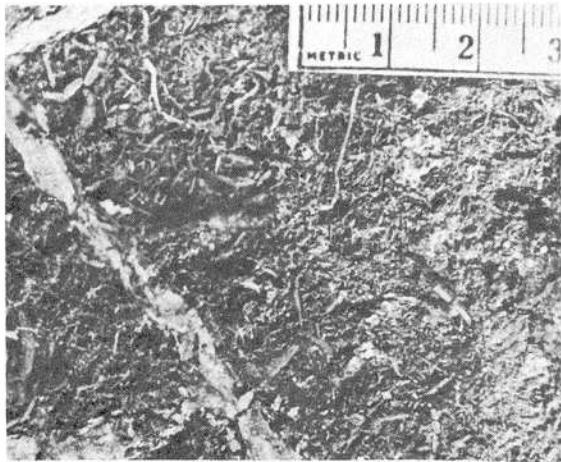


Fig. 24 Category 15

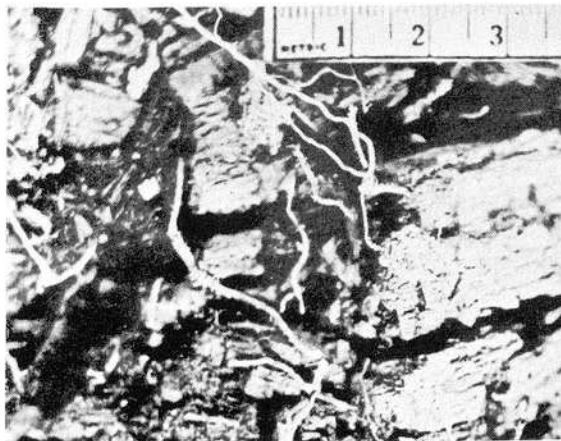


Fig. 25 Category 16

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7. Muskeg Field Investigation Record - Surface Investigations

Site:

Date:

Detailed Location:

Approx. Area of Terrain:

Map -

Aerial Photos -

Surface Elevation:

Physiographic Features:

Water Conditions:

Notes on Climatic Conditions:

Evidence of drainage  
pattern

Depth to water table

Colour of water

pH value (acidity)

Remarks

Description:

Surface Coverage

Topographic

Remarks

Photographs:

Number

Description

General Remarks:

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8. Muskeg Field Investigation Record - Subsurface Investigations

Site:

Date:

Location of Sample(s):

Hole No(s):

Surface Elevation:

Sample No(s):

Depth:

Type of Sample:

Colour of Peaty Soil:

Type of Mineral Subsoil:

Peat Profile

Peat Category


Depth to Mineral Subsoil:

Depth to Frost Level:

Photographs:

Number

Description

General Remarks:

## Section 6

TABLE I

Summary of Properties Designating Nine Pure Coverage Classes

verage Type lass)	Woodiness vs. Non- woodiness	Stature (approx. height)	Texture (where req'd)	Growth Habit	Example
A	woody	15 ft. or over	-----	tree form	Spruce Larch
B	woody	5 to 15 ft.	-----	young or dwarfed tree or bush	Spruce Larch Willow Birch
C	non-woody	2 to 5 ft.	-----	tall grass-like	Grasses
D	woody	2 to 5 ft.	-----	tall shrub or very dwarfed tree	Willow Birch Labrador tea
E	woody	up to 2 ft.	-----	low shrub	Blueberry Laurel
F	non-woody	up to 2 ft.	-----	mats, clumps or patches, sometimes touching	Sedges Grasses
G	non-woody	up to 2 ft.	-----	singly or loose association	Orchid Pitcher pla
H	non-woody	up to 4 in.	leathery to crisp	mostly continuous mats	Lichens
I	non-woody	up to 4 in.	soft or velvety	often continuous mats, some- times in hummocks	Mosses



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TABLE II  
TOPOGRAPHIC FEATURES

Contour Type	Feature	Description
a	Hummock	includes "tussock" and "nigger-head", has tufted top usually vertical sides, occurring in patches, several to numerous
b	Mound	rounded top, often elliptic or crescent-shaped in plane view
c	Ridge	similar to Mound but extended, often irregular and numerous; vegetation often coarser on one side
d	Rock gravel plain	extensive exposed areas
e	Gravel bar	eskers and old beaches (elevated)
f	Rock enclosure	grouped boulders overgrown with organic deposit
g	Exposed boulder	visible boulder interrupting organic deposit
h	Hidden boulder	single boulder overgrown with organic deposit
i	Peat plateau (even)	usually extensive and involving sudden elevation
j	Peat plateau (irregular)	often wooded, localized and much contorted
k	Closed pond	filled with organic debris, often with living coverage
l	Open pond	water rises above organic debris
m	Pond or lake margin (abrupt)	
n	Pond or lake margin (sloped)	
o	Free polygon	forming a rimmed depression
p	Joined polygon	formed by a system of banked clefts in the organic deposit

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TABLE III  
SUBSURFACE CONSTITUTION

PREDOMINANT CHARACTERISTIC	CATEGORY	NAME
AMORPHOUS-GRANULAR	1.	Amorphous-granular peat
	2.	Non-woody, fine-fibrous peat
	3.	Amorphous-granular peat containing non-woody fine fibres
	4.	Amorphous-granular peat containing woody fine fibres
	5.	Peat, predominantly amorphous-granular, containing non-woody fine fibres, held in a woody, fine-fibrous framework
	6.	Peat, predominantly amorphous-granular containing woody fine fibres, held in a woody, coarse-fibrous framework
	7.	Alternate layering of non-woody, fine-fibrous peat and amorphous-granular peat containing non-woody fine fibres
FINE-FIBROUS	8.	Non-woody, fine-fibrous peat containing a mound of coarse fibres
	9.	Woody, fine-fibrous peat held in a woody, coarse-fibrous framework
	10.	Woody particles held in non-woody, fine-fibrous peat
	11.	Woody and non-woody particles held in fine-fibrous peat
COARSE-FIBROUS	12.	Woody, coarse-fibrous peat
	13.	Coarse fibres criss-crossing fine-fibrous peat
	14.	Non-woody and woody fine-fibrous peat held in a coarse-fibrous framework
	15.	Woody mesh of fibres and particles enclosing amorphous-granular peat containing fine fibres
	16.	Woody, coarse-fibrous peat containing scattered woody chunks

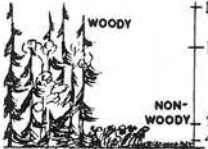
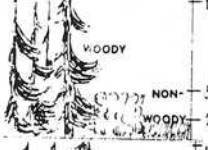
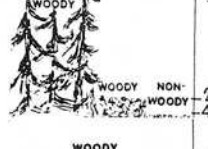
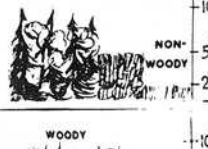
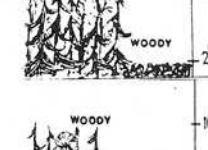
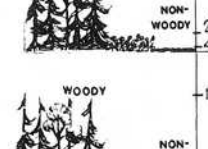

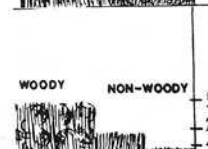

## Section 6

TABLE IV

Topographic		Location by Coverage	Occurrence Distribution	Peat Category
Feature	Symbol			
Hummock	a	FI background hummock coverage - F	in groups commonest near peat plateaus or ponds	non-woody, fine-fibrous (2)
Mound	b	FI background mound coverage - EH	random, common where ill-drained	non-woody, fine- fibrous - mound itself, coarse-fibrous (8)
Ridge	c	FI background ridge coverage - HE	regularly associated common on ill- drained plains	coarse-fibrous, traversing fine- fibrous (13)
Rock gravel plain	d	HEB where covered	infrequent interruptions	amorphous granular, with woody, fine- fibrous held in coarse-fibrous (6)
Gravel bar	e	HEB	coastal plain	
Rock enclosure	f	EHB	uncommon, on elevated rock ridge or plateau, often near ponds	coarse-fibrous, woody (12)
Exposed boulder	g	EHB	random, common in EHB background of FI	
Hidden boulder	h	EH	random, common under EHB background of FI	woody, fine-fibrous, held in coarse- fibrous (9)
Peat plateau (even)	i	HE	spreading, usually equidimensional, common interrupt- ing FI	amorphous granular in fine-fibrous (3)
Peat plateau (irregular)	j	HFE	spreading, usually linear, common traversing mixed background	amorphous granular fine-fibrous non- woody in woody, fine-fibrous (5)
Closed pond	k		random, in HE occasionally FI, common usually associated with ridge margin	amorphous granular (1)
Open pond	l		in FI, common	
Pond or lake margin (abrupt)	m	EH	often part of drain- age route in F, common, often with marginal ridge of EA	non-woody and woody, fine-fibrous. held in coarse- fibrous (14)
Pond or lake margin (Sloped)	n	F	random, in flooded plains, common, in F	non-woody, fine-fibrous (2)
Free polygon	o	EH	random, uncommon in EH or FI background	woody, fine-fibrous held in coarse- fibrous (9)
Joined polygon	p	HE, FI	random areas, common on peat plateaus or confined FI	non-woody, fine- fibrous covering amorphous granular in fine-fibrous (7)

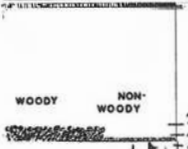
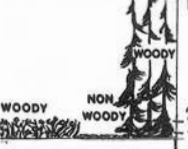
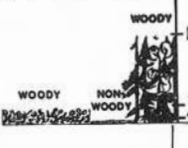
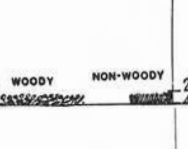


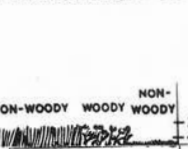
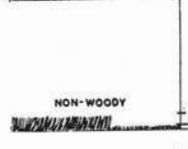
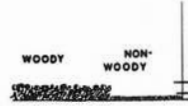
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TABLE V

Sketch	Ground Form Description	Location by Coverage	Occurrence Distribution	Coverage Formula	Peat Category
	woody coverage highly irregular in stature and mixed forms; intermediate woody and lowest non-woody layers mixed and abruptly changing	better drained areas where tree crown coverage is open	frequent, dispersed and ill-defined	A<>B,E,H<>I	woody, fine-fibrous held in coarse-fibrous (9)
	tree crowns not overlapping; undergrowth often impassable, interrupted only by clumped non-woody member	following river courses	broken distribution in forested terrain generally in areas less than 1/2 sq. mile	ADF	woody, coarse and fine-fibrous (9, 13)
	spotted to impassable tree growth; undergrowth broken to continuous, even as to height	commonly on localized divides in relatively good drainage	often continuous for hundred square miles, but sometimes around finger-like processes with sharp definition	AEH	woody, fine-fibrous held in coarse-fibrous (9)
	often clear, eye-level vision occasionally impassable woody mesh interrupted by clumped non-woody growth	following river and creek courses	often predominating, dispersed in linear fashion	BDF	woody, coarse and fine-fibrous (9, 13)
	undulating layering on very uneven terrain, the condition continuous	on broken terrain	widespread and merging with several classes	BE	woody, coarse-fibrous (12)
	as for BE with relatively structureless H class smoothing irregularities and intermittently a pure class	on moderately rough patches in rougher terrain as background	widespread and less frequent than BE	BEH	woody, fine-fibrous held in coarse fibrous (9)
	interrupted islands of even height woody growth in background mosaic of other classes	crowns of divides sometimes well-drained shoulders of eskers	frequent interruptions each a few metres square	BHE	woody, with amorphous granular in fine-fibrous (15)
	non-woody member in continuous mesh, with low woody class dispersed	commonly on old beach lines	infrequent, isolated, localized	CE	woody, and non-woody, fine-fibrous held in coarse-fibrous (14)
	woody member marking a dispersed higher contour often merging with low non-woody classes arranged irregularly	usually traversing FI where very localized drainage is slightly improved	frequent, dispersed	DFI	woody, in non-woody, fine-fibrous (10)

# Section 6

TABLE V

Sketch	Ground Form Description	Location by Coverage	Occurrence Distribution	Coverage Formula	Peat Category
	random irregular woody groups, low and open branched framed in relatively structureless folded ground layer	common interrupting FI background in treeless areas	often covering extensive areas of elevated contour, several to many square miles	EH	woody, fine-fibrous held in coarse-fibrous (9)
	as for EH, with folded condition accentuated and scattered tree forms	irregular plateaus near poorly drained areas in FI background	continuous, in widely separated areas	EHA	woody, coarse-fibrous with scattered woody erratics (16)
	as for EHA, with tree stature reduced	irregular plateaus near poorly drained areas in FI background	continuous, in widely separated areas	EHB	woody, coarse-fibrous with scattered woody erratics (16)
	as for EH except for sunken variously shaped interruptions of non-woody organized growth	associated with boundaries of EH and FI	occupying areas of several square miles	EHF	woody, fine-fibrous held in coarse-fibrous (9)
	slightly elevated areas with diffuse margins grading into FI	often occurring at margins of HE plateaus before grading into FI, and in ponds	infrequent, isolated and widely separated	F	non-woody, fine-fibrous (2)
	frequent islands of uniform non-woody, interrupted by irregular masses of low woody growth	as islands interrupting FI areas with ponds	examples closely associated but may be isolated	FEB	woody and non-woody in fine-fibrous (11)
	irregular expanses with roughness accentuated by randomly distributed low woody member	near ponds in low lying areas	infrequent, localized	FEI	woody and non-woody, fine-fibrous (5)
	meadow-like expanses with appressed class I, often water soaked or submerged, often clumping	in poorly drained areas - usually associated with ponds	serves frequently as background for other class combinations - very common	FI	non-woody, fine-fibrous (2)
	folded continuous areas of uniform surface texture	often as polygon coverage in treeless areas	common as coverage for plateaus, often as islands with FI as background	HE	amorphous granular in fine-fibrous (3)

