Field Guide to the

# Forest Ecosystem Classification for Northwestern Ontario

by R. A. Sims, W. D. Towill, K. A. Baldwin and G. M. Wickware



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## About the Guide and its Contents

This guide will assist in the recognition of vegetation and soil features of forest ecosystems in northwestern (NW) Ontario. A classification system is provided which will enable the user to allocate any forest ecosystem to one of 38 Vegetation Types (V-Types) and one of 22 Soil Types (S- and SS-Types). Vegetation and Soil Types can also be aggregated or considered in combination for potential forest management applications and interpretations. The classification is based on a large and detailed dataset collected and analyzed during a 6 year research program, details of which are reported elsewhere (Sims 1986, Sims et al 1986, Sims and Baldwin 1989).

The guide is organized in a logical sequence for the user's convenience. One should first read Section 1 for an orientation to the classification. Section 2 deals with the Vegetation Types and their determination. It includes a key and factsheets for classifying (allocating) stands to Vegetation Types. Section 3 provides keys and factsheets for classifying Soil Types. Section 4 gives a brief overview of relationships among Vegetation and Soil Types in NW Ontario as well as background information on potential applications of the classification. Sections 5 and 6 contain aids for describing or recognizing important soil features and many of the plant species employed in the allocation keys and factsheets. References are listed in Section 7.

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## 1. Orientation

### 1.1. Introduction

Forest ecosystems are the forest / landscape units which forest resource managers must deal with during planning and implementation stages of management. Forest ecosystems provide a basis for integrated, multi-use resource management which weighs wildlife, recreation and other concerns along with timber harvesting. If management knowledge and experience are to be organized, communicated and used effectively, a clear and practical system for classifying these ecosystems is necessary. To address these needs, Forest Ecosystem Classification (FEC) was first undertaken in the Clay Belt of northeastern Ontario (Jones et al 1983, Jeglum et al 1983, Jones 1984). Recently an FEC system was developed for sites supporting red and white pine stands in the Algonquin Region of central Ontario (Merchant et al 1989). The current Northwestern Ontario (NWO) FEC provides the necessary framework for improved communication among forest managers in the North Central (NC) and Northwestern (NW) Regions.

Forest ecosystems are more than just the trees in the main canopy. Climate, understory vegetation, soil and other physical site features play important roles in determining how the forest ecosystems of northern Ontario evolve and develop (Hills and Pierpoint 1960, Hills 1961). The forest resource manager must consider more than just the forest cover and use a classification system which incorporates features in addition to the trees.

The classification system presented in this guide was developed using data collected from many relatively mature forests situated on a range of landforms and soils throughout NW Ontario. The NWO FEC database is primarily based on mature, natural forests over 50 years of age, although some younger and some second-growth forests are also represented. An attempt was made to sample across the entire range of landform features, slope positions and soil texture and moisture conditions. Sampling was conducted at a wide variety of geographic locations throughout the NC and NW Regions.

The NWO FEC system is intended for application at the "stand level", normally within relatively small (e.g., less than ten ha) forested areas. While it is designed to be primarily a field level tool, it may also be used in association with mapping and air photo interpretation (investigation of such "other" applications has been undertaken in 2 test areas in NW Ontario and will be reported elsewhere).

#### Orientation

The NWO FEC system has been rigorously tested in the field for both accuracy and practicality. A classification is of limited operational use if ecosystems cannot be allocated to classes quickly in the field using a few easily recognized, diagnostic features. Ultimately there should be sufficient classes to characterize the wide range of conditions that prevail in NW Ontario, yet few enough to keep the classification relatively simple and the number of resulting management options reasonable.

The NWO FEC system can be readily applied to a forest ecosystem in NW Ontario by individuals who have some basic knowledge or training in plant identification and field description of forest soils. There is a two-stage allocation process:

- **Step 1.** A forest stand is allocated to one of 38 Vegetation Types (V-Types). To assist in the stand allocation process, a vegetation field key has been developed based on general overstory composition, modified as necessary by the presence/absence or general abundance of a few important understory plants.
- Step 2. The soil is directly characterized in terms of a few critical parameters (e.g. moisture regime, parent material texture, depth to bedrock). Two field keys are provided: there are 13 S-Types (Soil Types with ≥ 100 cm of mineral or organic substrate) and 9 SS-Types (very shallow to moderately deep Soil Types with < 100 cm of mineral or organic substrate).</p>

Each Vegetation or Soil Type is defined by a set of ecologically similar samples which have conditions ranging around a "modal" description. These descriptions are provided in a series of Factsheets in this guide. Once Vegetation and Soil Types are determined, a variety of forest management concerns (see Section 4.5; Northwestern Ontario Forest Ecosystem Interpretations, Racey et al 1989) may be addressed. The NWO FEC system provides a framework for organizing, overlaying and updating forest management interpretations. For example, it can be applied directly as part of an operational cruise or pre-cut assessment procedure (see Section 4.6) and it can be an important component of silvicultural planning.

It is notable that major initial divisions of the NWO FEC system are not directly based on macroclimatic features. Most macroclimatic gradients vary gradually across NW Ontario. Sharp climatic changes, such as those elevational / topographic / climatic gradients which are recognized in B.C.'s biogeoclimatic classification (Krajina 1969, Klinka et al 1979), are not significant in NW Ontario. During analytical phases of the NWO FEC program, a number of climatically-based stratifications were applied, including Site Regions (Hills 1961), but none provided a clear or significant enough

breakdown to be useful. Climatic features are nonetheless integral and important elements of NW Ontario forest ecosystems. At this stage, it is felt that climatic information can be more effectively incorporated into individual forest management interpretations (Racey et al 1989). Specific climatic variables can be important criteria for a wide range of potential interpretations, for example selection of species and stock types, determination of outplanting constraints and prediction of severity of frost damage.

## 1.2. Geographic Setting

The NWO FEC system applies to forest ecosystems in NW Ontario. The area of study includes a broad area within two administrative regions of the Ontario Ministry of Natural Resources (OMNR): the North Central (NC) and Northwestern (NW) Regions. The study area is generally north and northwest of Lake Superior, and ranges from the Ontario - Manitoba border in the west to the Manitouwadge / White River general vicinity in the east. The study area extends south to the Ontario - Minnesota international border and north to the limit of commercial forest in this part of the province, a line which roughly coincides with the southern edge of the Hudson Bay Lowland physiographic zone (Anon. 1974). The total area exceeds some 184,000 sq km.

NW Ontario includes portions of the Boreal Forest Region (characterized by extensive black spruce, jack pine and balsam fir forests as well as mixed stands of conifer and northern deciduous species such as trembling aspen and white birch) and of the Great Lakes - St. Lawrence Forest Region (characterized by a diversity of conifer and hardwood species, including white and red pine, red maple, yellow birch and ash) (Rowe 1972). The Boreal Forest Region covers by far the largest proportion of the area, and includes the Northern Coniferous, Upper English River, Lower English River, Central Plateau and Superior Forest Sections. The Great Lakes - St. Lawrence Forest Region is represented by the Quetico and Rainy River Forest Sections, extending in a strip along the Ontario - U.S. border to the west of Thunder Bay.

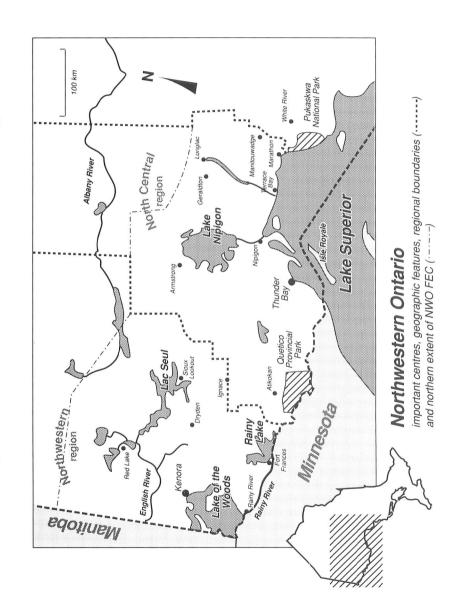
The forests of NW Ontario comprise a diverse mosaic of vegetational and soil / site ecosystem conditions. For example, pure, even-aged jack pine stands occur widely on well-drained, coarse-textured soils. Black spruce stands, often with poorly developed understory vegetation, occur across a range of soil and site conditions from thin, mineral soils overlying bedrock to poorly drained, organic wetlands. Balsam fir, white spruce, trembling aspen and white birch tend to occur in stands of mixed composition on a

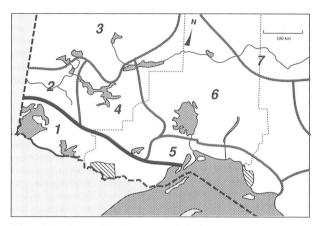
#### Orientation

variety of dry to moist, coarse- to fine-textured soils. Extensive and repetitive forest fires, cyclical insect infestations, disease, and other factors have an ongoing and pervasive effect on the ecology of forests in NW Ontario.

NW Ontario is characterized by a diverse physical setting. It is underlain by mostly Archean (Precambrian) rocks of the Superior and Southern Provinces (Pye 1969). In some areas, Phanerozoic sedimentary rocks overlie the bedrock. Glacial landform patterns are distinct due to complex events which occurred during glacial and early postglacial periods (Zoltai 1961, 1965a, 1967). Common surficial deposits include shallow drift, undulating ablation and basal tills, morainal and drumlin features and large expanses of predominantly thin glacial sediments over rolling to rugged bedrock (Sado and Carswell 1987). Glaciofluvial and glaciolacustrine deposits are also very common but tend to be more localized. Other surficial features include spillways, aeolian deposits and peat accumulations. While there are many small areas of organic deposits, there are relatively few large expanses of wetland in NW Ontario.

In general, the climate of NW Ontario is microthermal (C'21 to C'22) and humid (B'1 to B'3 - B'4) (Sanderson 1948). There are however two main climatic gradients — temperature and humidity — that generally stratify the area. Seasonal temperatures tend to increase with decreasing latitude and are further moderated in proximity to Lake Superior (Chapman and Thomas 1968); mean annual temperatures, for example, range from 0°C in northern parts of the study area to over +3°C near the U.S. border in the southwestern sector of NW Ontario. Humidity (and precipitation) trends from drier conditions in the west to moist in the east (Chapman and Thomas 1968); mean annual precipitation ranges from less than 550 mm west of Kenora to over 800 mm in the Marathon / Manitouwadge general vicinity (see climographs, pages 8-9). Because of this stratification, NW Ontario encompasses four Site Regions, and portions of four others, as defined by Hills (1961): 5S, 4S and the southern half of 3S ("Subhumid Western" Site Regions); 4W, 3W and the southern portion of 2W ("Humid Western" [driest humid] Site Regions) and the western edges of 3E and 2E ("Humid Eastern" [medium humid] Site Regions).





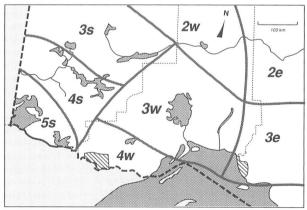
Forest Regions of Northwestern Ontario (after Rowe 1972)

#### Great Lakes - St. Lawrence Forest Region

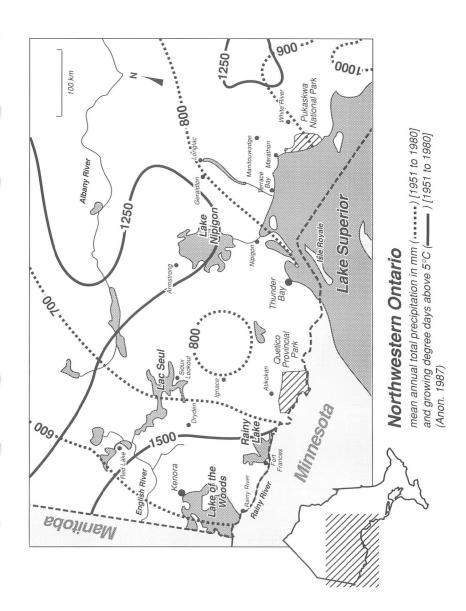
1 Quetico - Rainy River

#### Boreal Forest Region

- 2 Lower English River
- 3 Northern Coniferous
- 5 Superior
- 6 Central Plateau
- 4 Upper English River 7 Hudson Bay Lowlands

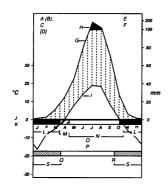


Site Regions of Northwestern Ontario (after Hills 1961)

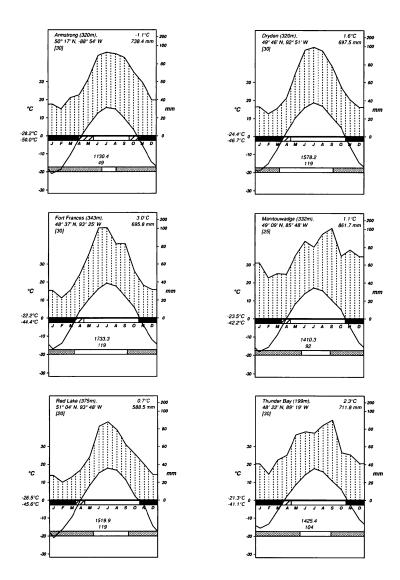


#### Orientation

## Climatic summaries for selected NW Ontario communities (Anon. 1982)



- A Name of climatic station
- B Elevation of climatic station (metres above sea level)
- Latitude and longitude of climatic station
- D Number of years of observations
- Mean annual temperature (°C)
- F Mean annual precipitation (mm)
- G Curve of mean monthly total precipitation
- H Mean monthly total precipitation (scale reduced 1/10 for rainfall greater than 100 mm) [shown in black]
- Curve of mean monthly temperature
- J Mean daily minimum temperature of coldest month (°C)
- K Lowest recorded temperature (°C)
- Months with mean daily temperature below 0°C (shown in black)
- M Months with mean daily temperatures above 0°C, but mean daily minimum temperatures below 0°C (diagonal hatching)
- N Months with mean daily temperatures above 0°C
- Mean annual number of degree days (above 5°C)
- P Frost free period (days)
- Q Last frost
- R First frost
- S Frost period (screened area)



## 1.3. Regional Comparisons

In general, forest ecosystems across the NC and NW Regions have shared a similar set of formative conditions. The broad climatic gradients described in Section 1.2 are perhaps the most notable factors serving to discriminate between the forest geography of the two regions. Most other factors are either relatively constant across NW Ontario (e.g. elapsed time in soil development) or are variable on a localized or sub-regional scale (e.g. parent soil materials, topographic landform features and biological communities).

Climatic gradients are reflected in the species composition of forest vegetation within NW Ontario. The latitudinal gradient is manifest within both the NC and NW Regions in the transition from Great Lakes - St. Lawrence to boreal forest conditions (see Section 1.2). Within both Forest Regions (Rowe 1972), increasing distance from L. Superior results in climatic characteristics of a slightly more continental nature, with warmer summers and lower annual precipitation. Under these conditions, species adapted to warmer, drier growing conditions and colder winters occur more frequently in upland forest vegetation.

The Quetico - Rainy River Forest Sections occupy an area of NW Ontario extending approximately 100 km north of the U.S. border between Thunder Bay and the Manitoba border. They represent the northern limit of the mixed forests of Minnesota and Wisconsin as well as the western limit of the Great Lakes - St. Lawrence Forest Region of Canada (Rowe 1972, Kotar et al 1988). Of the NW Ontario flora, numerous understory species occur only in this area (Walshe 1980, Baldwin and Sims 1989). Species such as large-toothed aspen, red maple, yellow birch, basswood, white elm and red ash can be found in forest overstorys (V3, V5), especially throughout the southern portions of this Section; red and white pine (V12, V13, V26, V27) occur commonly here (Zoltai 1965b). In the Fort Frances District of the NW Region, prairie-woodland species such as bur oak and Manitoba maple (V3) are encountered (Walshe 1980), reflecting a climate generally warmer and drier than that found in the Thunder Bay - Quetico area of the NC Region.

Likewise, in the Boreal Forest Region, the growing season tends to be warmer and drier in the western portions of the NW Region than elsewhere in NW Ontario. This is reflected in the understory conditions of a variety of NWO FEC Vegetation Types. For example, both the frequency of occurrence and the average abundance of species like *Vaccinium vitis-idaea* (esp. *V32* - *V37*) and *Arctostaphylos uva-ursi* (esp. *V27* - *V29*, *V30*, *V32*) are greater in the NW Region than in the NC Region. Some mesic species such as

Acer spicatum (esp. V5, V6, V8, V12, V17) tend to occur in lower abundances in the NW Region than throughout the NC Region.

The climatic gradients which influence the area also have potential implications for pedogenic (soil developmental) processes that are driven by precipitation (e.g. translocation of ions) and/or biological activity (e.g. decomposition of organic matter). For example, general differences in the forest humus conditions between the NC and NW Regions are notable in the NWO FEC dataset. Upland, boreal humus forms (mors) are typically less decomposed in the NW Region where fibrimors are, by far, the prevailing group on dry/fresh mineral soils (S1 - S6, SS1 - SS7). Humifibrimors, common in the NC Region (esp. S5 - S10, SS5 - SS8), are infrequent in the NW Region while fibrihumimors and humimors are rare. Similarly, for peaty humus forms (peaty mors), the proportion of more highly decomposed mesic and humic peaty mors is significantly higher in the NC Region (esp. S12F and S12S). These trends result, in large part, from reduced biological activity in the boreal portions of the NW Region due to a drier, warmer summer climate.

Relative to the size of the overall geographic area, spatial variation of many factors is limited or local in scale. For example, calcareous **S1** and **S2** (sandy) soils were not encountered in the NW Region during NWO FEC sampling, although approximately 20% of combined **S1** and **S2** samples from the NC Region were found to be calcareous. The calcareous samples, however, were primarily obtained from one specific area east of Lake Nipigon. Consequently, these observations do not suggest a dichotomy between the NW and NC Regions, rather they describe a sub-regional pattern of parent material distribution. Such distributional trends are noted, whenever they are identifiable from the NWO FEC dataset, in the "Comments" sections of individual Soil and Vegetation Type Factsheets.

Future research, as well as ongoing operational use of the NWO FEC, will undoubtedly provide more understanding of regional similarities and differences. Studies are now underway to clearly characterize growth and yield relationships for several major species according to NWO FEC Types. In some cases, these results are being stratified on a regional basis. Management interpretations, as they are developed, may sometimes need to recognize differences in acceptable standards, mill requirements and species mixes, etc. that are best expressed at a regional scale. For wildlife interpretations, some species have different niches, occupy different habitats or ranges or have different feeding, foraging, migrational or other characteristics that may also be most appropriately expressed at a regional level. Future studies on spatial distribution of NWO FEC units in both regions may show differences in the way they are complexed or configured across landscapes.

## 2. Vegetation Types

## 2.1. Introduction to the Vegetation Types Allocation Key

#### 2.1.1. General

The key to the 38 Vegetation Types is hierarchical, and requires that a simple yes/no decision be made at each successive division point. Initial divisions are based on tree layer characteristics while finer divisions are primarily based on understory and ground layer vegetation. There are three main groupings: *Mainly Hardwood* (11 V-Types), *Conifer Mixedwood* (9 V-Types) and *Conifer* (18 V-Types). The key is in two parts, 'A' and 'B'. Part 'A' contains the hardwood and mixedwood V-Types while Part 'B' deals with the pure conifer V-Types. Wherever possible V-Types have been placed in a sequence that reflects a broad gradient from dry, upland to wet, lowland stand conditions. This is especially clear, for example, across the pine / black spruce dominated conifer V-Types (*V26* to *V38*).

In deriving Vegetation Types, consideration was given to linking them as closely as possible with existing "working group" concepts; such general affinities should be readily apparent. For example, the black spruce working group (Arnup et al 1988) is mainly represented by *V19*, *V20* and *V30* - *V38*, the jack pine working group (Anon. 1986) by *V17*, *V18* and *V28* - *V32* and the poplar working group (Davidson et al 1988) by *V5* - *V11*.

#### 2.1.2. Vegetation Type Names

V1Balsam Poplar Hardwood and Mixedwood  V2Black Ash Hardwood and Mixedwood  V3Other Hardwoods and Mixedwoods  V4White Birch Hardwood and Mixedwood  Aspen Hardwood				
V2Black Ash Hardwood and Mixedwood				
V3Other Hardwoods and Mixedwoods				
V4White Birch Hardwood and Mixedwood				
V5Aspen Hardwood				
V6Trembling Aspen (White Birch) - Balsam Fir / Mountain Maple				
V7Trembling Aspen - Balsam Fir / Balsam Fir Shrub				
<b>V8</b> Trembling Aspen (White Birch) / Mountain Maple				

## Vegetation Types -

	V9Trembling Aspen Mixedwood
	V10Trembling Aspen - Black Spruce - Jack Pine / Low Shrub
	V11Trembling Aspen - Conifer / Blueberry / Feathermoss
Ç	V12White Pine Mixedwood
3	V13Red Pine Mixedwood
, 20 20 20 20 20 20 20 20 20 20 20 20 20	V14Balsam Fir Mixedwood
ថ្ង	V15White Spruce Mixedwood
28	V16Balsam Fir - White Spruce Mixedwood / Feathermoss
** **	V17Jack Pine Mixedwood / Shrub Rich
3	V18Jack Pine Mixedwood / Feathermoss
COLUMN WINDERSON	V19Black Spruce Mixedwood / Herb Rich
3	V20Black Spruce Mixedwood / Feathermoss
	V21Cedar (inc. Mixedwood) / Mountain Maple
	V22Cedar (inc. Mixedwood) / Speckled Alder / Sphagnum
	<b>V23</b> Tamarack (Black Spruce) / Speckled Alder / Labrador Tea
	V24White Spruce - Balsam Fir / Shrub Rich
	<b>V25</b> White Spruce - Balsam Fir / Feathermoss
	<b>V26</b> White Pine Conifer
	V27Red Pine Conifer
~	V28Jack Pine / Low Shrub
5	V29Jack Pine / Ericaceous Shrub / Feathermoss
Š	V30Jack Pine - Black Spruce / Blueberry / Lichen
)	V31Black Spruce - Jack Pine / Tall Shrub / Feathermoss
	V32Jack Pine - Black Spruce / Ericaceous Shrub / Feathermoss
	V33Black Spruce / Feathermoss
	V34Black Spruce / Labrador Tea / Feathermoss (Sphagnum)
	V35Black Spruce / Speckled Alder / Sphagnum
	V36Black Spruce / Bunchberry / Sphagnum (Feathermoss)
	V37Black Spruce / Ericaceous Shrub / Sphagnum
	V38Black Spruce / Leatherleaf / Sphagnum

#### 2.1.3. How to Use the Vegetation Key

The vegetation key is constructed so that one needs to use a minimum number of variables. The key's simplicity and consistency of style are important from an operational and multi-user viewpoint.

The NWO FEC vegetation classification is intended for application in mature, undisturbed forest stands (see Section 1.1). When using the key, the location for stand typing should be *selected carefully* to ensure it is typical of surrounding forest stand conditions; it is important to select a *representative spot* within which to apply the key. A quick reconnaissance of the surrounding area will help familiarize the user with both the extent and general composition of the overall stand. A short time spent conducting this preliminary assessment will make the vegetation key more effective.

The basic unit of measurement for the vegetation key is a 10 m by 10 m (100 sq m) sample plot. This plot can be physically laid out with ropes or markers, or it can be roughly paced out and the area estimated. Once the user has developed some experience using the NWO FEC vegetation classification, the sample plot area can be easily estimated.

With the vegetation key, a stand is allocated by making the requested decisions using only species occurring within the sample plot. The initial division points of the key ask that main tree layer species be determined using a percent cover estimate. Some of the finer division points of the key use decision rules which are based either on presence/absence or cover percentage of important species or conditions.

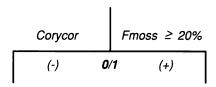
In applying a decision rule, score (-1) for each "negative" indicator species or condition (i.e. listed on the left-hand side of the division point) and (+1) for each "positive" case (i.e. those listed on the right). Total the scores on each side and calculate their sum by simply adding up negative and positive sub-totals. Then:

If the sum is greater than or equal to the right-hand number of the decision rule, proceed right.

If the sum is less than or equal to the left-hand number of the decision rule, proceed left.

## Vegetation Types

e.g.



In this example, score (-1) if *Corylus cornuta* (beaked hazel) is present and (+1) if feathermosses cover at least 20% of the ground surface. If both conditions are met, the sum becomes 0 and one would proceed left.

Keep in mind that NWO FEC Vegetation Factsheets are designed to provide "modal" descriptions of the Vegetation Types along with information on ranges of ecological conditions within each Type. Factsheet descriptions can assist the user in making "borderline decisions" in the key (see Section 2.2.3).

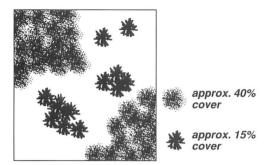
#### 2.1.4. Conventions for Use of the Vegetation Key

**Cover Percentage Values:** In the vegetation key, cover percentage values must be determined in order to apply many of the decision rules (e.g.  $Alnurug \ge 10\%$ ;  $Bw \ge 80\%$ ).

Percent cover is defined as the proportional vertical projection onto a horizontal surface (i.e. the ground) of the aerial growth mass of a given species (cf. Kershaw and Looney 1985). Cover is readily determined for an understory species by looking downward through the foliage and estimating the amount of ground covered as a percentage of the total plot area. For a tree species one must look upward through the canopy, estimating the ground cover from below. Note that it is possible for species cover values within a layer of vegetation to total more than 100%.

For all cases in the key the numerical figure (e.g. Acerspi  $\geq$  10%) refers to the absolute cover value of the named species expressed as a percentage of the area of the 10 m x 10 m sample plot. It does not refer to the relative abundance of that species compared to the total vegetative abundance.

e.g.



**Main Species Group / Main Species**: In the NWO FEC system, many division points in the vegetation key request that absolute cover percentages of individual tree species or species groups be compared. The one with the highest cover value is the main species or species group.

e.g. Stand is Mainly Hdwd requests that total cover percentages of the hardwood and conifer tree species be compared.

e.g. Cnfr Spp Mainly Bf requests that the cover percentage of balsam fir be compared with each of the other conifer species present in the tree layer.

As a convention, if two species in the tree layer are about equally abundant — within 5% cover — the taller, primary canopy species is considered to be the main species.

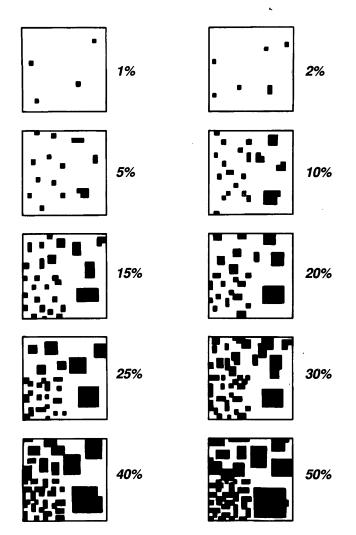
e.g

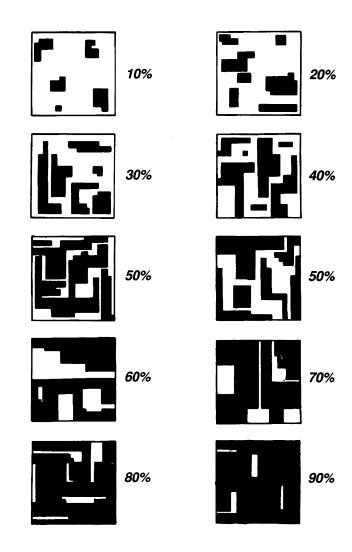
	Primary Canopy	Secondary Canopy
Pj	10%	
Sb		13%

In this case Pj is the main species although its absolute cover value is slightly less than that of Sb.

## Vegetation Types -

## Cover percentage charts (Ontario Institute of Pedology 1985)





### Vegetation Types

**And(+)/Or Categories**: In instances where the key refers to a group of species (e.g. Bf +/or Sw), sum their abundances to obtain a maximum total cover value. Compare the sum with cover values of other species or species groups at the division point.

e.g. Hdwd spp mainly Pot +/or Bw +/or Pogr asks if total cover of these 3 species exceeds that of any other hardwood species.

**Use of Tree Layer Species:** For species which can occur either as trees or shrubs, all references are to *tree species in the tree layer* unless specifically noted otherwise. An individual occupies the tree layer if its height is equal to or over 10 m and/or its diameter at breast height (DBH) is greater than or equal to 10 cm.

e.g. Cnfr Spp Mainly Pj refers only to jack pine (Pj) in the tree layer.

e.g.  $Bf(shr) \ge 10\%$  refers only to balsam fir (Bf) in the shrub layer.

**Pure Stands and the "2% Rule"**: At several division points the vegetation key asks whether the stand being examined is pure, e.g. *Stand is only Hdwd*. This is to be strictly applied; only a tolerance of 2% cover for species which would alter the decision at these points is allowed.

e.g. 1% cover of Pot in an Sb stand would not alter its classification as a pure conifer Type.

**Ratio of Feathermoss to Sphagnum**: For some conifer stands the vegetation key asks if total cover of feathermoss relative to Sphagnum cover exceeds a 2:1 ratio. This decision point helps distinguish between drier (i.e. relatively more feathermoss ground cover) and wetter (i.e. relatively less feathermoss ground cover) black spruce stands.

**Bedrock**: In the vegetation key, bedrock cover is used to help define **V30**. This criterion pertains *only* to exposed bedrock surfaces. Neither bedrock covered by a continuous mat of moss and/or lichens nor large boulders should be considered here.

**Lichen:** In the vegetation key, ground lichen cover is used to help define **V30**. Only forest floor lichen species should be considered (see Section 2.1.5).

**Season of Use**: The appropriate period for applying the vegetation classification is between late-May and late-September. Within the key, species have been used which are fairly easy to recognize throughout the growing season. At other times of the year, however, the vegetation key will be difficult to apply. In particular, before full leaf flush in the spring or after leaf fall in autumn, cover percentage values of deciduous species will differ significantly from summer cover values.

#### 2.1.5. Terminology Used in the Vegetation Key

The decision criteria of the vegetation key are presented as clearly as possible within the space constraints imposed by the layout of the key. However, abbreviations, acronyms and symbols are used. This section defines the terminology of the key.

#### General Terms

Cnfr	conifer
Hdwd	hardwood
Spp	species (plural)
+/or	and/or
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to

#### Tree Species

Abbreviation	Scientific Name	Common Name
Ab	Fraxinus nigra	black ash
Bf	Fraxinus nigra Abies balsamea	balsam fir
Bw	Betula papyrifera Thuja occidentalis	white birch
Ce	Thuja occidentalis	eastern white cedar

## Vegetation Types -----

La	Larix laricina	tamarack or larch
Pj	Pinus banksiana	jack pine
Pob	Populus balsamifera	balsam poplar
Pogr	Populus grandidentata	large-toothed aspen
Pot	Populus tremuloides	trembling aspen
Pr	Pinus resinosa	red pine
Pw	Pinus strobus	white pine
Sb	Picea mariana	black spruce
Sw	Picea glauca	white spruce

## Shrub Species

Page No.	. Abbreviation	Scientific Name	Common Name
165	Acerspi	Acer spicatum	mountain maple
166	Alnurug	Alnus rugosa	speckled alder
-	Bf(shr)	Abies balsamea	balsam fir (shrub)
167	Corycor	Corylus cornuta	beaked hazel
168	Dierlon	Diervilla lonicera	bush honeysuckle
169	Epigrep	Epigaea repens	trailing arbutus
170	Kalmpol	Kalmia polifolia	bog laurel
171	Ledugro	Ledum groenlandicum	Labrador tea
172	Rosaaci	Rosa acicularis	prickly wild rose
173	Rubupub	Rubus pubescens	dwarf raspberry
174		Vaccinium angustifolium	blueberry
175	Vaccspp	Vaccinium myrtilloides	blueberry
176		Vaccinium vitis-idaea	mtn. cranberry

## Herb Species

Page No.	Abbreviation	Scientific Name	Common Name
177	Astemac	Aster macrophyllus Coptis trifolia	large-leaved aster
178	Copttri	Coptis trifolia	goldthread
-	Fern spp Mitenud	1	any species of fern
179	Mitenud	Mitella nuda	naked mitrewort

#### Moss and Lichen Species

Page No.	Abbreviation	Scientific Name	Common Name
181 182 183	Fmoss	Hylocomium splendens Pleurozium schreberi Ptilium crista-castrensis	feathermosses
184	Sphag spp or Sphagnum	any species of Sphagnum moss	
180 180 180	Lichen	any species of ground lichen e.g Cladina mitis Cladina stellaris Cladina rangiferina	•

Page numbers refer to Section 6 where identification aids for the understory species in the vegetation key are presented. A companion NWO FEC plant guide (*Field Guide to the Common Forest Plants in Northwestern Ontario*, Baldwin and Sims 1989) provides additional detail about field identification of common forest species.

## 2.2. Introduction to the Vegetation Type Factsheets

#### 2.2.1. General

The Vegetation Type Factsheets provide descriptive information on each V-Type. Once familiar with the Factsheets, the user will develop a better understanding and visual impression of the main vegetation conditions, along with soil, site and forest stand characteristics, associated with the V-Types.

It is important to appreciate that the Factsheets present an average (or "modal") summary of information on each V-Type. The forests of NW Ontario are inherently variable. The NWO FEC vegetation classification, while subdividing this variability into smaller, more homogeneous units, still represents within each V-Type a range of conditions. Thus, Factsheets will seldom describe exactly any given stand. They do, however, provide

## Vegetation Types

insight into the variability which can be expected within any one V-Type. Range and frequency information is included for each V-Type as well as frequencies of occurrence of certain conditions within each Type.

#### 2.2.2. Layout of the Vegetation Type Factsheets

The identification banner at the top of each Factsheet gives the V-Type number [1] and name [2]. The V-Type name consists of a few important species or species groups listed by stratum. Slashes are used to separate strata and dashes or brackets separate species or species groups within a stratum. A short text description [3] of the V-Type is given, noting the sample size [4] the Type description is based on. Below the **General Description**, on the left, is the Vegetation Types ordination diagram [5], explained in Section 4.1. Location of the V-Type within the ordination is highlighted.

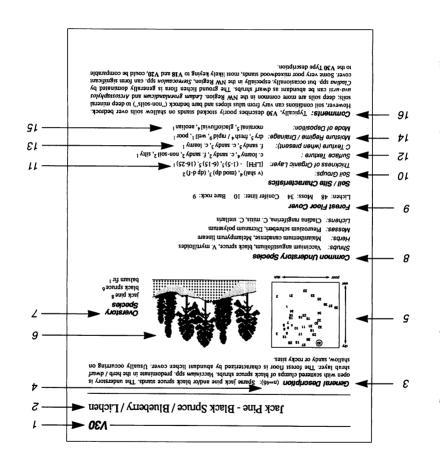
The V-Type cross-sectional diagram [6] shows typical stand structure and tree species composition as well as general surface topography. Due to the scale of this diagram, features of the understory cannot be as well expressed as those of the canopy layer. A legend for the symbols used in these diagrams is provided in Section 2.2.3.

Each Factsheet lists the overstory species (≥ 10 m tall) which occurred in over 10% of the V-Type sample [7]. Diagnostic species for the Type are highlighted; superscripts indicate the frequency of occurrence for each species (see Section 2.2.3). Understory species (shrubs < 10 m tall, herbs, graminoids, mosses and lichens) which occurred in over 50% of the V-Type sample are listed in descending order of occurrence frequency [8]. Scientific and common names, as well as illustrated descriptions, for species listed in the Vegetation Type Factsheets are contained in the companion NWO FEC plant guide (Baldwin and Sims 1989).

The average condition of forest floor cover for the V-Type is summarized [9], although it can vary widely on any given site. The numerical values are mean cover percentages for each forest floor component averaging  $\geq 5\%$  cover.

A number of soil / site attributes are summarized on each V-Type Factsheet: commonly associated groupings of NWO FEC Soil Types [10], organic layer thickness [11], soil texture (or substrate description) in the surface 25 cm of the soil profile [12], C horizon soil texture [13], soil moisture regime and soil drainage classes [14] and surficial deposit conditions [15]. This information describes the ranges of conditions which characterize the V-Type.

### Example Vegetation Type Factsheet



## Vegetation Types

At the bottom of each Factsheet there is a **Comments** section [16] providing miscellaneous descriptive notes. Users may wish to append additional comments for their own use.

#### 2.2.3. Conventions for Use of the Vegetation Type Factsheets

**Comparing Similar Factsheets**: Remember, the key is not in itself the classification! It will always get the user to an end-point. Validate the end-point by checking the Factsheets.

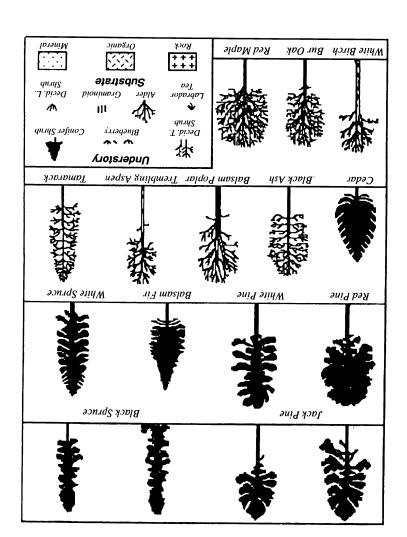
For a number of reasons, there is potential for occasional misclassification. The ordination diagram on each Factsheet shows those V-Types which are most similar to the keyed Type. In addition, there are sometimes notes on similar V-Types in the *Comments* section. The user may use this information as an aid to checking and comparing the Factsheet descriptions of other V-Types to see if a better "fit" exists. (This is also a useful process simply to increase one's familiarity with the whole of the classification!) If a better fit is in fact found, the alternate V-Type may be adopted.

[CAUTION: This option of switching to a different V-Type should be limited to very occasional use - and only when there are clear discrepancies. The procedure can undermine the classification if applied indiscriminantly. For example, if a user repeatedly encounters problems with one particular V-Type, and often reallocates stands out of it or into it, he/she may perpetuate an inaccurate personal interpretation of what the V-Type represents].

**Frequency Superscripts:** For overstory species and the soil/site descriptors, superscripts indicate the proportion of the V-Type sample in which each species or descriptor class occurred (superscript value X 10 = percent frequency occurrence). Individual frequency values are rounded to the nearest 10%, consequently total frequency occurrence may sum to a value other than 100%.

## Cross-sectional Diagrams

Symbols used in the V-Type cross-sectional diagrams are defined below:



## Vegetation Types

In most cases the superscripts indicate frequency of occurrence within the entire V-Type sample. The exception is the *C Texture* summary where they indicate frequency of occurrence only within the total number of sampled plots *for which C horizon texture was recorded* (mineral C horizons are often absent in deep organic or shallow mineral soils).

e.g. Soil Groups: (dp d-f)<sup>7</sup>, (v shal)<sup>3</sup>

70% (65-74% range) of the stands sampled for this V-Type occurred on deep soils in the dry/fresh category of NWO FEC S-Types (*\$1-\$6*); 30% (25-34% range) occurred on soils in the very shallow category (*\$\$51-\$\$54*).

e.g. Thickness of Organic Layer: [LFH] -  $(6-15)^7$ ,  $(16-25)^2$  [O] -  $(\ge 40)^1$ 

70% (65-74% range) of the stands sampled for this V-Type occurred on soils with an LFH organic layer between 6 and 15 cm thick. 20% (15-24% range) were on soils with an LFH layer that was 16 to 25 cm thick and 10% (5-14% range) on soils with an organic O horizon (Of, Om, Oh) at least 40 cm thick.

**Forest Floor Cover.** Forest floor cover values are reported only if they average 5% or greater; for this reason total cover rarely sums to 100%.

**Deep Texture**: For a few V-Types (V22, V23, V35, V37, V38) where C horizons were rarely sampled due to a predominance of organic soils, the *C Texture* summary is replaced by a summary of substrate classes in the lower portion of the profile ( $\geq 40 \text{ cm}$ ).

### 2.2.4. Terminology Used in the Vegetation Type Factsheets

Soil Groups: Groupings of NWO FEC S-Types:

(dp d-f)	dry to fresh, deep mineral soils	S1-S6
(dp m)	moist, deep mineral soils	S7-S11
(w org)	wet, deep organic soils	S12F, S12S
(v shal)	very shallow soils	SS1-SS4
(mod dp)	shallow to mod. deep, mineral soils	SS5-SS8
(w org/R)	shallow to mod. deep, wet organic soils	SS9

**Soil Texture**: Mineral soil texture classes (Working Group on Soil Survey Data 1978; Ontario Institute of Pedology 1985) are grouped in the *Surface Texture* and *C Texture* summaries. Organic and non-soil substrate conditions are also summarized in *Surface Texture*. See Section 5.1 for information on the assessment of soil textures.

very coarse sand, coarse sand, medium sand, loamy,

lithic material (e.g. bedrock, colluvium, boulders)

The texture class groupings are:

c. sandy (coarse sandy)

non-soil

	v. coarse sand, loamy coarse sand, loamy medium sand
f. sandy (fine sandy)	fine sand, very fine sand, loamy fine sand
c. loamy (coarse loamy)	loamy v. fine sand, loam, all sandy loams, all silty sands
f. loamy (fine loamy)	clay loam, silty clay loam, all sandy clay loams
silty	silt, silt loam
clayey	clay, silty clay, sandy clay
organic	Of, Om, Oh layers

**Moisture Regime / Drainage**: Moisture regime and drainage classes, derived using standard tables (Ontario Institute of Pedology 1985; see Section 5.2), are grouped for Vegetation Type Factsheet summaries:

# Vegetation Types

### Moisture Regime:

dry	dry, moderately dry	$MR \emptyset, 0$
fresh	moderately fresh, fresh, very fresh	MR 1, 2, 3
moist	moderately moist, moist, very moist	MR 4, 5, 6
wet	moderately wet, wet, very wet	MR 7, 8, 9

### Soil Drainage:

rapid	very rapid, rapid	Drainage Classes 1, 2
well	well, moderately well	Drainage Classes 3, 4
poor	imperfect, poor	Drainage Classes 5, 6
v. poor	very poor	Drainage Class 7

Mode of Deposition: Landform soil material classes are defined in Section 5.7.

**Herb or Shrub Rich / Poor.** These descriptive terms incorporate information on both species diversity and overall abundance within a stratum. For example, a "shrub rich" understory would be expected to have a diversity of species as well as relatively dense development within the shrub layer.

**Graminoid:** A collective term referring to grass-like vegetation. Species of grasses, sedges and rushes are included in the graminoid category.

Ericaceous Species: A group of low, woody plants including Ledum groenlandicum, Vaccinium spp., Kalmia polifolia, Andromeda glaucophylla, Chamaedaphne calyculata, Gaultheria hispidula, G. procumbens, Epigaea repens, Chimaphila umbellata, Arctostaphylos uva-ursi, Oxycoccus microcarpus and O. macrocarpus. The term "ericaceous" refers to the taxonomic family to which they belong, the Ericaceae (Heath Family).

**Dwarf Shrub:** Any plant species with a perennial woody stem (see Section 6.1) which typically grows to a height of less than 50 cm.



V5; Aspen Hardwood (p. 38)



Shrub rich understory



V9; Trembling Aspen Mixedwood (p. 42) with white spruce as the main conifer tree species

### Herb rich understory





V29; Jack Pine / Ericaceous Shrub / Feathermoss (p. 62)



Ericaceous shrub / feathermoss ground cover



V33; Black Spruce / Feathermoss (p. 66)



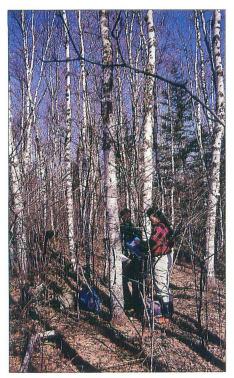
Feathermoss ground cover



V25; White Spruce – Balsam Fir / Feathermoss (p. 58)



V37; Black Spruce / Ericaceous Shrub / Sphagnum (p. 70)



V4; White Birch Hardwood and Mixedwood (p. 37)



V26; White Pine Conifer (p. 59)

# 2.3. Vegetation Types Allocation Key and Factsheets

	V1	Balsam Poplar Hardwood and Mixedwood	
Ğ	V2	Black Ash Hardwood and Mixedwood	
8	V3	Other Hardwoods and Mixedwoods	
Š	V4	White Birch Hardwood and Mixedwood	
Ġ	V5	Aspen Hardwood	
<u>m</u>	V6	Trembling Aspen (White Birch) - Balsam Fir / Mountain Maple	
~d	V7	Trembling Aspen - Balsam Fir / Balsam Fir Shrub	
2	V8	Trembling Aspen (White Birch) / Mountain Maple	
·	V9	Trembling Aspen Mixedwood	
Mainly Hardwood	V10	Trembling Aspen - Black Spruce - Jack Pine / Low Shrub	
- COLON	V11	Trembling Aspen - Conifer / Blueberry / Feathermoss	
	<b>V</b> 11	Tremoting Aspen - Conner / Bideberry / Peamermoss	
Conifer Mixedwood	V12	White Pine Mixedwood	
9	V13	Red Pine Mixedwood	
~~~~	V14	Balsam Fir Mixedwood	
Ğ	V15	White Spruce Mixedwood	
~~	V16	Balsam Fir - White Spruce Mixedwood / Feathermoss	
******	V17	Jack Pine Mixedwood / Shrub Rich	
Ö,	V18	Jack Pine Mixedwood / Feathermoss	
, E	V19	Black Spruce Mixedwood / Herb Rich	
Ö	V20	Black Spruce Mixedwood / Feathermoss	
U			
	V21	Cedar (inc. Mixedwood) / Mountain Maple	
	V22	Cedar (inc. Mixedwood) / Speckled Alder / Sphagnum	
	V23	Tamarack (Black Spruce) / Speckled Alder / Labrador Tea	
	V24	White Spruce - Balsam Fir / Shrub Rich	
	V25	White Spruce - Balsam Fir / Feathermoss	
	V26	White Pine Conifer	
	V27	Red Pine Conifer	
Š.	V28	Jack Pine / Low Shrub	
****	V29	Jack Pine / Ericaceous Shrub / Feathermoss	
Conifer	V30	Jack Pine - Black Spruce / Blueberry / Lichen	
Ü	V31	Black Spruce - Jack Pine / Tall Shrub / Feathermoss	
	V32	Jack Pine - Black Spruce / Ericaceous Shrub / Feathermoss	
	V33	Black Spruce / Feathermoss	
	V34	Black Spruce / Labrador Tea / Feathermoss (Sphagnum)	
	V35	Black Spruce / Speckled Alder / Sphagnum	
	V36	Black Spruce / Bunchberry / Sphagnum (Feathermoss)	
	V37	Black Spruce / Ericaceous Shrub / Sphagnum	
	V38	Black Spruce / Leatherleaf / Sphagnum	
		Diana Spides / Beatherteat / Spinagham	

V2

V3

V4

Mainly Hardwood

**NWO FEC** Vegetation Key part 'A' Start Stand is only Cnfr Go to part 'B' n/y Cnfr spp mainly Pr + / or Pw n/v Stand is mainly Hdwd y/n Ab Pob -1/0 Hdwd spp mainly Pot + / or Bw + / or Pogr n/y Hdwd spp only Bw or Bw ≥ 80% y/n Stand is only Hdwd Cnfr spp mainly Ce Go to V21, V22 y/n n/v(part 'B') Pob > Ab Cnfr spp mainly Bf Cnfr spp mainly Bf + / or Sw y/n y/n Vacc spp ≥ 20% Cnfr spp mainly Pj Acerspi≥10% Fmoss≥20% Fmoss≥20% v/n 0/1 n/vAcerspi ≥10% Hdwd Bf mainly Astemac y/n Ab + / or Dierlon Pot + / or Acerspi ≥10% Rosaaci Fmoss Corycor Bw Astemac ≥10% Pw≥Pr Bf ≥Sw Rubupub Fmoss ≥50% Cnfr spp ≥20% Acerspi + / or mainly V/n -1/0Corycor ≥10% y/n y/n 0/1 -1/0 Pj or Sb 0/1

V9

V10 V11

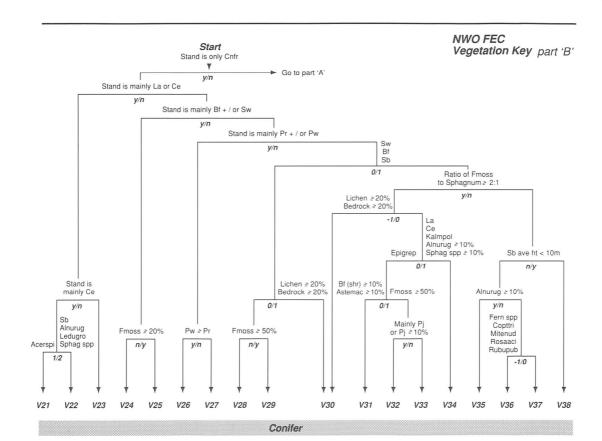
V13

V16

Conifer Mixedwood

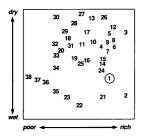
V19

V20



# Balsam Poplar Hardwood and Mixedwood

**General Description** (n=54): Hardwood and mixedwood stands containing balsam poplar in the overstory. The understory is typically herb and shrub rich with a broad diversity of species. Occurring on deep, fresh to moist mineral soils, often of lacustrine origin.





### **Overstory Species**

balsam poplar 10 trembling aspen 6 balsam fir 4 white birch 4 white spruce 4 black spruce 3 jack pine 1 white cedar I black ash 1

### Common Understory Species

Shrubs: Rubus pubescens, balsam fir, Rosa acicularis, Ribes triste, Actaea rubra, Cornus

stolonifera, Alnus rugosa, Rubus idaeus, Acer spicatum, Amelanchier spp.

Herbs: Aralia nudicaulis, Mitella nuda, Galium triflorum, Maianthemum canadense, Streptopus

roseus, Aster macrophyllus, Petasites palmatus, Equisetum spp., Clintonia borealis, Comus canadensis, Trientalis borealis, Fragaria virginiana, Aster ciliolatus, Mertensia

paniculata, Viola renifolia, Anemone quinquefolia

Mosses: Pleurozium schreberi, Plagiomnium cuspidatum

### Forest Floor Cover

Broadleaf litter: 77 Moss: 7 Graminoid litter: 6 Wood: 5

### Soil / Site Characteristics

Soil Groups:  $(dp m)^5$ ,  $(dp d-f)^4$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>6</sup>, (16-25)<sup>1</sup>, (1-5)<sup>1</sup>, (26-39)<sup>1</sup> Surface Texture: clayey<sup>3</sup>, c. loamy<sup>3</sup>, silty<sup>1</sup>, f. loamy<sup>1</sup>, f. sandy<sup>1</sup>

clayev 4, c. loamy 2, silty 2, f. loamy 1, sandy 1 C Texture (when present):

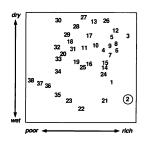
Moisture Regime / Drainage: fresh 5, moist 5 / poor 5, well 4, rapid 1

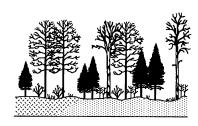
Mode of Deposition: lacustrine 6, morainal 2, fluvial 1, glaciofluvial 1

**Comments:** Typically, in V1 stands, balsam poplar is the main tree species although occasionally other hardwoods (especially trembling aspen) are more abundant. V1 stands often have an uneven age distribution in the overstory resulting in broken, irregular canopies. Soils tend to be fine-textured and poorly drained (although potentially very productive); calcareous soils are common. Calamagrostis canadensis can be abundant in the herb layer.

# Black Ash Hardwood and Mixedwood

**General Description** (n=37): Hardwood and mixedwood stands containing black ash in the overstory. The understory is typically dense and floristically diverse. Of limited areal extent; occurring in low-lying locations on deep, moist to wet, usually non-calcareous substrates.





### Overstory Species

black ash 10 balsam fir 3 trembling aspen 3 white birch 2 white spruce 1 white cedar 1 red ash 1 American elm 1 balsam poplar 1

### Common Understory Species

Shrubs: Rubus pubescens, Acer spicatum, balsam fir, Ribes triste, Prunus virginiana, Cornus

stolonifera, Alnus rugosa, Corylus cornuta, Rubus idaeus

Herbs: Viola spp., Mitella nuda, Athyrium filix-femina, Galium triflorum, Maianthemum

canadense, Dryopteris austriaca, Circaea alpina, Streptopus roseus, Aralia nudicaulis,

Aster macrophyllus, Trientalis borealis, Equisetum sylvaticum

Mosses: Plagiomnium cuspidatum, Climacium dendroides

Forest Floor Cover

Broadleaf litter: 39 Moss: 20 Humus: 12 Water: 11 Graminoid litter: 11 Wood: 6

Soil / Site Characteristics

Soil Groups:  $(dp m)^5$ ,  $(dp d-f)^2$ ,  $(w org)^2$ ,  $(w org/R)^1$ 

Thickness of Organic Layer: [LFH] - (6-15)4, (0)1, (1-5)1, (16-25)1

[O]  $-(\ge 40)^3$ ,  $(16-25)^1$ ,  $(26-39)^1$ 

Surface Texture: clayey 3, c. loamy 3, organic 3, silty 1, f. loamy 1

C Texture (when present): clayey 6, c. loamy 3, silty 1, f. sandy 1

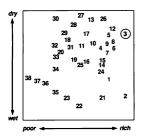
Moisture Regime / Drainage: moist 5, wet 3, fresh 2 / poor 5, v. poor 2, well 2

Mode of Deposition: lacustrine 4, organic 3, morainal 1, fluvial 1, glaciofluvial 1

**Comments:** Typically, throughout NW Ontario, black ash is the main tree species of this V-Type, often occurring in pure stands. In the Quetico / Rainy River area, however, V2 also contains stands in which black ash is a minor tree layer component associated with trembling aspen. Graminoids, especially *Calamagrostis canadensis* and *Carex* spp., can be abundant in the herb layer. V2 stands often occur on organic substrates.

### Other Hardwoods and Mixedwoods

**General Description** (n=6): Hardwood and mixedwood stands dominated by species other than aspen/poplar, white birch or black ash. These stands are, in general, confined to the Quetico / Rainy River area where they are infrequent and of limited areal extent. On a range of site and soil conditions.





### Overstory Species

black ash <sup>5</sup> red ash <sup>3</sup> bur oak <sup>3</sup> red maple <sup>2</sup> yellow birch <sup>2</sup> basswood <sup>2</sup> white cedar <sup>2</sup> white spruce <sup>2</sup> Manitoba maple <sup>2</sup>

### Common Understory Species

Shrubs: Prunus virginiana, Acer spicatum, Corylus cornuta, Rubus pubescens, Ribes hirtellum,

Amelanchier spp., Lonicera canadensis, L. dioica, Rhus radicans

Herbs: Streptopus roseus, Galium triflorum, Carex pedunculata, Dryopteris austriaca,

Maianthemum canadense, Aralia nudicaulis, Cinna latifolia

#### Forest Floor Cover

Broadleaf litter: 84 Conifer litter: 5 Moss: 5

#### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^3$ ,  $(dp m)^3$ ,  $(mod dp)^2$ ,  $(v shal)^2$ 

Thickness of Organic Layer: [LFH] - (1-5)<sup>5</sup>, (6-15)<sup>3</sup>, (0)<sup>2</sup>

Surface Texture: c. loamy<sup>5</sup>, c. sandy<sup>2</sup>, silty<sup>2</sup>, clayey<sup>2</sup>

C Texture (when present): c. loamy<sup>2</sup>, silty<sup>2</sup>, f. loamy<sup>2</sup>, clayey<sup>2</sup>

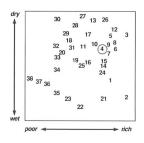
Moisture Regime / Drainage: fresh<sup>7</sup>, moist<sup>3</sup> / poor<sup>7</sup>, well<sup>2</sup>, rapid<sup>2</sup>

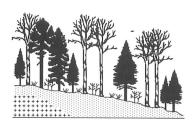
Mode of Deposition: fluvial<sup>3</sup>, glaciofluvial<sup>3</sup>, lacustrine<sup>3</sup>

**Comments:** There is no general stand concept for V3. Stands keying to this Type encompass a wide range of both vegetation and soil / site conditions. On dry, upland sites bur oak or red maple may be encountered. On low, moist, rich sites elm, basswood, yellow birch, Manitoba maple or red ash can be locally abundant, often in association with black ash.

### White Birch Hardwood and Mixedwood

**General Description** (n=73): Hardwood and mixedwood stands in which white birch is, typically, the only hardwood species in the overstory. These stands are generally herb and shrub rich although poor understory development can be encountered. Occurring generally on fresh to moist, coarse-textured, non-calcareous mineral soils.





### Overstory Species

white birch <sup>10</sup> balsam fir <sup>4</sup> white spruce <sup>4</sup> black spruce <sup>3</sup> jack pine <sup>3</sup> trembling aspen <sup>1</sup>

### Common Understory Species

Shrubs: balsam fir, Acer spicatum, Sorbus decora, Diervilla Ionicera, Amelanchier spp., Linnaea

borealis, Vaccinium angustifolium, V. myrtilloides

Herbs: Clintonia borealis, Cornus canadensis, Maianthemum canadense, Aralia nudicaulis,

Trientalis borealis, Streptopus roseus, Aster macrophyllus, Lycopodium annotinum,

Viola spp.

Mosses: Pleurozium schreberi, Ptilium crista-castrensis, Dicranum polysetum

### Forest Floor Cover

Broadleaf litter: 73 Moss: 13 Wood: 5 Conifer litter: 5

#### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^5$ ,  $(mod dp)^3$ ,  $(dp m)^2$ ,  $(v shal)^1$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>2</sup>, (16-25)<sup>1</sup>

Surface Texture: c. loamy <sup>6</sup>, f. sandy <sup>2</sup>, c. sandy <sup>1</sup>, silty <sup>1</sup> c. loamy <sup>5</sup>, f. sandy <sup>2</sup>, c. sandy <sup>2</sup>, silty <sup>1</sup>

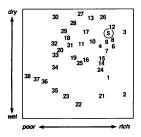
Moisture Regime / Drainage: fresh <sup>6</sup>, moist <sup>3</sup>, dry <sup>1</sup> / rapid <sup>4</sup>, well <sup>4</sup>, poor <sup>2</sup>

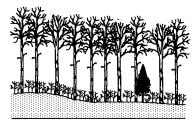
Mode of Deposition: morainal 5, glaciofluvial 3, lacustrine 2

**Comments:** V4 is most common near Lake Superior in the Marathon / White River area. In the NW Region, stands of this Type tend to be similar to those of V10 due to prevalence of jack pine and black spruce as canopy associates of white birch. In the NC Region, balsam fir is the most common conifer species, both in the tree and shrub layers; V4 stands from this Region more closely resemble those of V6, V7, V8 and V9. Rarely, V4 occurs on very shallow bedrock sites; these stands may resemble those of V30.

# Aspen Hardwood

**General Description** (n=79): Hardwood stands containing trembling and/or large-toothed aspen (usually trembling aspen). The understory is characteristically herb and shrub rich. Occurring mostly on deep, fresh, upland mineral soils.





### Overstory Species

trembling aspen <sup>9</sup> white birch <sup>5</sup> large-toothed aspen <sup>1</sup> red maple <sup>1</sup>

### Common Understory Species

Shrubs: Diervilla Ionicera, Corylus cornuta, Rubus pubescens, Acer spicatum, balsam fir,

trembling aspen, Amelanchier spp., Rosa acicularis, Alnus crispa

Herbs: Aralia nudicaulis, Maianthemum canadense, Streptopus roseus, Aster macrophyllus,

Clintonia borealis, Cornus canadensis, Trientalis borealis, Viola spp., Galium triflorum

Mosses: Pleurozium schreberi, Plagiomnium cuspidatum

#### Forest Floor Cover

Broadleaf litter: 87 Wood: 6

### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^7$ ,  $(dp m)^2$ ,  $(mod dp)^1$ Thickness of Organic Layer:  $[LFH] - (6-15)^6$ ,  $(1-5)^4$ 

Surface Texture: c. loamy <sup>4</sup>, f. sandy <sup>2</sup>, clayey <sup>2</sup>, silty <sup>1</sup>, f. loamy <sup>1</sup>

C Texture (when present): c. loamy <sup>3</sup>, f. sandy <sup>2</sup>, clayey <sup>2</sup>, silty <sup>1</sup>, c. sandy <sup>1</sup>

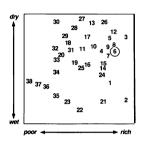
Moisture Regime / Drainage: fresh <sup>7</sup>, moist <sup>2</sup>, dry <sup>1</sup> / well <sup>5</sup>, rapid <sup>3</sup>, poor <sup>2</sup>

Mode of Deposition: morainal <sup>4</sup>, lacustrine <sup>3</sup>, glaciofluvial <sup>2</sup>, fluvial <sup>1</sup>

**Comments:** Several variants of V5, primarily differing in overstory composition, can be encountered in NW Ontario. The most common and widespread conditions are stands of pure trembling aspen and of mixed trembling aspen / white birch. Stands dominated by large-toothed aspen occur in the Quetico / Rainy River area. *Acer spicatum* is often abundant in the NC Region; this condition occurs much less frequently in the NW Region. V5 often intergrades with the V6-V11 hardwood mixedwoods.

# Trembling Aspen (White Birch) - Balsam Fir / Mountain Maple

**General Description** (n=68): Hardwood mixedwood stands with balsam fir as the main conifer tree species. The canopy is typically diffuse and two-tiered with aspen or aspen-birch in the overstory and balsam fir constituting a secondary stratum. The understory is generally herb and shrub rich with *Acer spicatum*, *Aralia nudicaulis* and *Aster macrophyllus* often abundant. Occurring mainly on deep, fresh, well to rapidly drained, upland mineral soils.





### Overstory Species

balsam fir <sup>10</sup> trembling aspen <sup>10</sup> white birch <sup>7</sup> white spruce <sup>3</sup> black spruce <sup>2</sup> jack pine <sup>1</sup>

### Common Understory Species

Shrubs: balsam fir, Acer spicatum, Rubus pubescens, trembling aspen, Diervilla lonicera, Corvlus cornuta, Linnaea borealis. Lonicera canadensis. Sorbus decora, Rosa acicularis

Herbs: Aralia nudicaulis, Streptopus roseus, Maianthemum canadense, Cornus canadensis, Clintonia borealis, Aster macrophyllus, Viola renifolia, Trientalis borealis, Galium

triflorum, Mitella nuda, Anemone quinquefolia

Mosses: Pleurozium schreberi, Plagiomnium cuspidatum, Rhytidiadelphus triquetrus, Ptilium

crista-castrensis

#### Forest Floor Cover

Broadleaf litter: 81 Moss: 7 Wood: 7

#### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^8$ ,  $(dp m)^1$ ,  $(mod dp)^1$ 

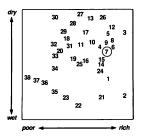
Thickness of Organic Layer: [LFH] - (6-15)<sup>6</sup>, (1-5)<sup>3</sup>, (16-25)<sup>1</sup>

Surface Texture: c. loamy <sup>4</sup>, silty <sup>2</sup>, f. sandy <sup>2</sup>, clayey <sup>1</sup>, f. loamy <sup>1</sup>
C Texture (when present): c.loamy <sup>4</sup>, f. sandy <sup>2</sup>, silty <sup>2</sup>, clayey <sup>1</sup>, c. sandy <sup>1</sup>
Moisture Regime / Drainage: fresh <sup>8</sup>, dry <sup>1</sup>, moist <sup>1</sup> / well <sup>5</sup>, rapid <sup>4</sup>, poor <sup>1</sup>
Mode of Deposition: morainal <sup>5</sup>, lacustrine <sup>2</sup>, glaciofluvial <sup>2</sup>, fluvial <sup>1</sup>

**Comments:** Some stands may key to this Type solely as a result of herb richness (*Astemac* ≥ 10%). Balsam fir is frequently abundant in the shrub layer. V6 differs from V7, and is similar to V8, primarily on the basis of *Acer spicatum* abundance. V6 occurs more frequently in the NC Region than in the NW.

# Trembling Aspen - Balsam Fir / Balsam Fir Shrub

**General Description** (n=49): Hardwood mixedwoods, typically with a two-tiered canopy. In general, trembling aspen constitutes the overstory with balsam fir in the secondary canopy. Understory development is variable with balsam fir, *Aralia nudicaulis* and *Diervilla lonicera* often abundant. Occurring mainly on deep, fresh, well-drained, fine-textured mineral soils.





### Overstory Species

balsam fir 10 trembling aspen 10 white birch 5 white spruce 3 black spruce 2 jack pine 1

### Common Understory Species

Shrubs: balsam fir, Rubus pubescens, Diervilla lonicera, Acer spicatum, Rosa acicularis,

trembling aspen, Corylus cornuta, Linnaea borealis, Sorbus decora

Herbs: Maianthemum canadense, Aralia nudicaulis, Cornus canadensis, Clintonia borealis,

Aster macrophyllus, Streptopus roseus, Trientalis borealis, Viola renifolia, Mitella nuda,

Petasites palmatus, Anemone quinquefolia, Galium triflorum

Mosses: Pleurozium schreberi, Rhytidiadelphus triquetrus

### Forest Floor Cover

Broadleaf litter: 81 Moss: 7 Conifer litter: 6 Wood: 5

#### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^7$ ,  $(dp m)^2$ ,  $(mod dp)^1$ Thickness of Organic Layer: [LFH] -  $(6-15)^8$ ,  $(1-5)^2$ 

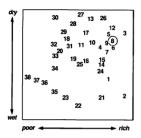
Surface Texture: c. loamy <sup>3</sup>, clayey <sup>3</sup>, f. loamy <sup>1</sup>, silty <sup>1</sup>, f. sandy <sup>1</sup>, c. sandy <sup>1</sup> clayey <sup>5</sup>, f. sandy <sup>1</sup>, c. sandy <sup>1</sup>, c. loamy <sup>1</sup>, f. loamy <sup>1</sup>

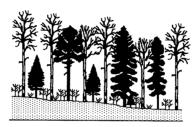
Moisture Regime / Drainage: fresh 7, moist 2, dry 1 / well 5, poor 3, rapid 2
Mode of Deposition: lacustrine 6, morainal 3, glaciofluvial 1

**Comments:** Stands of V7 tend to contain a diversity of species in the herb and shrub strata. They generally lack dense cover by broadleaved tall shrubs although *Corylus cornuta* and *Alnus crispa* can occasionally be abundant. On average, crown closure by balsam fir is somewhat greater than in V6. Relative to stands of V6, those of V7 occur more frequently on fine-textured, calcareous, lacustrine deposits.

# Trembling Aspen (White Birch) / Mountain Maple

**General Description** (n=49): Hardwood mixedwood stands with an abundance of broadleaved herbs and shrubs in the understory. Dense thickets of *Acer spicatum* are characteristic. Occurring mainly on deep, fresh to dry, well to rapidly drained mineral soils.





### Overstory Species

trembling aspen 10 white birch 6 white spruce 5 black spruce 5 jack pine 4 balsam fir 3

### Common Understory Species

Shrubs: Acer spicatum, Rubus pubescens, balsam fir, Corylus cornuta, Diervilla lonicera,

trembling aspen, Rosa acicularis, Amelanchier spp., Linnaea borealis, Sorbus decora,

Lonicera canadensis

Herbs: Aralia nudicaulis, Streptopus roseus, Clintonia borealis, Maianthemum canadense, Aster

macrophyllus, Trientalis borealis, Cornus canadensis, Viola renifolia, Galium triflorum,

Lycopodium clavatum, Mitella nuda, Coptis trifolia

Mosses: Pleurozium schreberi, Ptilium crista-castrensis, Rhytidiadelphus triquetrus, Plagiomnium

cuspidatum

#### Forest Floor Cover

Broadleaf litter: 84 Moss: 7 Wood: 5

#### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^7$ ,  $(mod dp)^1$ ,  $(dp m)^1$ 

Thickness of Organic Layer: [LFH] - (6-15)8, (1-5)2

Surface Texture: c. loamy<sup>5</sup>, silty<sup>2</sup>, f. sandy<sup>1</sup>, c. sandy<sup>1</sup>, clayey<sup>1</sup>

C Texture (when present): c. loamy 3, c. sandy 2, f. sandy 2, silty 2, clayey 1, f. loamy 1

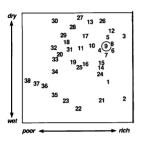
Moisture Regime / Drainage: fresh 7, dry 2, moist 2 / well 5, rapid 4, poor 1

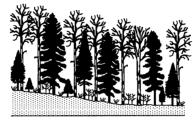
Mode of Deposition: morainal 5, glaciofluvial 3, lacustrine 2

**Comments:** Within NW Ontario, V8 is most common in the Central Plateau section of the NC Region; it is found infrequently in the NW Region. Stands of this Type are ecologically similar to those of V5, V6 and V9. V8 stands are distinguished from those of V5 and V6 on the basis of overstory composition; higher abundance of *Acer spicatum* separates them from stands of V9. Stands of V8 are often found on calcareous soils.

# Trembling Aspen Mixedwood

**General Description** (n=58): Hardwood mixedwoods with a shrub and herb rich understory. Typically, trembling aspen is the main tree species. *Corylus cornuta*, balsam fir, *Alnus crispa*, *Diervilla lonicera*, *Aralia nudicaulis* and *Aster macrophyllus* can be abundant in the understory. Occurring mainly on deep, fresh, well-drained mineral soils.





### Overstory Species

trembling aspen 10 white spruce 7 white birch 4 balsam fir 3 black spruce 3 jack pine 3 red maple 1

### Common Understory Species

Shrubs: Rubus pubescens, balsam fir, Diervilla lonicera, Corylus cornuta, Amelanchier spp.,

Rosa acicularis, trembling aspen, Linnaea borealis, Acer spicatum

Herbs: Maianthemum canadense, Cornus canadensis, Aralia nudicaulis, Aster macrophyllus,

Streptopus roseus, Clintonia borealis, Trientalis borealis, Galium triflorum, Mitella nuda,

Viola renifolia, Petasites palmatus, Anemone quinquefolia

Mosses: Pleurozium schreberi, Rhytidiadelphus triquetrus, Ptilium crista-castrensis, Plagiomnium

cuspidatum

#### Forest Floor Cover

Broadleaf litter: 84 Conifer litter: 5 Moss: 5

### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^7$ ,  $(dp m)^2$ ,  $(mod dp)^1$ Thickness of Organic Layer:  $[LFH] - (6-15)^7$ ,  $(1-5)^2$ ,  $(16-25)^1$ 

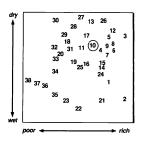
Surface Texture: c.loamy <sup>4</sup>, clayey <sup>3</sup>, f. sandy <sup>1</sup>, f. loamy <sup>1</sup>, silty <sup>1</sup>

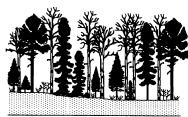
C.loamy <sup>4</sup>, clayey <sup>3</sup>, f. sandy <sup>1</sup>, f. loamy <sup>1</sup>, sitty <sup>1</sup>
Clayey <sup>4</sup>, c. loamy <sup>3</sup>, f.sandy <sup>1</sup>, f. loamy <sup>1</sup>, sitty <sup>1</sup>
Moisture Regime / Drainage: fresh <sup>7</sup>, moist <sup>2</sup>, dry <sup>1</sup> / well <sup>6</sup>, rapid <sup>2</sup>, poor <sup>2</sup>
Mode of Deposition: lacustrine <sup>4</sup>, morainal <sup>4</sup>, glaciofluvial <sup>1</sup>

**Comments:** Within NW Ontario, this Type is most common in the Central Plateau section of the NC Region. Stands of V9 are ecologically similar to those of V7, differing on the basis of overstory composition. *Acer spicatum* is less frequent and less abundant in the shrub layer than in V8 stands. Stands of V9 are commonly found on calcareous deposits; they occur more frequently on fine-textured soils than do those of V8.

# Trembling Aspen - Black Spruce - Jack Pine / Low Shrub

**General Description** (n=63): Hardwood mixedwoods with black spruce and jack pine as the primary conifer tree species. The herb and low shrub layers are usually rich in broadleaved species, often with abundances of *Diervilla lonicera* and *Aster macrophyllus*. Occurring mainly on deep, fresh, well to rapidly drained mineral soils.





### Overstory Species

trembling aspen <sup>10</sup> black spruce <sup>7</sup> jack pine <sup>7</sup> white birch <sup>5</sup> balsam fir <sup>3</sup> white spruce <sup>3</sup>

### Common Understory Species

Shrubs: Diervilla lonicera, Linnaea borealis, Rubus pubescens, balsam fir, Vaccinium

myrtilloides, V. angustifolium, trembling aspen, Rosa acicularis, Amelanchier spp., black

spruce, Alnus crispa, Sorbus decora

Herbs: Cornus canadensis, Maianthemum canadense, Aralia nudicaulis, Clintonia borealis,

Streptopus roseus, Aster macrophyllus, Trientalis borealis, Viola renifolia, Coptis

trifolia, Epilobium angustifolium, Lycopodium clavatum

Mosses: Pleurozium schreberi, Ptilium crista-castrensis, Dicranum polysetum

#### Forest Floor Cover

Broadleaf litter: 73 Moss: 10 Conifer litter: 10 Wood: 6

### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^6$ ,  $(dp m)^2$ ,  $(mod dp)^2$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>3</sup>

Surface Texture: c. loamy 5, c. sandy 2, f. sandy 1, silty 1, clayey 1

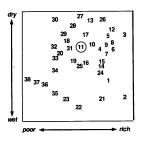
C Texture (when present): c. sandy 3, c. loamy 2, f. sandy 2, silty 1, f. loamy 1, clayey 1

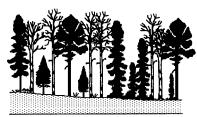
Moisture Regime / Drainage: fresh 6, dry 2, moist 2 / rapid 4, well 3, poor 3 Mode of Deposition: morainal 4, glaciofluvial 4, lacustrine 2

**Comments:** Within NW Ontario, this Type is most common in the Central Plateau section of the NC Region. Abundance of *Acer spicatum* and/or *Corylus cornuta*, typical of shrub layers in stands of V4, V5, V6, V8 and V9, is lacking in V10 stands. However, balsam fir, black spruce, *Alnus crispa* and, occasionally, *Alnus rugosa* can create dense tall shrub cover. Average abundance of ericaceous species is low relative to V11.

# Trembling Aspen - Conifer / Blueberry / Feathermoss

**General Description** (n=40): Hardwood mixedwood stands usually with black spruce or jack pine as the main conifer tree species. The understory is generally dominated by conifer and ericaceous shrubs. Large patches of feathermoss often occur on the forest floor. Found mainly on deep, dry to fresh, rapidly drained, coarse-textured mineral soils.





### Overstory Species

trembling aspen 10 black spruce 8 jack pine 6 white birch 6 white spruce 2 balsam fir 2

### Common Understory Species

Shrubs: Vaccinium myrtilloides, Linnaea borealis, black spruce, Gaultheria hispidula, trembling

aspen, balsam fir, Diervilla Ionicera, Vaccinium angustifolium, Ledum groenlandicum,

 $A melanchier\ spp.$ 

Herbs: Maianthemum canadense, Cornus canadensis, Aralia nudicaulis, Trientalis borealis,

Clintonia borealis, Coptis trifolia, Viola renifolia, Lycopodium clavatum, L. annotinum

Mosses: Pleurozium schreberi, Dicranum polysetum, Ptilium crista-castrensis, Hylocomium

 $splendens,\,Rhytidia delphus\,\,triquetrus$ 

Lichens: Cladina rangiferina

### Forest Floor Cover

Broadleaf litter: 43 Moss: 44 Conifer litter: 6 Wood: 5

### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^6$ ,  $(dp m)^2$ ,  $(mod dp)^2$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>2</sup>, (16-25)<sup>1</sup>

Surface Texture: c. loamy <sup>4</sup>, f. sandy <sup>3</sup>, silty <sup>2</sup>, c. sandy <sup>1</sup>, clayey <sup>1</sup>

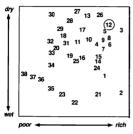
C Texture (when present): c. loamy <sup>3</sup>, f. sandy <sup>3</sup>, c. sandy <sup>3</sup>, c. sandy <sup>3</sup>

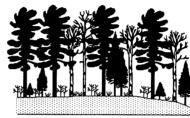
Moisture Regime / Drainage: fresh<sup>6</sup>, dry<sup>3</sup>, moist<sup>2</sup> / rapid<sup>5</sup>, well<sup>3</sup>, poor<sup>2</sup>
Mode of Deposition: glaciofluvial<sup>5</sup>, morainal<sup>4</sup>, lacustrine<sup>1</sup>

**Comments:** Within NW Ontario, V11 is most common in the Central Plateau section of the NC Region. Canopy closure by hardwood species is often lower than in stands of other hardwood mixedwood V-Types. *Alnus crispa*, *Diervilla lonicera*, *Aralia nudicaulis* and *Cornus canadensis* will occasionally occur in abundance; under such conditions feathermoss cover can be low and these stands may resemble those of V10.

### White Pine Mixedwood

**General Description** (n=28): Mixedwood stands, often with a tall overstory of white pine and a secondary canopy of other tree species. The understory is typically shrub and herb rich. Occurring on deep, fresh, non-calcareous, coarse-textured, upland mineral sites.





### Overstory Species

white pine <sup>10</sup>
white birch <sup>8</sup>
trembling aspen <sup>5</sup>
balsam fir <sup>5</sup>
white spruce <sup>4</sup>
red pine <sup>3</sup>
white cedar <sup>2</sup>
black spruce <sup>1</sup>
large-toothed aspen <sup>1</sup>
jack pine <sup>1</sup>
red maple <sup>1</sup>

### Common Understory Species

Shrubs: balsam fir, Corylus cornuta, Acer spicatum, Linnaea borealis, Amelanchier spp., Lonicera

canadensis, Diervilla lonicera, trembling aspen

Herbs: Aralia nudicaulis, Maianthemum canadense, Aster macrophyllus, Cornus canadensis,

Trientalis borealis, Clintonia borealis, Streptopus roseus, Oryzopsis asperifolia

Mosses: Pleurozium schreberi, Dicranum polysetum

#### Forest Floor Cover

Conifer litter: 50 Broadleaf litter: 40

#### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^7$ ,  $(mod dp)^2$ ,  $(dp m)^1$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>3</sup>

Surface Texture: c. loamy <sup>6</sup>, silty <sup>2</sup>, f. loamy <sup>1</sup>, f. sandy <sup>1</sup>
C Texture (when present): c. loamy <sup>5</sup>, f. sandy <sup>2</sup>, c. sandy <sup>1</sup>, clayey <sup>1</sup>

Moisture Regime / Drainage: fresh 7, moist 2, dry 1 / rapid 6, well 2, poor 2

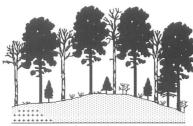
Mode of Deposition: morainal <sup>6</sup>, glaciofluvial <sup>3</sup>, lacustrine <sup>1</sup>

**Comments:** V12 is most common in the Thunder Bay / Quetico / Rainy River area of NW Ontario. This Type includes both hardwood and conifer dominated mixedwoods, although most stands represent the latter condition. In the NW Region, dense shrub layers are usually attributable to *Corylus cornuta* and balsam fir; in the NC Region, *Acer spicatum* tends to co-occur with these species. Red maple and *Cornus rugosa* can also be abundant in the understory. Stands of V12 tend to have denser canopy closures and greater understory development than do those of V13.

### Red Pine Mixedwood

**General Description** (n=34): Mixedwood stands comprising mainly red pine in the conifer component of the overstory. Conditions in the understory range from densely herb and shrub rich to open and sparse. Large patches of feathermoss can develop on the forest floor. Occurring on dry to fresh, rapidly drained, non-calcareous, coarse-textured mineral soils.





### Overstory Species

red pine <sup>10</sup>
white birch <sup>7</sup>
trembling aspen <sup>5</sup>
white pine <sup>4</sup>
jack pine <sup>3</sup>
balsam fir <sup>3</sup>
large-toothed aspen <sup>2</sup>
black spruce <sup>1</sup>
white spruce <sup>1</sup>

### Common Understory Species

Shrubs: Diervilla Ionicera, balsam fir, Vaccinium angustifolium, Linnaea borealis, Corylus

cornuta, Amelanchier spp., Vaccinium myrtilloides, Acer spicatum, Lonicera canadensis,

trembling aspen

Herbs: Maianthemum canadense, Aralia nudicaulis, Cornus canadensis, Clintonia borealis,

Aster macrophyllus

Mosses: Pleurozium schreberi, Dicranum polysetum

### Forest Floor Cover

Conifer litter: 47 Broadleaf litter: 33 Moss: 14

### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^7$ ,  $(mod dp)^3$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>8</sup>, (1-5)<sup>2</sup>
Surface Texture: c. loamy <sup>7</sup>, c. sandy <sup>1</sup>, f. sandy <sup>1</sup>, silty <sup>1</sup>

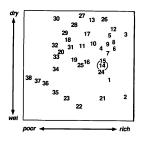
C Texture (when present): c. sandy <sup>6</sup>, c. loamy <sup>2</sup>, f. sandy <sup>1</sup>
Moisture Regime / Drainage: fresh <sup>5</sup>, dry <sup>5</sup> / rapid <sup>7</sup>, well <sup>3</sup>

Mode of Deposition: morainal <sup>6</sup>, glaciofluvial <sup>4</sup>, lacustrine <sup>1</sup>

Comments: This Type is most common in the Quetico / Rainy River / Dryden area of NW Ontario. V13 includes both hardwood and conifer dominated mixedwoods although the latter condition is prevalent. Both the overstory and the understory tend to be more open than in stands of V12. Balsam fir, red maple, Diervilla lonicera, Corylus cornuta, Acer spicatum and Alnus crispa can be abundant in the shrub layer. Herb cover is often very sparse, although Aster macrophyllus and Aralia nudicaulis can form dense patches.

### Balsam Fir Mixedwood

**General Description** (n=57): An extremely variable mixedwood Type. The canopy, comprising mainly balsam fir, may contain a mixture of several species. The understory varies from shrub rich to moderately herb and shrub poor. Usually on deep, fresh to moist, mineral soils but encompassing a wide range of soil and site conditions.





### Overstory Species

balsam fir <sup>10</sup> trembling aspen <sup>7</sup> white birch <sup>6</sup> white spruce <sup>5</sup> black spruce <sup>4</sup> jack pine <sup>2</sup> balsam poplar <sup>1</sup> white cedar <sup>1</sup>

### Common Understory Species

Shrubs: balsam fir, Acer spicatum, Rubus pubescens, Linnaea borealis, Diervilla lonicera, Sorbus

decora, trembling aspen, Corylus cornuta, Amelanchier spp., Rosa acicularis

Herbs: Maianthemum canadense, Aralia nudicaulis, Clintonia borealis, Streptopus roseus, Comus canadensis, Trientalis borealis, Viola renifolia, Mitella nuda, Aster macrophyllus,

Galium triflorum, Coptis trifolia, Petasites palmatus, Anemone quinquefolia

Mosses: Pleurozium schreberi, Ptilium crista-castrensis, Hylocomium splendens, Plagiomnium

cuspidatum

### Forest Floor Cover

Broadleaf litter: 66 Conifer litter: 14 Moss: 12 Wood: 6

### Soil / Site Characteristics

Soil Groups: (dp d-f) 6, (dp m) 3, (mod dp) 1
Thickness of Organic Layer: [LFH] - (6-15) 8, (1-5) 1, (16-25) 1

Surface Texture: c. loamy 4, silty 2, clayey 1, f. sandy 1, f. loamy 1

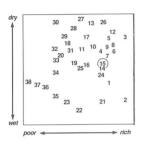
C Texture (when present): c. loamy 2, clayey 2, f. sandy 2, silty 2, c. sandy 1, f. loamy 1

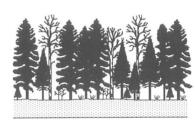
Moisture Regime / Drainage: fresh 5, moist 3, dry 2 / well 4, poor 4, rapid 3
Mode of Deposition: lacustrine 4, morainal 3, glaciofluvial 2

**Comments:** Variable both in overstory composition and understory development, this Type is often characterized by uneven-aged stands with relatively closed canopies. Understory richness, when present, is usually attributable to a combination of balsam fir, *Acer spicatum, Corylus cornuta*, *Aralia nudicaulis, Diervilla lonicera* and *Aster macrophyllus. Lycopodium annotinum* and various fern species can occasionally be abundant. Stands of V14 and V15 are very similar in general stand structure and species composition, differing in the relative overstory abundance of balsam fir and white spruce. Balsam fir stands with a large cover of *Sphagnum* spp., *Rhytidiadelphus triquetrus* or *Brachythecium* spp. on the forest floor may key to V14; some of these may better fit the V16 Type description.

# White Spruce Mixedwood

**General Description** (n=34): A variable mixedwood Type with white spruce as the main canopy species. The understory ranges from herb and shrub rich to poor, with balsam fir commonly abundant in the shrub layer. Occurring over a broad range of soil and site conditions but primarily on deep, fresh to moist, mineral soils.





### Overstory Species

white spruce <sup>10</sup> balsam fir <sup>7</sup> trembling aspen <sup>6</sup> white birch <sup>5</sup> black spruce <sup>4</sup> balsam poplar <sup>1</sup> red maple <sup>1</sup> jack pine <sup>1</sup>

### Common Understory Species

Shrubs: balsam fir, Acer spicatum, Rubus pubescens, Corylus cornuta, Sorbus decora, Linnaea

borealis, Diervilla lonicera, Rosa acicularis, Amelanchier spp., trembling aspen

Herbs: Aralia nudicaulis, Cornus canadensis, Clintonia borealis, Maianthemum canadense,

Streptopus roseus, Trientalis borealis, Galium triflorum, Aster macrophyllus, Mitella

nuda, Viola renifolia, Anemone quinquefolia, Petasites palmatus

Mosses: Pleurozium schreberi, Ptilium crista-castrensis, Rhytidiadelphus triquetrus, Plagiomnium

cuspidatum

Forest Floor Cover

Broadleaf litter: 61 Moss: 16 Conifer litter: 13 Wood: 5

Soil / Site Characteristics

Soil Groups:  $(dp d-f)^7$ ,  $(dp m)^1$ ,  $(mod dp)^1$ 

Thickness of Organic Layer: [LFH] - (6-15)9

Surface Texture: c. loamy 4, clayey 2, silty 2, f. loamy 2

C Texture (when present): clayey 4, c. loamy 2, silty 1, f. loamy 1, f. sandy 1, c. sandy 1

Moisture Regime / Drainage: fresh 7, moist 2, dry 1 / well 5, rapid 2, poor 2

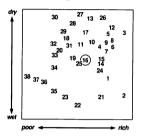
Mode of Deposition: fresh 7, moist 2, dry 1 / well 5, rapid 2, poor 2

morainal 5, lacustrine 4, glaciofluvial 1

**Comments:** Stands of V15 and V14 are very similar in general stand structure and species composition, differing in the relative overstory abundance of balsam fir and white spruce. As for V14, this Type largely comprises uneven-aged stands with fairly dense canopies. The understory can have dense patches of balsam fir, *Acer spicatum, Corylus cornuta, Aralia nudicaulis, Diervilla lonicera, Aster macrophyllus* and, on moist sites, *Anus rugosa*. Stands with extensive ground cover of *Rhytidiadelphus triquetrus, Brachythecium* spp. or *Sphagnum* spp. may key to this Type; some of these may better fit the V16 Type description. Stands of V15 occur commonly on calcareous soils; those of V14 do so infrequently. Stands of V14 and V15 are ecologically similar to those of V24, differing in overstory hardwood component.

# Balsam Fir - White Spruce Mixedwood / Feathermoss

**General Description** (n=43): A variable mixedwood Type with balsam fir and/or white spruce as the main tree species. The understory generally lacks an abundance of broadleaved species but balsam fir can occur in dense thickets. Extensive feathermoss mats cover the forest floor. Occurring on a broad range of soil and site conditions but primarily on fresh to moist, upland mineral soils.





### Overstory Species

balsam fir <sup>8</sup> white spruce <sup>7</sup> white birch <sup>7</sup> black spruce <sup>6</sup> trembling aspen <sup>6</sup> jack pine <sup>4</sup>

### Common Understory Species

Shrubs: balsam fir, Linnaea borealis, Diervilla lonicera, Vaccinium myrtilloides, Sorbus decora, Acer spicatum, Rubus pubescens, Picea mariana, Rosa acicularis, Gaultheria hispidula

Herbs: Cornus canadensis, Clintonia borealis, Aralia nudicaulis, Maianthemum canadense, Trientalis borealis, Streptopus roseus, Coptis trifolia, Lycopodium annotinum, Viola renifolia

Cilitolia

Mosses: Pleurozium schreberi, Ptilium crista-castrensis, Dicranum polysetum, Hylocomium splendens, Dicranum fuscescens, Rhytidiadelphus triquetrus

#### Forest Floor Cover

Moss: 64 Broadleaf litter: 19 Conifer litter: 11 Wood: 5

### Soil / Site Characteristics

Soil Groups: (dp d-f)<sup>4</sup>, (dp m)<sup>3</sup>, (mod dp)<sup>3</sup>
Thickness of Organic Layer: [LFH] - (6-15)<sup>8</sup>, (1-5)<sup>1</sup>, (16-25)<sup>1</sup>

Surface Texture: c. loamy 5, c. sandy 2, silty 1, f. sandy 1, f. loamy 1

C Texture (when present): c. loamy 3, c. sandy 3, silty 2, f. sandy 1, f. loamy 1, clayey 1

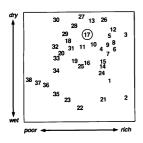
Moisture Regime / Drainage: fresh 5, moist 3, dry 2 / rapid 5, poor 3, well 2

Mode of Deposition: glaciofluvial 4, morainal 3, lacustrine 3

**Comments:** Relative to those of V14, V15 and V24, stands of V16 are generally characterized by a greater feathermoss ground cover and lower abundances of shrub and herb species like *Acer spicatum*, *Corylus cornuta*, *Aralia nudicaulis*, *Diervilla lonicera* and *Aster macrophyllus*. Canopy closure by hardwood tree species tends to be lower than in stands of V14 and V15. Stands of this Type can be similar to, or intergrade with, those of V25 or V19. Occasionally, Sphagnum dominated ground cover will be encountered on moister sites.

## Jack Pine Mixedwood / Shrub Rich

**General Description** (n=76): Jack pine mixedwoods with spruce and fir occasional in the canopy. The understory is typically rich in herb and low shrub species, often with abundances of *Diervilla lonicera*, *Aralia nudicaulis*, *Aster macrophyllus* and *Cornus canadensis*. Occurring on upland, fresh to dry, coarse-textured mineral soils.





### Overstory Species

jack pine 10 trembling aspen 7 white birch 5 black spruce 4 balsam fir 2 white spruce 1

### Common Understory Species

Shrubs: Diervilla lonicera, Linnaea borealis, balsam fir, Vaccinium angustifolium, Corylus

cornuta, Vaccinium myrtilloides, trembling aspen, Rubus pubescens, Amelanchier spp.,

Alnus crispa, black spruce, Rosa acicularis

Herbs: Aralia nudicaulis, Maianthemum canadense, Clintonia borealis, Cornus canadensis,

Aster macrophyllus, Trientalis borealis, Streptopus roseus, Viola spp.

Mosses: Pleurozium schreberi, Dicranum polysetum, Ptilium crista-castrensis

#### Forest Floor Cover

Broadleaf litter: 36 Conifer litter: 32 Moss: 27

#### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^7$ ,  $(mod dp)^2$ ,  $(dp m)^1$ 

Thickness of Organic Layer: [LFH] - (6-15)6, (1-5)4

Surface Texture: c. loamy 5, f. sandy 2, c. sandy 1, silty 1

C Texture (when present): c. loamy <sup>3</sup>, c. sandy <sup>3</sup>, f. sandy <sup>2</sup>, clayey <sup>1</sup>, silty <sup>1</sup>

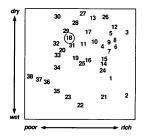
Moisture Regime / Drainage: fresh <sup>6</sup>, dry <sup>3</sup>, moist <sup>1</sup> / rapid <sup>6</sup>, well <sup>3</sup>, poor <sup>1</sup>

Mode of Deposition: morainal <sup>6</sup>, glaciofluvial <sup>3</sup>, lacustrine <sup>1</sup>

**Comments:** Development in the tall shrub layer ranges from open to very dense. *Corylus cornuta*, balsam fir, *Alnus crispa* and, especially in the NC Region, *Acer spicatum* can be abundant. Cover of feathermoss on the forest floor can exceed 20%. Rarely, Sphagnum rich stands may key to V17; these are usually on moist sites with fine-textured soils and may better fit the V18 Type description.

# Jack Pine Mixedwood / Feathermoss

**General Description** (n=80): Jack pine mixedwoods, often with black spruce in the overstory. Relative to other mixedwood V-Types, the understory tends to be herb and shrub poor. Feathermoss ground cover is extensive. Occurring on upland, fresh to dry, coarse-textured mineral soils.





### Overstory Species

jack pine 10 black spruce 7 trembling aspen 7 white birch 6 balsam fir 2 white spruce 1

### Common Understory Species

Shrubs: Linnaea borealis, Vaccinium myrtilloides, black spruce, Diervilla Ionicera, balsam fir,

Vaccinium angustifolium, Gaultheria hispidula, trembling aspen, Rosa acicularis

Herbs: Maianthemum canadense, Cornus canadensis, Aralia nudicaulis, Clintonia borealis,

Trientalis borealis

Mosses: Pleurozium schreberi, Dicranum polysetum, Ptilium crista-castrensis, Hylocomium

splendens

Lichens: Cladina rangiferina

#### Forest Floor Cover

Moss: 65 Broadleaf litter: 14 Conifer litter: 13 Wood: 6

### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^7$ ,  $(mod dp)^2$ ,  $(dp m)^1$ 

Thickness of Organic Layer: [LFH] - (6-15)8, (1-5)2

Surface Texture: c. loamy<sup>3</sup>, c. sandy<sup>3</sup>, f. sandy<sup>2</sup>, silty<sup>1</sup>, clayey<sup>1</sup>

C Texture (when present): c. sandy <sup>4</sup>, f. sandy <sup>3</sup>, c. loamy <sup>2</sup>, silty <sup>1</sup>

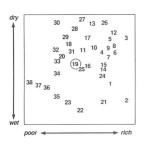
Moisture Regime / Drainage: fresh <sup>6</sup>, dry <sup>3</sup>, moist <sup>1</sup> / rapid <sup>6</sup>, well <sup>3</sup>, poor <sup>1</sup>

Mode of Deposition: glaciofluvial <sup>6</sup>, morainal <sup>4</sup>, lacustrine <sup>1</sup>

Comments: Diervilla lonicera, Cornus canadensis, Maianthemum canadense and Vaccinium spp. can be abundant in the herb / dwarf shrub stratum. Clumps of black spruce, Alnus crispa and balsam fir occasionally provide a significant tall shrub component; Acer spicatum and Corylus cornuta are typically absent. Rarely, jack pine stands with a predominantly Sphagnum moss cover will occur on moist, fine-textured soils; some of these may key to V17. Stands of V18 may intergrade with those of V31 and V32. Very poor stands which key to V18, especially those with ground lichen cover, may be comparable to those of V30.

# Black Spruce Mixedwood / Herb Rich

**General Description** (n=97): A black spruce mixedwood Type with several potential species in the overstory. The understory is typically dominated by a rich herb / dwarf shrub layer. The shrub stratum ranges from dense to open, usually with balsam fir and black spruce as important components. Forest floor cover varies from moss rich to mainly broadleaf litter. Occurring on a range of site conditions although mostly on fresh to moist, mineral soils.





### Overstory Species

black spruce <sup>10</sup> trembling aspen <sup>7</sup> jack pine <sup>4</sup> balsam fir <sup>4</sup> white birch <sup>3</sup> white spruce <sup>2</sup> balsam poplar <sup>1</sup>

### Common Understory Species

Shrubs: Linnaea borealis, balsam fir, Rubus pubescens, Vaccinium myrtilloides, black spruce,

Rosa acicularis, Amelanchier spp., Vaccinium angustifolium, Sorbus decora, Gaultheria

hispidula, Diervilla lonicera, Ledum groenlandicum, trembling aspen

Herbs: Cornus canadensis, Maianthemum canadense, Clintonia borealis, Trientalis borealis,

Aralia nudicaulis, Coptis trifolia, Petasites palmatus, Aster macrophyllus, Streptopus

roseus, Viola renifolia

Mosses: Pleurozium schreberi, Ptilium crista-castrensis, Dicranum polysetum, Hylocomium

splendens, Rhytidiadelphus triquetrus

### Forest Floor Cover

Moss: 49 Broadleaf litter: 33 Conifer litter: 12

### Soil / Site Characteristics

Soil Groups: (dp d-f)<sup>5</sup>, (dp m)<sup>3</sup>, (mod dp)<sup>1</sup>
Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>1</sup>, (16-25)<sup>1</sup>

Surface Texture: c. loamy <sup>4</sup>, clayey <sup>2</sup>, silty <sup>1</sup>, f. sandy <sup>1</sup>, c. sandy <sup>1</sup> c. loamy <sup>3</sup>, clayey <sup>2</sup>, silty <sup>2</sup>, f. sandy <sup>1</sup>, c. sandy <sup>1</sup>, f. loamy <sup>1</sup>

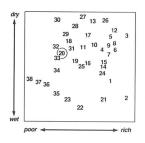
Moisture Regime / Drainage: fresh 6, moist 3, dry 1 / well 4, poor 4, rapid 2

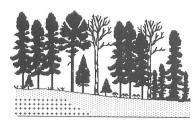
Mode of Deposition: lacustrine <sup>3</sup>, glaciofluvial <sup>3</sup>, morainal <sup>3</sup>

**Comments:** Within V19 stands, canopy closure can range from closed to relatively open. Stands with balsam fir in the overstory may be similar to those of V16 and V25. Although occasionally abundant, broadleaved shrubs are typically absent from the understory. Soil / site conditions range from fine-textured, lacustrine deposits to coarse-textured, morainal or glaciofluvial substrates. Stands of V19 occur commonly on calcareous soils, especially in the NC Region.

# Black Spruce Mixedwood / Feathermoss

**General Description** (n=74): Black spruce mixedwoods, commonly with white birch constituting the hardwood component of the canopy. The understory is typically dominated by low, ericaceous shrubs with scattered clumps of black spruce. Extensive, often continuous, feathermoss characterizes the forest floor cover. Occurring mainly on upland, fresh to dry, coarse-textured, mineral soils.





### Overstory Species

black spruce 10 white birch 7 jack pine 6 trembling aspen 3 balsam fir 1

### Common Understory Species

Shrubs: black spruce, Vaccinium myrtilloides, Gaultheria hispidula, Ledum groenlandicum,

Vaccinium angustifolium, Alnus crispa, Linnaea borealis

Herbs: Cornus canadensis, Maianthemum canadense

Mosses: Pleurozium schreberi, Dicranum polysetum, Ptilium crista-castrensis, Hylocomium

splendens

Lichens: Cladina rangiferina

### Forest Floor Cover

Moss: 82 Broadleaf litter: 7 Conifer litter: 5

### Soil / Site Characteristics

Soil Groups:  $(\text{mod dp})^4$ ,  $(\text{dp d-f})^3$ ,  $(\text{dp m})^1$ ,  $(\text{v shal})^1$ 

Thickness of Organic Layer: [LFH] - (6-15) <sup>7</sup>, (16-25) <sup>1</sup>, (1-5) <sup>1</sup>

Surface Texture: c. loamy <sup>5</sup>, f. sandy <sup>2</sup>, c. sandy <sup>1</sup>, silty <sup>1</sup>

C Texture (when present): c. loamy <sup>4</sup>, c. sandy <sup>3</sup>, f. sandy <sup>2</sup>, silty <sup>1</sup>

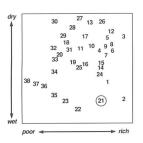
Moisture Regime / Drainage: fresh <sup>5</sup>, dry <sup>3</sup>, moist <sup>2</sup> / rapid <sup>4</sup>, well <sup>3</sup>, poor <sup>2</sup>

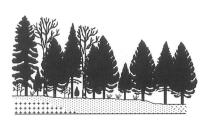
Mode of Deposition: morainal <sup>6</sup>, glaciofluvial <sup>3</sup>, lacustrine <sup>1</sup>

**Comments:** V20 is most common in the northern boreal areas of NW Ontario. *Alnus crispa* can be abundant in the shrub layer; *Sphagnum* spp. and *Cladina* spp. are common components of the ground cover. V20 stands often occur on shallow sandy soils over bedrock. Since the canopy tends to be open, with sparse hardwood cover, stands of V20 may intergrade with those of V32 and V33. Very poor stands, especially with ground lichen cover, may be comparable to those of V30.

# Cedar (inc. Mixedwood) / Mountain Maple

**General Description** (n=32): A diverse white cedar Type consisting of both conifer and mixedwood stands. Numerous species combinations are possible in the overstory. The shrub layer is usually dominated by balsam fir, white cedar and *Acer spicatum* but is rarely dense. Species diversity in the herb layer is often high. Occurring across a range of site and soil conditions from wet, organic lowlands to rich, fresh uplands.





### Overstory Species

white cedar <sup>10</sup> balsam fir <sup>5</sup> white birch <sup>4</sup> white spruce <sup>4</sup> trembling aspen <sup>3</sup> black spruce <sup>2</sup> balsam poplar <sup>1</sup> black ash <sup>1</sup>

### Common Understory Species

Shrubs: balsam fir, Acer spicatum, white cedar, Rubus pubescens, Linnaea borealis, Sorbus

decora, Lonicera canadensis, Ribes triste, Corylus cornuta

Herbs: Trientalis borealis, Viola renifolia, Mitella nuda, Aralia nudicaulis, Maianthemum

canadense, Clintonia borealis, Cornus canadensis, Streptopus roseus, Galium triflorum,

Aster macrophyllus, Gymnocarpium dryopteris

Mosses: Pleurozium schreberi, Rhytidiadelphus triquetrus, Hylocomium splendens, Ptilium

crista-castrensis, Plagiomnium cuspidatum, Drepanocladus uncinatus

#### Forest Floor Cover

Conifer litter: 42 Broadleaf litter: 30 Moss: 18 Wood: 5

### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^4$ ,  $(dp m)^2$ ,  $(mod dp)^2$ ,  $(w org)^1$ ,  $(v shal)^1$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>6</sup>, (16-25)<sup>1</sup>, (26-39)<sup>1</sup>

[O] - (≥40)<sup>1</sup>

Surface Texture: clayey <sup>3</sup>, silty <sup>2</sup>, c. loamy <sup>2</sup>, f. loamy <sup>2</sup>, organic <sup>1</sup>

C Texture (when present): clayey <sup>3</sup>, silty <sup>2</sup>, c. loamy <sup>2</sup>, f. loamy <sup>2</sup>, f. sandy <sup>1</sup>

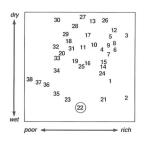
Moisture Regime / Drainage: fresh <sup>6</sup>, moist <sup>3</sup>, wet <sup>1</sup> / well <sup>5</sup>, poor <sup>2</sup>, v. poor <sup>1</sup>, rapid <sup>1</sup>

Mode of Deposition: morainal 4, lacustrine 3, fluvial 2, organic 1

**Comments:** Although V21 describes the upland cedar condition, many stands on wet, lowland sites will also key to this Type. White cedar often forms a dense secondary canopy, contributing to an open understory. Ericaceous species are sparse or lacking altogether. Forest floor cover tends to be dominated by conifer and/or broadleaf litter with patches of feathermoss. *Rhytidiadelphus triquetrus* is commonly associated with other feathermoss species on the forest floor; *Sphagnum* spp. are typically absent.

# Cedar (inc. Mixedwood) / Speckled Alder / Sphagnum

**General Description** (n=25): Lowland white cedar stands, including mixedwoods, often containing black spruce in the canopy. The shrub layer is generally dominated by balsam fir, white cedar, *Alnus rugosa* and *Ledum groenlandicum*. Moss cover, comprising both Sphagnum and feathermoss, forms the main ground layer. Occurring on wet, organic soils.





### Overstory Species

white cedar <sup>10</sup> black spruce <sup>7</sup> balsam fir <sup>4</sup> white birch <sup>2</sup> tamarack <sup>1</sup> white spruce <sup>1</sup> black ash <sup>1</sup>

### Common Understory Species

Shrubs: Alnus rugosa, balsam fir, Gaultheria hispidula, white cedar, Rubus pubescens, Linnaea borealis, Ledum groenlandicum, Cornus stolonifera, black spruce, Rosa acicularis, Vaccinium myrtilloides

Herbs: Trientalis borealis, Cornus canadensis, Coptis trifolia, Mitella nuda, Maianthemum canadense, Viola renifolia, Galium triflorum, Smilacina trifolia, Clintonia borealis, Carex disperma, Equisetum sylvaticum, Carex vaginata

Mosses: Pleurozium schreberi, Hylocomium splendens, Rhytidiadelphus triquetrus, Sphagnum girgensohnii, S. nemoreum, Ptilium crista-castrensis, Dicranum polysetum

#### Forest Floor Cover

Moss: 54 Conifer litter: 18 Graminoid litter: 12 Water: 6 Wood: 5 Broadleaf litter: 5

#### Soil / Site Characteristics

Soil Groups:  $(w \text{ org})^9$ ,  $(\text{other})^1$ Thickness of Organic Layer:  $[O] - (\ge 40)^9$ Surface Texture:  $(w \text{ org})^9$ ,  $(\text{other})^1$ 

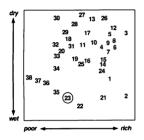
Deep Texture: organic 7, f. sandy 1, clayey 1, c. sandy 1

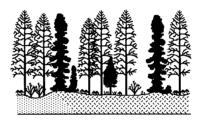
Moisture Regime / Drainage: wet <sup>8</sup>, moist <sup>1</sup> / v. poor <sup>9</sup>
Mode of Deposition: organic <sup>9</sup>, other <sup>1</sup>

**Comments:** V22 stands are mostly of limited areal extent, developing on rich, wet lowland sites. *Alnus rugosa* and white cedar often form dense thickets in the shrub layer. Sedges can be abundant in the herb stratum, especially in the NC Region. On the forest floor, mats of Sphagnum tend to occupy wet depressions while feathermoss is found on logs and drier hummocks; *Hylocomium splendens* and *Sphagnum girgensohnii* are frequently abundant.

# Tamarack (Black Spruce) / Speckled Alder / Labrador Tea

**General Description** (n=28): Wet tamarack stands, often with black spruce in the overstory. The shrub layer is typically dominated by low, ericaceous species although thickets of *Alnus rugosa*, balsam fir or black spruce may occur. The herb layer generally contains a significant graminoid component. Moss cover is often split between Sphagnum and feathermoss. Occurring primarily on organic deposits but also on moist, mineral soils.





### Overstory Species

tamarack <sup>10</sup> black spruce <sup>7</sup> balsam fir <sup>1</sup> white spruce <sup>1</sup> white cedar <sup>1</sup>

### Common Understory Species

Shrubs: Alnus rugosa, Ledum groenlandicum, Rubus pubescens, Gaultheria hispidula, black

spruce, Linnaea borealis, balsam fir, Ribes triste, Rosa acicularis, Lonicera villosa

Herbs: Cornus canadensis, Trientalis borealis, Maianthemum canadense, Viola spp., Equisetum

sylvaticum, Coptis trifolia, Mitella nuda, Smilacina trifolia, Galium triflorum, Dryopteris

austriaca

Mosses: Pleurozium schreberi, Sphagnum girgensohnii, S. nemoreum, Ptilium crista-castrensis,

Dicranum polysetum

#### Forest Floor Cover

Moss: 54 Conifer litter: 20 Graminoid litter: 10 Water: 7 Broadleaf litter: 6 Wood: 5

#### Soil / Site Characteristics

Soil Groups:  $(w \text{ org})^7$ ,  $(dp \text{ m})^2$ ,  $(dp \text{ d-f})^1$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>2</sup>, (≥26)<sup>1</sup>

[O] - (≥40)<sup>7</sup>

Surface Texture: organic <sup>7</sup>, f. sandy <sup>1</sup>, c. loamy <sup>1</sup>, f. loamy <sup>1</sup>

Deep Texture: organic <sup>5</sup>, silty <sup>2</sup>, clayey <sup>1</sup>, f. loamy <sup>1</sup>

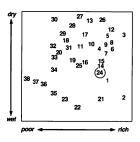
Moisture Regime / Drainage: wet <sup>6</sup>, moist <sup>3</sup>, fresh <sup>1</sup> / v. poor <sup>8</sup>, poor <sup>2</sup>

Mode of Deposition: organic <sup>7</sup>, lacustrine <sup>1</sup>, glaciofluvial <sup>1</sup>

**Comments:** Stands of V23 often develop as patches within lowland black spruce forests. The canopy can be very open, with widely spaced trees. Extensive cover by sedge species is characteristic on these low-lying, wet sites. Microtopography ranges from flat to very undulating, the latter condition due to hummock-forming *Sphagnum* spp. in the moss layer. Most V23 stands are found on peat deposits although, in the NW Region, mineral soils are encountered.

# White Spruce - Balsam Fir / Shrub Rich

**General Description** (n=25): A conifer Type with white spruce and/or balsam fir as the main canopy species. The understory tends to be shrub rich with balsam fir, *Acer spicatum*, *Corylus cornuta* and, on the wetter sites, *Alnus rugosa* potentially abundant. The herb layer varies from rich to poor. Occurring on deep, fresh to moist, mineral soils across a range of texture classes.





### Overstory Species

white spruce <sup>8</sup> balsam fir <sup>7</sup> black spruce <sup>3</sup> jack pine <sup>2</sup> white birch <sup>2</sup>

### Common Understory Species

Shrubs: balsam fir, Rubus pubescens, Amelanchier spp., Sorbus decora, Acer spicatum, Corylus

cornuta, Diervilla lonicera, Linnaea borealis, Rosa acicularis

Herbs: Clintonia borealis, Aralia nudicaulis, Cornus canadensis, Galium triflorum,

Maianthemum canadense, Streptopus roseus, Aster macrophyllus, Trientalis borealis, Mitella nuda, Anemone quinquefolia, Viola renifolia, Petasites palmatus, Fragaria

virginiana

Mosses: Pleurozium schreberi, Ptilium crista-castrensis, Rhytidiadelphus triquetrus, Dicranum

polysetum

### Forest Floor Cover

Conifer litter: 34 Moss: 32 Broadleaf litter: 23 Wood: 7

### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^6$ ,  $(dp m)^3$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>6</sup>, (1-5)<sup>3</sup>, (16-25)<sup>1</sup>

Surface Texture: c. loamy 4, silty 2, f. sandy 2, f. loamy 1, clayey 1

C Texture (when present): c. loamy 2, f. sandy 2, silty 2, f. loamy 2, clayey 1, c. sandy 1

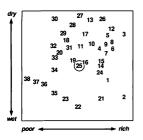
Moisture Regime / Drainage: fresh 7, moist 3 / well 4, rapid 3, poor 3

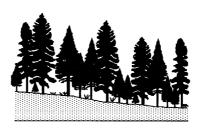
Mode of Deposition: lacustrine 6, morainal 3, glaciofluvial 1

**Comments:** The V14, V15, V16, V24, V25 group essentially represents the white spruce / balsam fir mixed forest condition. These Types characteristically comprise productive, floristically diverse stands which are likely to intergrade across a range of ecological factors. Stands of V24, like those of V14 and V15, tend to have a denser broadleaved shrub component than do stands of V25 (and V16). Subdivision of V24 into balsam fir and white spruce phases, on the same principal used to segregate V14 and V15, could be considered. Rarely, moss rich stands may key to V24 if the predominant moss is not one of the feathermoss species defined for the NWO FEC (see Section 2.1.5); some of these stands may better fit the V25 Type description.

# White Spruce - Balsam Fir / Feathermoss

**General Description** (n=41): White spruce and/or balsam fir stands, often with black spruce in the canopy. The understory ranges from shrub and herb poor to moderately rich. Balsam fir is often abundant in the shrub layer, *Cornus canadensis* in the herb stratum. Forest floor cover consists primarily of feathermoss and conifer litter. Occurring mainly on fresh, well-drained, upland mineral soils.





### Overstory Species

white spruce <sup>9</sup> balsam fir <sup>8</sup> black spruce <sup>6</sup> jack pine <sup>3</sup> white birch <sup>2</sup>

### Common Understory Species

Shrubs: balsam fir, Linnaea borealis, Rubus pubescens, Diervilla Ionicera, Amelanchier spp.,

Rosa acicularis, Sorbus decora, Vaccinium myrtilloides, Acer spicatum, Corylus cornuta,

black spruce

Herbs: Cornus canadensis, Maianthemum canadense, Clintonia borealis, Aralia nudicaulis,

Streptopus roseus, Trientalis borealis, Coptis trifolia, Viola renifolia, Mitella nuda

Mosses: Pleurozium schreberi, Ptilium crista-castrensis, Dicranum polysetum, Hylocomium

splendens, Rhytidiadelphus triquetrus, Dicranum fuscescens

### Forest Floor Cover

Moss: 66 Conifer litter: 21 Broadleaf litter: 6 Wood: 5

### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^6$ ,  $(mod dp)^2$ ,  $(dp m)^1$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>2</sup>

Surface Texture: c. loamy 5, silty 1, c. sandy 1, f. sandy 1, f. loamy 1, clayey 1

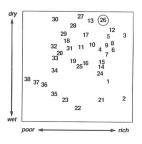
C Texture (when present): c. loamy 3, c. sandy 2, f. sandy 2, clayey 2, f. loamy 1

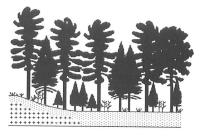
Moisture Regime / Drainage: fresh<sup>7</sup>, dry<sup>2</sup>, moist<sup>1</sup> / well<sup>6</sup>, rapid<sup>3</sup>, poor <sup>1</sup>
Mode of Deposition: lacustrine<sup>3</sup>, glaciofluvial<sup>3</sup>, morainal<sup>3</sup>, fluvial<sup>1</sup>

**Comments:** Broadleaved shrubs like *Acer spicatum* and *Corylus cornuta* occur less frequently than in stands of V24, but *Aralia nudicaulis* and *Diervilla lonicera* are common in the herb / dwarf shrub layer. Ericaceous shrub species can be abundant. Feathermoss cover is typically extensive, often including species such as *Rhytidiadelphus triquetrus* and *Brachythecium* spp.

## White Pine Conifer

**General Description** (n=21): White pine dominated conifer stands. Overstory composition ranges from solely white pine to a diverse conifer mixture. The understory tends to be shrub rich with balsam fir, *Acer spicatum* and *Corylus cornuta* frequently abundant. The herb layer is often sparse. Occurring on dry to fresh, rapidly drained, non-calcareous, coarse-textured soils.





**Species**white pine 10
balsam fir 4
red pine 4
white spruce 1
white cedar 1
black spruce 1
white birch 1

Overstory

## Common Understory Species

Shrubs: balsam fir, Acer spicatum, Linnaea borealis, Corylus cornuta, Diervilla lonicera,

Amelanchier spp., Rubus pubescens

Herbs: Maianthemum canadense, Aralia nudicaulis, Cornus canadensis, Aster macrophyllus,

Polypodium vulgare

Mosses: Pleurozium schreberi, Dicranum polysetum

#### Forest Floor Cover

Conifer litter: 68 Moss: 12 Broadleaf litter: 10

#### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^5$ ,  $(v shal)^3$ ,  $(mod dp)^2$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>3</sup>
Surface Texture: c. loamy<sup>5</sup>, non-soil<sup>2</sup>, silty<sup>2</sup>

C Texture (when present): c. sandy 4, f. sandy 3, c. loamy 3, clayey 1

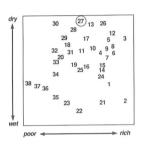
Moisture Regime / Drainage: dry 5, fresh 5 / rapid 8, well 2

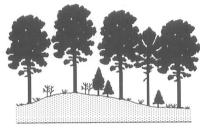
Mode of Deposition: morainal<sup>9</sup>, lacustrine<sup>1</sup>, glaciofluvial<sup>1</sup>

**Comments:** V26 is most common in the Quetico / Rainy River area of NW Ontario. In this area, red maple and *Juniperus communis* can be significant elements of the understory. *Diervilla lonicera* and *Aster macrophyllus* are occasionally abundant in the herb / dwarf shrub stratum. The generally herb poor forest floor is characterized by an abundance of persistent pine needle litter; feathermoss cover is typically scattered on stones and dead wood. Occasionally, white pine stands on shallow, exposed bedrock sites will be comparable to those of V30.

## Red Pine Conifer

**General Description** (n=43): Red pine dominated conifer stands. These are often pure stands of red pine although other conifer species can occasionally be present in the canopy. The understory ranges from moderately herb and shrub rich to extremely poor. Forest floor cover ranges from mainly pine needle litter to extensive feathermoss mats. Occurring on dry to fresh, rapidly drained, non-calcareous, sandy or coarse loamy soils.





## Overstory Species

red pine 10 jack pine 3 balsam fir 2 white pine 2 black spruce 2 white birch 1

### Common Understory Species

Shrubs: Vaccinium myrtilloides, Diervilla lonicera, Linnaea borealis, balsam fir, Vaccinium

angustifolium, black spruce, Amelanchier spp.

Herbs: Maianthemum canadense, Aralia nudicaulis, Cornus canadensis, Oryzopsis asperifolia

Mosses: Dicranum polysetum, Pleurozium schreberi

Lichens: Cladina rangiferina

### Forest Floor Cover

Conifer litter: 51 Moss: 37 Broadleaf litter: 5

### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^8$ ,  $(mod dp)^1$ ,  $(v shal)^1$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>5</sup>, (1-5)<sup>5</sup>

Surface Texture: c. sandy <sup>3</sup>, c. loamy <sup>3</sup>, silty <sup>2</sup>, f. sandy <sup>2</sup>

C Texture (when present): c. sandy <sup>5</sup>, c. loamy <sup>2</sup>, f. sandy <sup>2</sup>

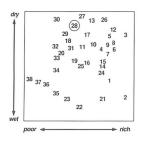
Moisture Regime / Drainage: dry <sup>5</sup>, fresh <sup>5</sup> / rapid <sup>7</sup>, well <sup>2</sup>, poor <sup>1</sup>

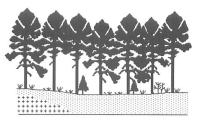
Mode of Deposition: glaciofluvial<sup>5</sup>, morainal<sup>4</sup>

Comments: V27 occurs most commonly in the Quetico / Rainy River / Dryden area of NW Ontario. Within stands of the Quetico area Acer spicatum, Corylus cornuta, Alnus crispa, Diervilla lonicera and Aralia nudicaulis often combine to form a rich understory. In contrast, the understory of stands from further north and west is usually open and dominated by low, often ericaceous, species. Feathermoss, on average, has a higher cover in the NW Region compared to the NC Region.

## Jack Pine / Low Shrub

**General Description** (n=35): Even-aged jack pine stands. The understory is variable, although typically well-developed in the low shrub (< 1 m high) stratum. *Corylus cornuta*, *Alnus crispa* and occasionally *Acer spicatum* can be abundant as tall shrubs. Feathermoss occurs in scattered, often extensive, patches. Occurring on rapidly drained, dry to fresh, coarse-textured soils.





Overstory Species

jack pine 10 trembling aspen 1

### Common Understory Species

Shrubs: Vaccinium myrtilloides, Amelanchier spp., Linnaea borealis, Diervilla lonicera, Vaccinium angustifolium, balsam fir, Corylus cornuta, Rosa acicularis, black spruce,

Alnus crispa

Herbs: Aralia nudicaulis, Maianthemum canadense, Cornus canadensis, Aster macrophyllus,

Melampyrum lineare, Clintonia borealis

Mosses: Pleurozium schreberi, Dicranum polysetum

Lichens: Cladina rangiferina

## Forest Floor Cover

Conifer litter: 43 Moss: 36 Broadleaf litter: 13

#### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^6$ ,  $(mod dp)^2$ ,  $(v shal)^1$ ,  $(dp m)^1$ 

Thickness of Organic Layer: [LFH] - (1-5)<sup>6</sup>, (6-15)<sup>4</sup>

Surface Texture: c. loamy <sup>3</sup>, f. sandy <sup>3</sup>, c. sandy <sup>3</sup>, clayey <sup>1</sup>

C Texture (when present): c. sandy <sup>5</sup>, c. loamy <sup>3</sup>, f. sandy <sup>1</sup>, clayey <sup>1</sup>

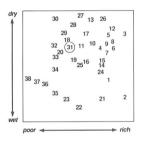
Moisture Regime / Drainage: dry <sup>5</sup>, fresh <sup>4</sup>, moist <sup>1</sup> / rapid <sup>7</sup>, well <sup>2</sup>, poor <sup>1</sup>

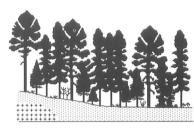
Mode of Deposition: glaciofluvial 4, morainal 3, lacustrine 1, fluvial 1

**Comments:** Stands of V28 are distinguished from those of V29 on the basis of a less continuous ground cover by feathermoss. The understory can range from a dense, broadleaved tall shrub layer to an herb rich condition or an abundance of ericaceous species. In the latter case, close similarity with stands of V29 is common. Diervilla lonicera and Aralia nudicaulis are frequently abundant in the herb / dwarf shrub layer of V28 stands in the NC Region; ericaceous species usually dominate in the NW Region. Rarely, on moist sites, stands with continuous Sphagnum moss cover may key to V28; these may better fit the V29 Type description.

## Black Spruce - Jack Pine / Tall Shrub / Feathermoss

**General Description** (n=97): Black spruce - jack pine stands are typical although other conifers can be present in the canopy. The understory is variable in both structure and species composition but, in general, the shrub and/or herb strata are moderately dense. Balsam fir and black spruce are often abundant in the shrub layer. Feathermoss cover can be extensive. Occurring across a range of soil and site conditions but most commonly on deep, fresh, upland mineral soils.





#### Overstory Species

black spruce <sup>10</sup> jack pine <sup>9</sup> balsam fir <sup>3</sup> white spruce <sup>2</sup> trembling aspen <sup>1</sup>

### Common Understory Species

Shrubs: Vaccinium myrtilloides, Linnaea borealis, balsam fir, black spruce, Vaccinium

angustifolium, Diervilla Ionicera, Rosa acicularis, Gaultheria hispidula, Amelanchier

spp., Rubus pubescens

Herbs: Cornus canadensis, Maianthemum canadense, Clintonia borealis, Aralia nudicaulis,

Trientalis borealis, Coptis trifolia, Aster macrophyllus

Mosses: Pleurozium schreberi, Dicranum polysetum, Ptilium crista-castrensis, Hylocomium

splendens

#### Forest Floor Cover

Moss: 60 Conifer litter: 20 Broadleaf litter: 11 Wood: 6

Soil / Site Characteristics

Soil Groups:  $(dp d-f)^6$ ,  $(dp m)^2$ ,  $(mod dp)^2$ ,  $(v shal)^1$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>2</sup>, (16-25)<sup>1</sup>

Surface Texture: c. loamy 4, f. sandy 2, silty 2, clayey 1, c. sandy 1

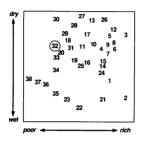
C Texture (when present): c. loamy 3, f. sandy 2, clayey 2, c. sandy 2, silty 1, f. loamy 1

Moisture Regime / Drainage: fresh<sup>6</sup>, moist<sup>2</sup>, dry<sup>2</sup> / well<sup>4</sup>, rapid<sup>3</sup>, poor<sup>3</sup>
Mode of Deposition: glaciofluvial<sup>3</sup>, lacustrine<sup>3</sup>, morainal<sup>3</sup>

**Comments:** Understory conditions in V31 stands are variable. *Corylus cornuta* and *Alnus crispa* are occasionally abundant in the shrub layer. The herb / dwarf shrub layer can have dense patches of *Cornus canadensis*, *Ledum groenlandicum* and *Vaccinium* spp. as well as of broadleaved species like *Aralia nudicaulis*, *Diervilla lonicera* and *Aster macrophyllus*. Forest floor cover ranges from mainly litter to a feathermoss mat. Stands of V31 are ecologically similar to those of V18, V20, V32 and V33.

## Jack Pine - Black Spruce / Ericaceous Shrub / Feathermoss

**General Description** (n=187): Jack pine - black spruce stands with an open understory. Scattered clumps of black spruce and, occasionally, *Alnus crispa* occur in the tall shrub layer. The herb / dwarf shrub layer is typically dominated by *Cornus canadensis* and ericaceous species, but can be extremely poor. The forest floor is covered by a continuous carpet of feathermoss. Occurring mainly on fresh to dry, coarse-textured mineral soils.





#### Overstory Species

jack pine 10 black spruce 10 white spruce 1 balsam fir 1

### Common Understory Species

Shrubs: black spruce, Vaccinium myrtilloides, Linnaea borealis, Gaultheria hispidula, Vaccinium

angustifolium, Ledum groenlandicum

Herbs: Maianthemum canadense, Cornus canadensis, Clintonia borealis

Mosses: Pleurozium schreberi, Dicranum polysetum, Ptilium crista-castrensis, Hylocomium

splendens

Lichens: Cladina rangiferina

### Forest Floor Cover

Moss: 87 Conifer litter: 7

#### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^6$ ,  $(mod dp)^2$ ,  $(dp m)^2$ ,  $(v shal)^1$ 

Thickness of Organic Layer: [LFH] - (6-15)8, (1-5)2

Surface Texture: c. loamy 4, f. sandy 2, c. sandy 2, silty 1

C Texture (when present):

Moisture Regime / Drainage:

f. sandy <sup>3</sup>, c. sandy <sup>3</sup>, c. loamy <sup>2</sup>, silty <sup>1</sup>, clayey <sup>1</sup>

fresh <sup>5</sup>, dry <sup>3</sup>, moist <sup>2</sup> / rapid <sup>5</sup>, well <sup>3</sup>, poor <sup>2</sup>

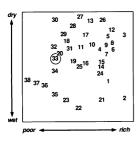
Mode of Deposition:

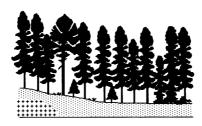
glaciofluvial <sup>5</sup>, morainal <sup>4</sup>, lacustrine <sup>1</sup>

**Comments:** In combination, V32 and V33 essentially represent the black spruce - jack pine / feathermoss forest condition. These Types characteristically comprise even-aged, fire-originated stands. Stands with an abundance of *Alnus crispa* in the shrub layer may be similar to some elements of V31. Occasionally, jack pine stands with balsam fir or white spruce in the canopy will key to V32.

## Black Spruce / Feathermoss

**General Description** (n=144): Black spruce stands with occasional occurrences of other conifers in the canopy. The understory is typically open with clumps of black spruce in the tall shrub layer. Ericaceous species dominate the herb / dwarf shrub stratum, although *Cornus canadensis* can also be abundant. Ground cover generally consists of a continuous feathermoss mat. Occurring across a range of soil and site conditions but most frequently on fresh, coarse-textured mineral soils.





## Overstory Species

black spruce 10 jack pine 4 balsam fir 1 white spruce 1 white birch 1

### Common Understory Species

Shrubs: Gaultheria hispidula, black spruce, Vaccinium myrtilloides, V. angustifolium, Ledum

groenlandicum, balsam fir

Herbs: Cornus canadensis, Maianthemum canadense

Mosses: Pleurozium schreberi, Dicranum polysetum, Ptilium crista-castrensis, Hylocomium

splendens

Lichens: Cladina rangiferina

#### Forest Floor Cover

Moss: 90

### Soil / Site Characteristics

Soil Groups:  $(dp d-f)^3$ ,  $(mod dp)^2$ ,  $(dp m)^2$ ,  $(v shal)^2$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>6</sup>, (16-25)<sup>2</sup>, (1-5)<sup>1</sup>, (26-39)<sup>1</sup>

Surface Texture: c. loamy <sup>5</sup>, f. sandy <sup>1</sup>, c. sandy <sup>1</sup>, silty <sup>1</sup>, non-soil <sup>1</sup>, clayey <sup>1</sup>
C Texture (when present): c. loamy <sup>3</sup>, f. sandy <sup>3</sup>, silty <sup>1</sup>, clayey <sup>1</sup>, c. sandy <sup>1</sup>

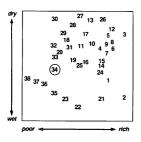
Moisture Regime / Drainage: fresh 5, moist 3, dry 3 / rapid 5, poor 3, well 3

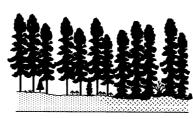
Mode of Deposition: morainal 4, glaciofluvial 3, lacustrine 2

**Comments:** In local areas, stands of this Type will typically intergrade with those of **V32**. When a minor component of hardwood (especially white birch) is present in the overstory, **V33** stands may be similar to those of **V20**. Alnus crispa is occasionally abundant as a tall shrub while Diervilla lonicera can be abundant in the dwarf shrub layer. Sphagnum can occur in low abundances on the forest floor of moist sites.

## Black Spruce / Labrador Tea / Feathermoss (Sphagnum)

**General Description** (n=110): Black spruce stands with occasional occurrences of other conifers in the canopy. Ericaceous species typically dominate the understory, often with an abundance of *Ledum groenlandicum*. Black spruce, balsam fir and *Alnus rugosa* may provide dense tall shrub cover. The forest floor is primarily covered by a continuous feathermoss mat with patches, often extensive, of Sphagnum. Occurring mainly on moist to wet, lowland or lower slope sites.





## Overstory Species

black spruce <sup>10</sup> jack pine <sup>2</sup> balsam fir <sup>2</sup> tamarack <sup>2</sup> white cedar <sup>1</sup> white spruce <sup>1</sup>

### Common Understory Species

Shrubs: Ledum groenlandicum, Gaultheria hispidula, black spruce, Vaccinium myrtilloides,

Linnaea borealis, Vaccinium angustifolium, balsam fir, Alnus rugosa, Rubus pubescens

Herbs: Cornus canadensis, Equisetum sylvaticum, Coptis trifolia, Maianthemum canadense

Mosses: Pleurozium schreberi, Ptilium crista-castrensis, Dicranum polysetum, Hylocomium

splendens, Sphagnum nemoreum, S. girgensohnii

#### Forest Floor Cover

Moss: 84 Conifer litter: 7

## Soil / Site Characteristics

Soil Groups:  $(w \text{ org})^4$ ,  $(dp \text{ m})^3$ ,  $(dp \text{ d-f})^1$ ,  $(mod \text{ dp})^1$ ,  $(w \text{ org/R})^1$ 

Thickness of Organic Layer: [LFH] - (6-15)<sup>2</sup>, (16-25)<sup>1</sup>, (26-39)<sup>1</sup>

[O] - (≥40)<sup>5</sup>, (16-25)<sup>1</sup>

Surface Texture: organic<sup>5</sup>, c. loamy<sup>3</sup>, f. sandy<sup>1</sup>, silty<sup>1</sup>, clayey<sup>1</sup>

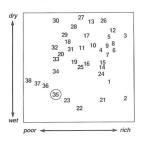
C Texture (when present): c. loamy<sup>4</sup>, silty<sup>2</sup>, clayey<sup>2</sup>, f. sandy<sup>2</sup>, f. loamy<sup>1</sup>

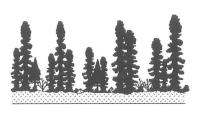
Moisture Regime / Drainage: moist 5, wet 3, fresh 1 / v. poor 4, poor 4, well 1, rapid 1 organic 5, lacustrine 2, morainal 1, glaciofluvial 1

**Comments:** This is a variable Type. Stands containing white cedar or tamarack in the overstory may resemble those of V22 or V23 respectively. Stands with an abundance of *Alnus rugosa* in the shrub layer may be similar to V35 stands. However, V34 principally describes a transitional condition between the upland black spruce / feathermoss Types (V31 to V33) and the wetland black spruce / Sphagnum Types (V35 to V38). Thus, most V34 stands are characterized by a significant component of Sphagnum in the moss cover; these stands may be comparable to those of V36 or V37 depending on species composition in the herb / dwarf shrub layer. Stands of V34 are typically found on wet, organic or moist, mineral soils; mineral soils predominate in the NW Region while organic substrates are most frequent in the NC Region.

## Black Spruce / Speckled Alder / Sphagnum

**General Description** (n=39): Wet, shrub rich black spruce stands, occasionally with other conifers in the canopy. *Alnus rugosa*, often in association with black spruce and balsam fir, is abundant in the tall shrub layer. Species diversity in the herb / dwarf shrub layer can be high. Ground cover consists of Sphagnum and feathermoss, often with large patches of broadleaf litter. Occurring on wet, lowland sites.





## Overstory Species

black spruce <sup>10</sup> balsam fir <sup>2</sup> tamarack <sup>1</sup> white cedar <sup>1</sup>

### Common Understory Species

Shrubs: Alnus rugosa, Gaultheria hispidula, Ledum groenlandicum, black spruce, Linnaea

borealis, Vaccinium myrtilloides, Rubus pubescens, balsam fir, Vaccinium

angustifolium, Sorbus decora, Oxycoccus microcarpus

Herbs: Cornus canadensis, Equisetum sylvaticum, Smilacina trifolia, Trientalis borealis, Mitella nuda, Coptis trifolia, Maianthemum canadense, Viola renifolia, Clintonia borealis,

Petasites palmatus, Carex trisperma

Mosses: Pleurozium schreberi, Sphagnum girgensohnii, S. nemoreum, Ptilium crista-castrensis, Sphagnum magellanicum, Hylocomium splendens, Aulacomnium palustre, Dicranum

polysetum

1 3

### Forest Floor Cover

Moss: 79 Graminoid litter: 6 Broadleaf litter: 5 Conifer litter: 5

## Soil / Site Characteristics

Soil Groups:  $(w \text{ org})^8$ ,  $(dp \text{ m})^2$ Thickness of Organic Layer: [LFH] -  $(16-25)^1$ 

[O] - (≥40)<sup>8</sup>, (26-39)<sup>1</sup>

Surface Texture: organic 8, c. loamy 1, silty 1, clayey 1

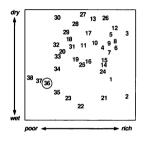
Deep Texture: organic 5, silty 2, f. sandy 1, f. loamy 1, c. loamy 1, clayey 1

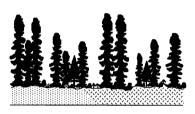
Moisture Regime / Drainage: wet <sup>7</sup>, moist <sup>2</sup> / v. poor <sup>8</sup>, poor <sup>2</sup>
Mode of Deposition: organic <sup>8</sup>, lacustrine <sup>1</sup>, glaciofluvial <sup>1</sup>

**Comments:** These are wet black spruce stands, often with small pockets of standing water. The understory condition ranges from herb and shrub rich to poor. *Ledum groenlandicum* may form a dense low shrub cover while *Equisetum sylvaticum* and various *Carex* spp. can be abundant in the herb layer. Most V35 stands occur on deep, fibric organic soils.

## Black Spruce / Bunchberry / Sphagnum (Feathermoss)

**General Description** (n=56): Black spruce stands occasionally with other conifers in the canopy. The shrub layer is dominated by low, ericaceous species often with scattered clumps of black spruce and balsam fir. The herb layer may contain a diversity of species. Forest floor cover is mainly Sphagnum and feathermoss. Occurring on poorly drained, lowland sites.





#### Overstory Species

black spruce <sup>10</sup> jack pine <sup>1</sup> balsam fir <sup>1</sup> tamarack <sup>1</sup>

### Common Understory Species

Shrubs: Ledum groenlandicum, Gaultheria hispidula, black spruce, Vaccinium myrtilloides,

balsam fir, Vaccinium angustifolium, Linnaea borealis, Alnus rugosa, Oxycoccus

microcarpus

Herbs: Cornus canadensis, Equisetum sylvaticum, Coptis trifolia, Smilacina trifolia, Clintonia

borealis, Maianthemum canadense

Mosses: Pleurozium schreberi, Ptilium crista-castrensis, Sphagnum girgensohnii, S. nemoreum,

Dicranum polysetum, Hylocomium splendens, Sphagnum magellanicum

#### Forest Floor Cover

Moss: 87 Conifer litter: 5

#### Soil / Site Characteristics

Soil Groups: (dp m)<sup>5</sup>, (w org)<sup>5</sup>

Thickness of Organic Layer: [LFH] - (6-15)1, (16-25)1

[O]  $-(\ge 40)^5$ ,  $(26-39)^2$ ,  $(16-25)^1$ ,  $(6-15)^1$ 

Surface Texture: organic 5, c. loamy 2, f. sandy 1, silty 1, clayey 1

C Texture (when present): clayey 3, f. sandy 3, c. loamy 2, silty 1, f. loamy 1, c. sandy 1

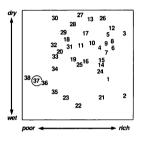
Moisture Regime / Drainage: moist 5, wet 4, fresh 1 / v. poor 5, poor 5

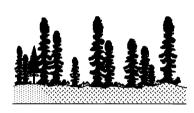
Mode of Deposition: organic 6, lacustrine 2, glaciofluvial 2, morainal 1

**Comments:** V36 stands lack the abundance of *Alnus rugosa* which is characteristic in stands of V35. Species composition in the tree, shrub and herb strata is generally more diverse than in stands of V37 or V38. Some V36 stands with a relatively high feathermoss ground cover may resemble, or intergrade with, stands of V34. Stands of both V36 and V37 are found across a broader range of site and soil conditions than are those of V35 and V38, occurring on mineral soils much more frequently. In the NW Region the majority of V36 stands occurs on mineral soils. Rarely, jack pine dominated stands will key to V36 when the moss cover is predominantly Sphagnum.

## Black Spruce / Ericaceous Shrub / Sphagnum

**General Description** (n=56): Lowland black spruce stands. The understory is dominated by ericaceous species, with *Ledum groenlandicum* typically abundant. Scattered clumps of black spruce constitute the tall shrub layer. The herb stratum is generally sparse although graminoid cover can occasionally be extensive. Continuous ground cover by Sphagnum and feathermoss is characteristic. Occurring on wet, poorly drained sites.





## Overstory Species

black spruce 10 tamarack 1

### Common Understory Species

Shrubs: Ledum groenlandicum, Gaultheria hispidula, black spruce, Vaccinium angustifolium,

V. myrtilloides, Oxycoccus microcarpus, Kalmia polifolia, Chamaedaphne calyculata

Herbs: Smilacina trifolia, Carex trisperma, Equisetum sylvaticum

Mosses: Pleurozium schreberi, Sphagnum nemoreum, S. girgensohnii, Dicranum polysetum,

Sphagnum magellanicum, Ptilium crista-castrensis, Sphagnum angustifolium

Lichens: Cladina rangiferina

#### Forest Floor Cover

Moss: 94

### Soil / Site Characteristics

Soil Groups:  $(w \text{ org})^7$ ,  $(dp \text{ m})^2$ ,  $(mod dp)^1$ ,  $(v \text{ shal})^1$ 

Thickness of Organic Layer: [LFH] - (16-25) 1

[O]  $-(\ge 40)^7, (6-15)^1, (26-39)^1$ 

Surface Texture: organic <sup>7</sup>, f. sandy <sup>1</sup>, c. loamy <sup>1</sup>, silty <sup>1</sup>

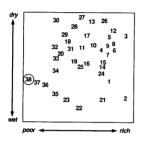
Deep Texture: organic <sup>5</sup>, c. loamy <sup>2</sup>, f. sandy <sup>1</sup>, clayey <sup>1</sup>

Moisture Regime / Drainage: wet <sup>6</sup>, moist <sup>3</sup>, fresh <sup>1</sup> / v. poor <sup>6</sup>, poor <sup>3</sup>, rapid <sup>1</sup>, well <sup>1</sup>
Mode of Deposition: organic <sup>7</sup>, glaciofluvial <sup>2</sup>, morainal <sup>1</sup>, lacustrine <sup>1</sup>

**Comments:** Most stands keying to V37 are herb poor black spruce wetlands on organic soils with a Sphagnum dominated ground cover. Other V37 stands, however, will have about equal ground cover by Sphagnum and feathermoss; these can be extremely herb poor, often occurring on mineral soils, and may be comparable to some elements of V34.

## Black Spruce / Leatherleaf / Sphagnum

**General Description** (n=20): Poor, wetland black spruce stands with stunted, widely spaced trees. The shrub layer is typically dominated by *Chamaedaphne calyculata* and *Ledum groenlandicum*, often in abundance, with scattered clumps of black spruce. Species diversity in the herb layer is extremely low. Ground cover is a continuous Sphagnum / feathermoss mat. Occurring on wet, organic sites.





Overstory Species black spruce 10 tamarack 1

## Common Understory Species

Shrubs: Ledum groenlandicum, black spruce, Chamaedaphne calyculata, Oxycoccus

microcarpus, Gaultheria hispidula, Kalmia polifolia, Vaccinium angustifolium,

V. myrtilloides

Herbs: Smilacina trifolia, Carex trisperma

Mosses: Pleurozium schreberi, Sphagnum fuscum, S. magellanicum, S. nemoreum,

S. girgensohnii, Dicranum polysetum, Sphagnum angustifolium, Polytrichum

juniperinum, Ptilium crista-castrensis

Lichens: Cladina rangiferina

### Forest Floor Cover

Moss: 96

### Soil / Site Characteristics

Soil Groups: (w org) 10, (mod dp) 1

Thickness of Organic Layer: [LFH] - (6-15) 1

[O] - (≥40) <sup>10</sup>

Surface Texture: organic 10, f. sandy 1

Deep Texture: organic <sup>9</sup>, f. sandy <sup>1</sup>, c. loamy <sup>1</sup>

Moisture Regime / Drainage: wet <sup>9</sup>, moist <sup>1</sup> / v. poor <sup>10</sup>, poor <sup>1</sup>

Mode of Deposition: organic 10, glaciofluvial 1

**Comments:** V38 consists of poorly stocked, non-merchantable stands on unproductive wetland sites. Typically these stands are situated on deep, organic soils although rarely a shallow or mineral soil condition will be encountered. Some stands can be transitional to open peatlands.

# 3. Soil Types

# 3.1. Introduction to the Soil Types Allocation Keys

### 3.1.1. General

There are 22 Soil Types in the NWO FEC classification: 13 represent deep soil conditions (S-Types; at least 100 cm of soil matrix) while 9 describe very shallow to moderately deep soils (SS-Types; less than 100 cm of soil matrix). The two soil keys are hierarchical with the user working down through decision points in order to make a Type allocation.

The deep soil (≥100 cm) key derives an S-Type based on field assessments of soil moisture regime, soil texture and organic layer qualities. There are 3 main groupings: **Dry to Fresh Mineral** (6 S-Types), **Moist Mineral** (5 S-Types) and **Wet Organic** (2 S-Types). The key to the shallower soils (<100 cm) also uses field-measurable criteria, including depth to rock, thickness of organic layer and soil texture. Here there are 4 main groupings: **Very Shallow** (4 SS-Types); **Dry to Fresh, Shallow to Moderately Deep** (3 SS-Types); **Moist, Shallow to Moderately Deep** (1 SS-Type); **Wet Organic / Rock** (1 SS-Type).

## 3.1.2. Soil Type Names

<b>51</b>	Dry / Coarse Sandy
<b>S2</b>	Fresh / Fine Sandy
<i>\$3</i>	Fresh / Coarse Loamy
S4	Fresh / Silty - Silt Loamy
S5	Fresh / Fine Loamy
S6	Fresh / Clayey
	14: 10: 1

<i>\$</i> 7	Moist / Sandy
S8	Moist / Coarse Loamy
S9	Moist / Silty - Silt Loamy
	Moist / Fine Loamy - Clayer
	Moist / Peaty Phase

## Soil Types

```
S12F......Wet / Organic [Feathermoss]
S12S.....Wet / Organic [Sphagnum]

S51.....Discontinuous Organic Mat on Bedrock
S52......Extremely Shallow Soil on Bedrock
S53.....Very Shallow Soil on Bedrock
S54.....Very Shallow Soil on Boulder Pavement

S55.....Shallow - Moderately Deep / Sandy
S56.....Shallow - Moderately Deep / Coarse Loamy
S57....Shallow - Moderately Deep / Silty - Fine Loamy - Clayey

S58.....Shallow - Moderately Deep / Mottles - Gley
S59.....Shallow - Moderately Deep / Organic - Peaty Phase
```

## 3.1.3. How to Use the Soil Keys

In order to classify Soil Types, the main parameters to be measured are: depth to bedrock or boulder pavement, texture of the soil C horizon (parent) material, soil moisture regime, total depth of peat and the presence of mottles/gley in the profile. Soil Types were initially determined on the basis of computer analyses of detailed soil data collected in the NWO FEC program. Variables for use in the field keys were chosen for their relevance to forestry operations and practices. Variables which can be quickly and accurately determined in the field and which are not easily altered by forestry activities have been emphasized.

It is important to place the sample pit or auger hole in a spot *representative* of the predominant site condition. Selection of the sampling location should be done in the field, with consideration of general slope, microtopography and local relief characteristics. A quick reconnaissance of the area will familiarize the user with the degree of site variability. When both Vegetation and Soil Types are to be determined, the soil pit should be within the 10 m x 10 m sample plot used for vegetation assessment (see Section 2.1.3).

The basic sampling unit for the soil keys is either an augered hole or an excavated pit to a depth of 100 cm (from mineral soil surface) or to a bedrock contact. In order to make some of the measurements for the keys, soil material must be obtained from the C horizon, essentially the unweathered soil parent material. Normally, 100 cm is a sufficient depth to be well into the C horizon but occasionally one will need to go deeper, at least 25 cm into the C horizon is suggested before a sample is taken.

At the first division point in each key the user determines the soil depth, thereby deciding which key to follow in determining the Soil Type. If there is a minimum depth of 100 cm of mineral soil matrix, or if there is an organic soil that has at least 40 cm of peat material *and* does not have a bedrock contact within 100 cm of the ground surface, then the S-Type (deep soil) key is used. Otherwise the soil is considered "very shallow to moderately deep" and the SS-Type (shallow soil) key is followed.

Mineral soils in the NWO FEC system are those with a mineral soil matrix near the ground surface, often with an overlying organic LFH layer of variable thickness. Organic soils in the NWO FEC system have a wet, peaty organic layer that must extend a depth of 40 cm or more from the ground surface. Those soils with less than 40 cm peat (i.e. where mineral soil or lithic contact is reached within 40 cm) are classified as mineral soils. For mineral soils, the depth to bedrock or to a boulder pavement contact is determined from the mineral soil surface, i.e. below any organic layer that may be present. For organic soils, however, the depth to bedrock is measured from the surface of the organic deposit.

Mottles and gley colours may be observed in mineral soils. Their presence, depth and distinctness of colour relative to the surrounding soil matrix can all help to indicate the seasonal moisture status of the soil (Ontario Institute of Pedology 1985). Mottles and gley colours form in soils where anaerobic, reducing conditions exist for at least a portion of the year. Mottles typically develop as blotchy discolorations in the profile while gleyed soils are distinctively dark grey or brown. Their depth from the mineral soil surface should be determined. Depth to mottles and/or gley is considered directly in the SS-Type (shallow soil) key and indirectly, through inclusion in the scheme for estimating soil moisture regime (see Section 5.2), in the S-Type (deep soil) key.

Aids for field description of important soil parameters including soil texture, moisture regime and soil drainage are provided in Section 5.

## 3.1.4. Conventions for Use of the Soil Keys

General: The NWO FEC system generally follows the terminology and conventions laid out in *The Canadian System of Soil Classification* (Canada Soil Survey Committee, Subcommittee on Soil Classification 1978), the Canadian Soil Information System (CanSIS) *Manual for Describing Soils in the Field* (Working Group on Soil Survey Data 1978) and the *Field Manual for Describing Soils* (Ontario Institute of Pedology 1985). In field testing the NWO FEC system, it was determined that an experienced user could key to a Soil Type in a few minutes time. Some sites present difficulties, requiring more time and effort than others. It is necessary, albeit sometimes time-consuming, to obtain a sample of C horizon material for field texturing. We aren't aware of any shortcuts that haven't already been built into the system. One may expect increased speed with proficiency.

Normally, vegetation and soil typing are done at the same time. It may be preferable to determine the Vegetation Type first, then the Soil Type, to help avoid local disruption of the vegetation by trampling, digging or augering.

**Augering vs. Digging a Pit:** For most soil conditions a pit permits greater accuracy of observation. For example, in recognizing and measuring depths to mottles or gley, or for determining soil horizonation (especially in stratified soils) a pit face exposes more of the variability inherent in the profile. Augering, however, is considerably faster except in densely stony or cobbly soils where a shovel may be preferred.

**Soil Texture:** All textures for soil Typing are to be determined using C horizon (parent) material. In certain shallow soils with no C horizon, material from the lowermost B horizon may be used.

There is a period of time required for the user to become proficient with the field texturing procedures (see Section 5.1). There will always be borderline cases that are difficult to assess, although the soil keys are constructed to help avoid some of these situations by lumping certain textural classes. If possible, it is useful to occasionally compare findings with samples of known texture (i.e. lab textured samples). Rainy or very humid weather can hinder field texturing. In such instances, C horizon samples can be placed in labelled, plastic bags and textured later.

**Stratified Soils:** Stratified soils can be encountered throughout NW Ontario, especially in areas that have been subjected to a variety of glacial activities. Stratified soils are typically associated with more than one mode of deposition. This often results in contrasting textures occurring within a single soil profile.

For purposes of the NWO FEC, a soil is considered to be stratified only when a significant change in depositional mode is encountered, resulting in strata of distinctly different parent material composition (e.g. lacustrine sediments overlying a morainal deposit; see Section 5.7). For stratified soils with at least 60 cm of mineral soil matrix, guidelines for choosing the "effective stratum" for the derivation of moisture regime / drainage are presented in Section 5.2. For these soils, the NWO FEC Soil Type is determined using the C horizon (if present) texture from the same stratum used for moisture regime / drainage estimations.

**Shallow Soils:** There is little known about the effects of different soil depths on the silvics of the main boreal tree species. In the SS-Type key the use of 0-20 cm as a depth criterion for "very shallow" soils and 21-99 cm for "shallow to moderately deep" soils generally follows conventions adopted in the modified moisture regime / drainage tables for shallow soils in the *Field Manual for Describing Soils* (Ontario Institute of Pedology 1985). These are simple classes and they may be elaborated upon as knowledge increases with time. For SS-Types, moisture regime / drainage is estimated using the tables presented in Section 5.2.

**Bedrock Contact or Large Boulders:** Differentiating between bedrock contact and large stones or boulders in the soil can be a problem, especially if an auger is being used. It may require more than one excavation or a careful look at surrounding surficial conditions (e.g. look for nearby bedrock outcrops or an abundance of surface boulders or stones) to help make the determination.

**Boulder Pavement:** Boulder pavement (**SS4**) is characterized by large stones and boulders with little or no mineral soil matrix in the interstices. Typically an organic mat overlies the boulders. This is a condition distinct from bedrock, often being associated with colluvial deposits or washed boulder tills.

## Soil Types

**Mottles** / **Gley in the SS-Type Key:** In the SS-Type (shallow soil) key, reference to mottles or gley in the soil profile is used to define **SS8**. In keying, mottles and/or gley colours within 15 cm of bedrock are to be disregarded; these conditions are likely due to slow lateral water movement along the bedrock surface rather than to a fluctuating seasonal water table.

**Peaty Phase Soils:** In the S-Type (deep soil) key, the Peaty Phase Type (**S11**) describes mineral soils that are transitional to organic soils but don't meet the 40 cm minimum peat depth criterion. Peaty phase soils are typically recognized as moist soils with a Sphagnum-derived peat accumulation of 20-39 cm. The general appearance of these sites is similar to that of sites with deeper organic soils. They may not, however, present the restrictions to trafficability and other operations encountered on deeper peats.

Organic Soils: Organic soils (at least 40 cm of peat) are considered only generally in the soil keys. Deeper organic soils are differentiated between S12F [Feathermoss] and S12S [Sphagnum] on the basis of ground layer cover percentages (see Section 2.1.4) by Sphagnum vs. feathermoss. Both S-Types are peaty (usually Sphagnum-derived) soils, but S12F has a somewhat drier surface giving rise to a significant ground cover of feathermosses. S12F and S12S are distinguished on the basis of this feature because of the silvicultural implications of the different surface moisture and seedbed characteristics. Organic soils with a depth over bedrock of less than 100 cm are considered as shallow to moderately deep organic soils (SS9). Although it is not done in the SS-Type (shallow soil) key, SS9 soils could also be differentiated on the basis of ground layer cover according to the same criterion used in the S-Type (deep soil) key.

**Season of Use:** The optimum time for application of the soil classification is approximately late-May to late-October, about the same as for the vegetation classification. It is not practical to attempt use of the soil keys at times when the ground is frozen. Local understanding of landform relationships to Soil Types may prove useful in applying the soil classification.

## 3.1.5 Terminology Used in the Soil Keys

Decision criteria of the soil keys employ numerous symbols. This section defines the terminology of the keys.

## General Terms:

BR	bedrock
/R	soil underlain by bedrock or boulder pavement
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to
MR	moisture regime (see Section 5.2)
%	percentage cover (see Section 2.1.4)

## Organic Material:

Of,Om,Oh	wet, organic horizons typically derived from accumulations of Sphagnum
	mosses; peat (see Section 5.6)

Sphag any species of living Sphagnum moss on the ground surface

(cf. vegetation key)

## Soil Textures:

Si	silt	s	sand
SiS	silty sand	vfS	very fine sand
SiL	silt loam	fS	fine sand
SiC	silty clay	mS	medium sand
SiCL	silty clay loam	cS	coarse sand
L	loam	vcS	very coarse sand
SL	sandy loam	LS	loamy sand
C	clay	LvfS	loamy very fine sand
SC	sandy clay	LfS	loamy fine sand
SCL	sandy clay loam	LmS	loamy medium sand
CL	clay loam	LcS	loamy coarse sandy
		LvcS	loamy very coarse sand

## 3.2. Introduction to the Soil Type Factsheets

#### 3.2.1. General

The Soil Type Factsheets provide summary descriptions for each Soil Type. The 13 S-Types are listed first, followed by the 9 SS-Types. Details of specific conventions employed in the Soil Type Factsheets are outlined in Sections 3.2.2 and 3.2.3.

Using the Soil Type Factsheets for a short time will allow the user to become familiar with the modal conditions as well as the range of characteristics which embody each Soil Type. Users should keep in mind that, due to intrinsic variability of soil conditions, the Factsheets will seldom describe the exact soil being sampled. Some additional soil/site variables which could be influential in modifying the central concepts of the NWO FEC Soil Types, especially for silvicultural applications, are summarized in Section 3.3.

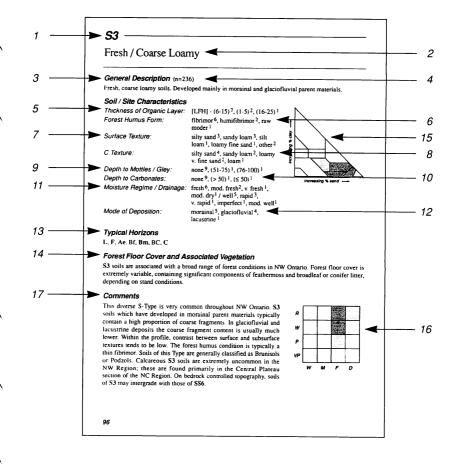
## 3.2.2. Layout of the Soil Type Factsheets

The identity banner at the top of each Factsheet gives the Soil Type number [1] and name [2]. The Type name consists of two descriptive features, e.g. moisture regime class(es) and soil texture, based on the diagnostic criteria of the soil keys. A short general description [3] of the Soil Type follows, including the NWO FEC sample size [4].

Below the text description, each Factsheet summarizes a number of soil/site descriptors in relation to the Soil Type: thickness ranges of LFH and peat (O) organic mats [5], forest humus forms [6], surface (0-25 cm) [7] and C horizon [8] texture classes, depths to mottles/gley [9] and carbonates [10] (if present), ranges of soil moisture regime and soil drainage classes [11] and surficial deposit condition [12]. For the organic Soil Types (S12F, S12S, SS9), other variables listed include Depth to Mineral Contact, Decomposition Class (top 25 cm of organic deposit) and Decomposition Class (bottom 25 cm of organic deposit). As for the Vegetation Type Factsheets, the superscript values denote frequencies of occurrence for the various descriptor categories (see Section 2.2.3 and 3.2.3).

A list of some typical soil horizons for the Type follows [13] with the most commonly encountered ones underlined. Below, a short description of stand and forest floor conditions commonly associated with the Soil Type [14] is presented.

## Example Soil Type Factsheet



## Soil Types

To the right of the soil/site summaries is a diagrammatic representation of one of the Soil Type's characteristic features [15] based on observations from the NWO FEC dataset: for the deep and the shallow to moderately deep Types which are defined by mineral texture criteria (S1-S10; SS5-SS8) the range of C horizon textures is mapped into the standard soil texture triangle (see Section 5.1); for the Soil Types which are defined by organic layer thickness (S11, S12F, S12S, SS9) as well as the very shallow SS-Types (SS1-SS4) a representative soil profile is portrayed.

A graphic cross-tabulation of the generalized moisture regime and drainage classes (see Section 3.2.3) for the Soil Type [16] is presented at the lower right-hand corner of each Factsheet. There is a *Comments* [17] section at the bottom of each Factsheet where miscellaneous notes and observations are provided. Individuals may wish to add other comments for their own use.

## 3.2.3. Conventions for Use of the Soil Type Factsheets

Comparing Similar Factsheets: It is useful to compare Factsheet descriptions for similar Soil Types. Unlike the Vegetation Types, there is no ordination diagram for the soils to help in the determination of similar Types. However, as far as possible the Factsheets are organized in the manual so that similar Soil Types are adjacent to each other (e.g. if you key to an S5, compare it with S4 and S6 Factsheets). Sometimes the Comments section of a Factsheet will draw attention to similar Types.

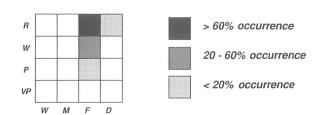
For some deep soils, users may have difficulty deciding between a soil moisture regime that is very fresh (MR=3) or moderately moist (MR=4), thus putting the soil on the borderline of a major division point in the S-Type key. In such cases, the Factsheets for those S-Types with similar textures on each side of the moisture regime cut-off (Moisture Regime  $\geq$  4) might be compared to determine which is a better "fit" for the soil in question.

As with the Vegetation Types, comparative procedures like these may occasionally lead to a reallocation if the user determines that it is justified (see Section 2.2.3).

**Soil Type Diagrams:** Each Soil Type Factsheet contains 2 illustrations which display some characteristic properties of the Type. There are 3 concepts used:

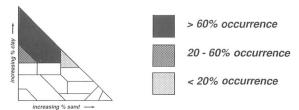
a) A cross-tabulation of grouped moisture regime and drainage classes within the Soil Type. The class groupings employed here are the same as those defined for the V-Type Factsheets (see Section 2.2.4). These illustrations are included in every Soil Type Factsheet.

e.g.



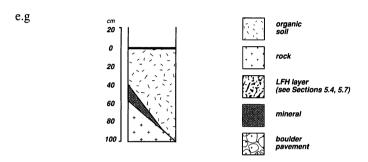
b) A soil texture triangle illustrating C horizon texture classes, according to frequency of occurrence, within the Soil Type. Sub-divisions of the triangle are defined in Section 5.1. These illustrations are included in Factsheets for *S1-S10* and *SS5-SS8*.

e.g.



## Soil Types

c) A representative soil profile showing general substrate classes and ranges of possible substrate depths (in cm) for the Soil Type. Hatching conventions correspond to those employed in the stand cross-sectional diagrams on the V-Type Factsheets. These illustrations are included in Factsheets for *S11*, *S12S*, *S12F*, *SS1-SS4* and *SS9*.



**Frequency Superscripts:** In the Soil Type Factsheets, superscripts attached to the soil/site descriptor classes indicate frequency of occurrence within the entire Soil Type sample (see Section 2.2.3). If a certain soil/site descriptor was absent in at least 10% of the sample plots, a "not present" or "none" category is included in the descriptor summary.

e.g. (S-Type) Depth to Mottles / Gley: none  $^9$ ,  $(51-75)^1$ 

90% (85-94% range) of the soils sampled for this S-Type had no mottles or gley within 100 cm of the mineral soil surface. In 10% (5-14% range) of the sample, mottles and/or gley colours were observed at depths between 51 and 75 cm below mineral surface.

e.g. (SS-Type) C Texture: not present 6, silt loam 2, silt 1, sandy clay loam 1

No C horizon was present in 60% (55-64% range) of the soils sampled for this SS-Type. In 20% (15-24% range) of the soils, the C horizon was textured to a silt loam. Silt and sandy clay loam were each observed in 10% (5-14% range) of the sampled pits.

**Depth Classes:** Depth classes give ranges of depths as measured from the appropriate soil surface. For mineral soils, depth is measured from the mineral soil surface; for organic soils, from the top of the organic layer (see Section 3.1.3).

e.g. Depth to Carbonates: none  $^6$ ,  $(\le 50)^3$ ,  $(>50)^1$ 

Carbonates were encountered at a depth of 50 cm or less (below the soil surface) in 30% (25-34% range) of the soils sampled for this Type. In 10% (5-14% range) of the cases they were noted at a depth of greater than 50 cm; 60% (55-64% range) of the time no carbonates were present in the profile.

**Typical Horizons:** Due to natural variability, numerous horizon sequences were encountered within the soil profiles of each Soil Type sample. This section of each Soil Type Factsheet does not suggest typical sequences, it just summarizes the most common horizons observed in the Type sample. Listed horizons occurred in at least 40% of the profiles in the Type sample; highlighted horizons occurred in at least 67% of the cases. Several examples of profiles found commonly in the forest soils of NW Ontario are presented in Section 3.4.

**SS-Type Naming Conventions:** Depth class terminology used in the titles of the SS-Types (e.g. "very shallow") is modelled on that adopted in the modified moisture regime / drainage tables for shallow soils in the *Field Manual for Describing Soils* (Ontario Institute of Pedology 1985). These tables are presented in Section 5.2.

**Decomposition Classes:** For organic Soil Types (*S12F*, *S12S*, *SS9*) texture summaries are replaced by summaries of the degree of organic material decomposition in the top and bottom 25 cm of the organic profile (to a maximum depth of 100 cm). The classes used (fibric, mesic, humic) are described in Sections 5.4 and 5.6.

**Depth to Mineral Contact:** This section, presented only for the organic Soil Types (**S12F**, **S12S**, **SS9**), summarizes depth from the surface of the organic layer to underlying mineral material (either bedrock or mineral soil).

## 3.2.4. Terminology Used in the Soil Type Factsheets

**Forest Humus Form:** A key to forest humus classification is presented in Section 5.5. The humus forms are defined in detail in the CanSIS *Manual for Describing Soils in the Field* (Working Group on Soil Survey Data 1978). In the **Comments** section of each Factsheet, reference to the "forest humus condition" includes information on typical humus form and thickness. Thickness classes are defined as follows:

very thin LFH predominantly 0-5 cm thick

thin LFH and/or O predominantly 1-15 cm thick thick LFH and/or O predominantly 16-40 cm thick deep LFH and/or O predominantly >40 cm thick

**Soil Texture:** Mineral soil texture classes follow the conventions outlined in the CanSIS *Manual for Describing Soils in the Field* (Working Group on Soil Survey Data 1978) and the *Field Manual for Describing Soils* (Ontario Institute of Pedology 1985). The texture classes are presented graphically in the standard soil texture triangle in Section 5.1. In the Factsheets, size classes for the dominant sand fraction are distinguished in the sands (e.g. very fine sand) and loamy sands (e.g. loamy medium sand) but not in the silty sands, sandy loams, sandy clay loams and sandy clays.

**Moisture Regime / Drainage:** Soil moisture regime and drainage are described by 11 moisture regime classes and 7 drainage classes derived using standard tables (Ontario Institute of Pedology 1985; see Section 5.2). Additional tables for shallow and stratified soils are provided in Section 5.2.

Mode of Deposition: Landform soil material classes are defined in Section 5.7.

**Soil Horizons:** Symbolic designations for and brief descriptions of some of the more common soil horizons encountered in the forest soils of NW Ontario are presented in Sections 5.3 and 5.6.

**Taxonomic Soil Classes:** In the **Comments** section of each Factsheet, reference is made to commonly observed taxonomic classes of soils (e.g. Podzols, Brunisols) within the NWO FEC Soil Type. These classes follow the definitions of *The Canadian System of Soil Classification* (Canada Soil Survey Committee, Subcommittee on Soil Classification 1978). A generalized classification of Ontario soils is outlined in the *Field Manual for Describing Soils* (Ontario Institute of Pedology 1985).

**Varving:** Distinct bands or varves in a soil profile represent an annual deposition of sedimentary materials. Varving usually consists of two layers: a thicker, light-coloured layer of silt and/or very fine sand laid down during the spring and summer and a thinner, dark-coloured layer of clay laid down in the fall and winter. In NW Ontario varving is typically observed in glaciolacustrine deposits.

## 3.3. Soil Type Modifiers

#### 3.3.1. General

There are other site and soil parameters, in addition to those directly considered in the NWO FEC soil classification, which are relevant to forest management considerations. These include such factors as ground surface stoniness, the proportion of sub-surface coarse fragments within the soil profile, the surface organic layer (or "duff") characteristics of mineral soils, calcareousness of parent materials and the topographic variability of the landscape including site aspect, degree of slope and topographic position. Such factors may modify the local interpretation of a given Soil Type for management purposes (see *Northwestern Ontario Forest Ecosystem Interpretations*, Racey et al 1989 for management interpretations).

These additional site and soil parameters can, if desired, be assessed in the field in conjunction with the diagnostic criteria for the NWO FEC soil keys. They could be recorded with the Soil Types as supplementary attributes, perhaps with a specialized coding notation (eg.  $SB_{5ct}$  for an SB soil with class 5 coarse fragment content, calcareous parent material and a toe slope position). Since they represent the spatial distribution of conditions across the landscape, these attributes are readily applied in mapping programs.

## 3.3.2. Examples of Soil Type Modifiers

**Coarse Fragment Content:** Soil particles with a diameter > 2 mm are termed "coarse fragments" (Working Group on Soil Survey Data 1978; Ontario Institute of Pedology 1985). Coarse fragments are further defined in classes of both size and shape (e.g. gravel, cobbles and stones). In NW Ontario, soils developed in morainal parent materials (see Section 5.7) are likely to have a significant coarse fragment content; most (glacio)fluvial materials also contain high coarse fragment fractions.

Coarse fragment content in soils is described by estimating the volumetric percentage of each coarse fragment class throughout the profile (or by horizon). The NWO FEC program employed 5 classes of soil coarse fragment content:

$$(<5\%), (6-20\%), (21-35\%), (36-50\%), (>50\%)$$

**Surface stoniness** is described by estimating the percentage of the land surface covered by fragments coarser than 15 cm in diameter. Conventions for defining classes of surface stoniness are provided in the CanSIS *Manual for Describing Soils in the Field* (Working Group on Soil Survey Data 1978) and the *Field Manual for Describing Soils* (Ontario Institute of Pedology 1985).

A significant coarse fragment content reduces the effective rooting medium of a soil and can reduce the productivity of boreal tree species, although this relationship is currently poorly understood. The capacity for both moisture and nutrient retention is lowered since the proportion of soil matrix is decreased relative to that in non-fragmental soils. Drainage is enhanced in soils with high coarse fragment percentages, often equivalent to a change of Drainage Class (see Section 5.2). Depending on their size, shape and abundance, soil coarse fragments and surface stones can pose hazards to machinery and constitute a hindrance to forestry operations.

**Calcareousness:** Soil calcareousness is determined by placing a few drops of 10% hydrochloric acid (HCl) on a small sample of soil material (Working Group on Soil Survey Data 1978). The sample is then observed for effervescence ("fizz") indicating the presence of free calcium (often with magnesium) carbonates. In NW Ontario, calcareous soils are most frequently associated with (glacio) lacustrine deposits.

Soils developed in calcareous parent materials provide a modified nutritional environment for vegetation, relative to non-calcareous soils. This may have implications for timber species management (see *Northwestern Ontario Forest Ecosystem Interpretations*, Racey et al 1989). Buffering capacity against soil acidification and clay particle or cation translocation is higher in calcareous soils. Soil structure may be altered as a result of carbonates in the soil (e.g. cementation or hardpan layers), thereby restricting penetration of air, water and plant roots.

**Slope:** Slope is standardly assessed as a percentage of vertical rise relative to horizontal distance (see the CanSIS *Manual for Describing Soils in the Field* for slope class definitions). Due to the broken, irregular nature of the landscape in NW Ontario, slope condition can be important as a local site factor. Shallow soils, often developed in morainal materials, tend to be associated with high slope percentages.

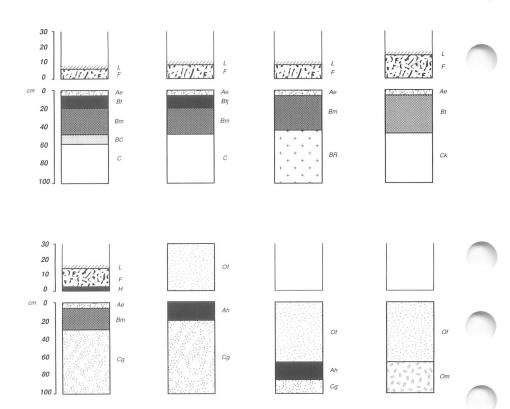
Due to a greater degree of lateral water flow (i.e. seepage and surface runoff), sites with significant slope tend to retain less soil moisture than those on more level landscape positions. Moisture holding capacity can be severely limited in shallow soils with high slope and coarse fragment percentages. Slope directly influences the risk of soil erosion (see *Northwestern Ontario Forest Ecosystem Interpretations*, Racey et al 1989) resulting from surface runoff. Slope percentage may pose limitations on machinery selection in certain locations.

**Topographic Position:** Site position along a slope gradient can be described using 7 classes, defined in the *Field Manual for Describing Soils* (Ontario Institute of Pedology 1985). These range from crest and upper slope positions to lower slopes, toe slopes and depressions.

The topographic position of a site is generally correlated with its relative moisture status due to conditions of lateral water flow influenced by slope (see above). For example, upper slope sites shed soil moisture to sites on lower slope positions.

## 3.4. Common Soil Profiles

Several soil profiles, common to forest soils in Northwestern Ontario, are illustrated here. Horizon sequences and thicknesses vary considerably from site to site.





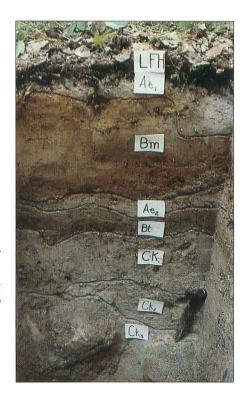
Bedrock knoll

SS3; Very Shallow Soil on Bedrock (p. 109)





Ground moraine



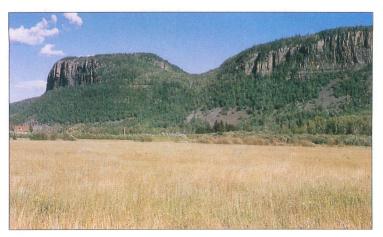
S3; Fresh / Coarse Loamy soils (p. 96)



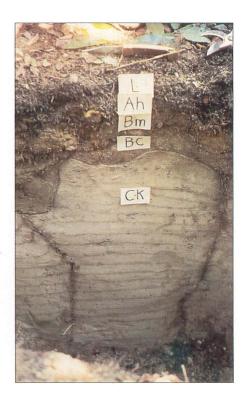
Sand dune deposit



S2; Fresh / Fine Sandy soils (p. 95)



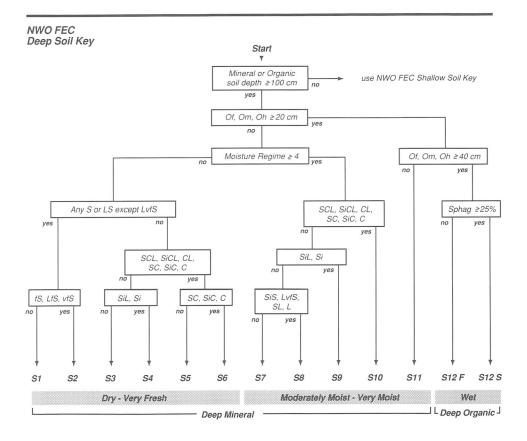
Lacustrine plain

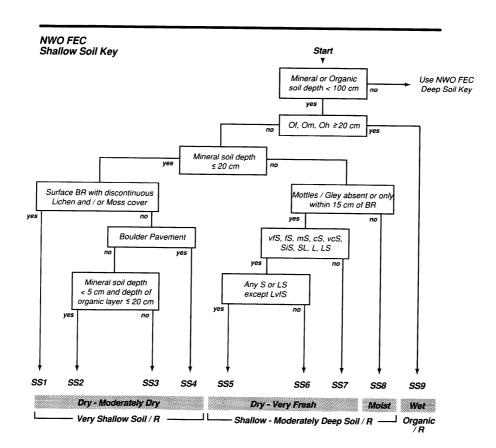


S4; Fresh / Silty - Silt Loamy soils (p. 97)

# 3.5. Soil Types Allocation Keys and Factsheets

Deep Mineral	S1 S2 S3 S4 S5 S6	Dry / Coarse Sandy Fresh / Fine Sandy Fresh / Coarse Loamy Fresh / Silty - Silt Loamy Fresh / Fine Loamy Fresh / Clayey
<u>e</u>	S7 S8 S9 S10 S11	Moist / Sandy Moist / Coarse Loamy Moist / Silty - Silt Loamy Moist / Fine Loamy - Clayey Moist / Peaty Phase
onganic Oudanic	S12F S12S	Wet / Organic [Feathermoss] Wet / Organic [Sphagnum]
Very Shallow	SS1 SS2 SS3 SS4	Discontinuous Organic Mat on Bedrock Extremely Shallow Soil on Bedrock Very Shallow Soil on Bedrock Very Shallow Soil on Boulder Pavement
Shallow to Mod. Deep	SS5 SS6 SS7	Shallow - Moderately Deep / Sandy Shallow - Moderately Deep / Coarse Loamy Shallow - Moderately Deep / Silty - Fine Loamy - Clayey Shallow - Moderately Deep / Mottles - Gley
Š≅	SS9	Shallow - Moderately Deep / Organic - Peaty Phase





## Dry / Coarse Sandy

#### General Description (n=281)

Moderately dry, medium to very coarse sandy soils. Developed primarily in glaciofluvial parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>3</sup>

Forest Humus Form: fibrimor 6, humifibrimor 2, raw

moder 1

Surface Texture: silty sand 2, sandy loam 2, loamy

medium sand 1, fine sand 1,

medium sand 1, loamy fine sand 1,

other 2

C Texture: medium sand 4, coarse sand 3,

v. coarse sand 2, loamy medium

sand 1

Depth to Mottles / Gley: none  $^9$ , (> 50)  $^1$ 

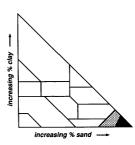
Depth to Carbonates: none 9,  $(\le 50)^{1}$ ,  $(> 50)^{1}$ 

Moisture Regime / Drainage: mod. dry7, mod. fresh 1, fresh 1 /

rapid<sup>5</sup>, v. rapid<sup>4</sup>, well <sup>1</sup>

Mode of Deposition: glaciofluvial 6, morainal 3,

lacustrine 1



#### Typical Horizons

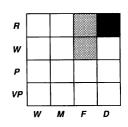
L. F. Ae, Bf, Bm, BC, C

#### Forest Floor Cover and Associated Vegetation

S1 soils are most commonly associated with mixedwood and conifer stands containing a significant component of jack pine. Black spruce and, in the NW Region, red pine dominated stands are also common. Forest floor cover is usually feathermoss dominated, with varying proportions of broadleaf and conifer litter.

#### Comments

S1 is a diverse Type found commonly throughout NW Ontario. Coarse fragment content ranges from none to over 50% of the soil volume. The forest humus condition is typically a thin fibrimor. Soils of this Type are generally classified as either Brunisols or Podzols. Morainal and lacustrine parent materials are more common in the NC Region. Surface textures tend, on average, to be coarser in the NW Region. No calcareous S1 soils were sampled in the NW Region; these occur primarily in glaciofluvial deposits to the east of Lake Nipigon. On bedrock controlled topography, soils of S1 may intergrade with those of SS5.



## Fresh / Fine Sandy

#### General Description (n=234)

Moderately fresh, fine or very fine sandy soils. Developed mainly in glaciofluvial and morainal parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>2</sup>
Forest Humus Form: fibrimor<sup>7</sup>, humifibrimor<sup>2</sup>

Surface Texture: fine sand <sup>2</sup>, loamy fine sand <sup>2</sup>,

sandy loam <sup>1</sup>, silty sand <sup>1</sup>, v. fine sand <sup>1</sup>, loamy v. fine sand <sup>1</sup>, medium sand <sup>1</sup>, silt loam <sup>1</sup>

C Texture: fine sand 5, loamy fine sand 3,

v. fine sand <sup>2</sup>

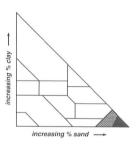
Depth to Mottles / Gley: none  $^8$ ,  $(51-75)^1$ Depth to Carbonates: none  $^9$ ,  $(>50)^1$ 

Moisture Regime / Drainage: mod. fresh<sup>6</sup>, fresh<sup>2</sup>, v. fresh<sup>2</sup>,

mod. dry<sup>1</sup> / rapid <sup>6</sup>, well <sup>2</sup>, v. rapid <sup>1</sup>, imperfect <sup>1</sup>, mod. well <sup>1</sup>

Mode of Deposition: glaciofluvial<sup>5</sup>, morainal<sup>3</sup>,

lacustrine<sup>2</sup>



#### Typical Horizons

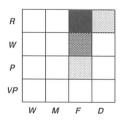
L, F, Ae, Bf, Bm, BC, C

#### Forest Floor Cover and Associated Vegetation

S2 soils are most commonly associated with jack pine / black spruce stands (this is especially true in the NW Region). The forest floor is covered predominantly by feathermoss, with scattered patches of broadleaf and conifer litter.

#### Comments

S2 is a common and diverse Type throughout NW Ontario. Although high proportions of coarse fragments can occur, soils of this Type are often pure sands. The forest humus condition is typically a thin fibrimor. These soils are primarily classified as Brunisols and Podzols. In the NW Region, S2 soils develop primarily in glaciofluvial deposits; in the NC Region, morainal and glaciofluvial parent materials are equally probable. Surface textures, on average, tend to be coarser in the NW Region. No calcareous S2 soils were sampled in the NW Region; these are most common in glaciofluvial and lacustrine deposits to the east of Lake Nipigon. On bedrock controlled topography, these soils may intergrade with soils of SS5.



### Fresh / Coarse Loamy

#### General Description (n=236)

Fresh, coarse loamy soils. Developed mainly in morainal and glaciofluvial parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] - (6-15) 7, (1-5) 2, (16-25) 1

Forest Humus Form: fibrimor <sup>6</sup>, humifibrimor <sup>2</sup>, raw moder <sup>1</sup>

mode

Surface Texture: silty sand 3, sandy loam 3, silt loam 1, loamy fine sand 1, other 2

C Texture: silty sand 4, sandy loam 2, loamy

v. fine sand 2, loam 1

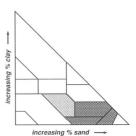
Depth to Mottles / Gley:  $none^{9}, (51-75)^{1}, (76-100)^{1}$ Depth to Carbonates:  $none^{9}, (>50)^{1}, (\le 50)^{1}$ 

Moisture Regime / Drainage: fresh 6, mod. fresh 2, v. fresh 1,

mod. dry<sup>1</sup> / well<sup>5</sup>, rapid<sup>3</sup>, v. rapid<sup>1</sup>, imperfect<sup>1</sup>, mod. well<sup>1</sup>

Mode of Deposition: morainal 5, glaciofluvial 4,

lacustrine 1



#### Typical Horizons

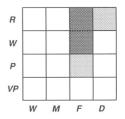
L, F, Ae, Bf, Bm, BC, C

#### Forest Floor Cover and Associated Vegetation

S3 soils are associated with a broad range of forest conditions in NW Ontario. Forest floor cover is extremely variable, containing significant components of feathermoss and broadleaf or conifer litter, depending on stand conditions.

#### Comments

This diverse S-Type is very common throughout NW Ontario. S3 soils which have developed in morainal parent materials typically contain a high proportion of coarse fragments. In glaciofluvial and lacustrine deposits the coarse fragment content is usually much lower. Within the profile, contrast between surface and subsurface textures tends to be low. The forest humus condition is typically a thin fibrimor. Soils of this Type are generally classified as Brunisols or Podzols. Calcareous S3 soils are extremely uncommon in the NW Region; these are found primarily in the Central Plateau section of the NC Region. On bedrock controlled topography, soils of S3 may intergrade with those of SS6.



## Fresh / Silty - Silt Loamy

#### General Description (n=98)

Fresh, silty or silt loamy soils. Primarily developed in lacustrine and glaciofluvial parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] -  $(6-15)^7$ ,  $(1-5)^2$ ,  $(16-25)^1$ 

Forest Humus Form: fibrimor 5, humifibrimor 2, raw moder 1, medium mull 1

Surface Texture: silt loam 5, silty sand 1, sandy

loam 1, silt 1, other 3 silt loam 8 silt 2

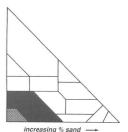
C Texture: Depth to Mottles / Glev: none  $^{7}$ ,  $(51-75)^{2}$ ,  $(76-100)^{1}$ 

Depth to Carbonates: none 5,  $(\le 50)^3$ ,  $(> 50)^2$ Moisture Regime / Drainage: fresh<sup>7</sup>, v. fresh<sup>3</sup> / well<sup>5</sup>,

mod. well<sup>3</sup>, imperfect <sup>1</sup>, rapid <sup>1</sup>

Mode of Deposition: lacustrine 5, glaciofluvial 3,

morainal 1, fluvial 1



#### Typical Horizons

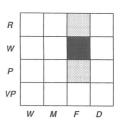
L. F. Ae. Bm. Ck

#### Forest Floor Cover and Associated Vegetation

Upland, black spruce stands are often associated with \$4 soils, especially in the NW Region. In addition, a variety of mixedwood stand conditions is encountered. Forest floor cover is usually dominated by a mixture of broadleaf litter and feathermoss.

#### Comments

S4 is most common in deep lacustrine and glaciofluvial deposits in the eastern Central Plateau section (NC Region) and in the Dryden and Lac Seul areas (NW Region). Silt loamy soils represent the dominant condition within the Type; silty soils are rare, occurring mainly to the northeast of L. Superior. Coarse fragment content is characteristically low (< 20%). The forest humus condition is typically a thin fibrimor. Bt horizons are occasionally present. S4 soils are generally classed as Brunisols; Podzols and Luvisols are less common. Carbonates are often present in S4 soils of the NC Region, where they tend to occur within 50 cm of the soil surface; calcareousness is less common in the NW Region. On bedrock controlled topography, soils of S4 may intergrade with those of SS7.



## Fresh / Fine Loamy

#### General Description (n=43)

Fresh, fine loamy soils. Most commonly developed in lacustrine parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: (LFH) - (6-15)<sup>7</sup>, (1-5)<sup>2</sup>, (16-25)<sup>1</sup>

Forest Humus Form: fibrimor 5, humifibrimor 3, raw

moder 1

Surface Texture: sandy loam 2, clay 2, loam 1, silty

clay 1, silt loam 1, silty sand 1,

other 3

C Texture: silty clay loam 5, sandy clay

loam 3, clay loam 1

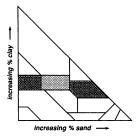
 Depth to Mottles / Gley:
 none  $^8$ , (76-100)  $^1$ , (51-75)  $^1$  

 Depth to Carbonates:
 none  $^3$ , (≤ 50)  $^4$ , (> 50)  $^3$ 

Moisture Regime / Drainage: fresh 8, v. fresh 2 / well 5, mod. well 4, imperfect 1

Mode of Deposition: lacustrine 6, morainal 2,

glaciofluvial<sup>2</sup>



#### **Typical Horizons**

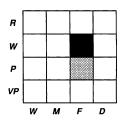
L, F, Ae, Bt, Bm, Ck

#### Forest Floor Cover and Associated Vegetation

S5 soils are most commonly associated with shrub rich, hardwood dominated stands. The forest floor cover typically has a high component of broadleaf litter.

#### Comments

S5 is uncommon throughout NW Ontario; it is most frequently encountered in the eastern Central Plateau section of the NC Region. These are fine-textured soils, frequently with Bt horizons. Coarse fragment content is typically low (< 20%). Carbonates are present in the majority of S5 soils, occurring at any depth in the profile. The forest humus condition is generally a thin fibrimor or humifibrimor. Soils of this Type are most commonly classed as Brunisols or Luvisols; Podzols occur occasionally. Morainal and glaciofluvial parent materials are common in the NC Region; in the NW Region, S5 soils develop primarily in lacustrine deposits.



#### General Description (n=168)

Fresh, clayey soils. Typically developed in lacustrine parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>2</sup>

Forest Humus Form: fibrimor <sup>5</sup>, humifibrimor <sup>2</sup>, raw

moder 1, medium mull 1, fine

mull 1

Surface Texture: clay 5, silty clay 1, silt loam 1, clay

loam 1, silty clay loam 1

C Texture: clay <sup>7</sup>, silty clay <sup>2</sup>, sandy clay <sup>1</sup> Depth to Mottles / Gley: none <sup>8</sup>, (76-100) <sup>1</sup>, (51-75) <sup>1</sup>

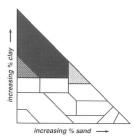
Depth to Carbonates:  $(76.100)^4$ ,  $(50)^4$ ,  $(50)^2$ 

Moisture Regime / Drainage: fresh 8, v. fresh 2 / mod. well8,

well 1, imperfect 1

Mode of Deposition: lacustrine 8, morainal 1,

glaciofluvial 1



#### Typical Horizons

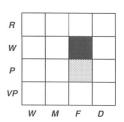
L, F, Ae, Bt, Ck

#### Forest Floor Cover and Associated Vegetation

S6 soils are most commonly associated with shrub rich, hardwood dominated stands. Balsam fir and black spruce mixedwoods are also frequently encountered. Forest floor cover is mainly broadleaf litter

#### Comments

S6 soils are frequently encountered in lacustrine deposits in the Dryden, Lac Seul and Lake of the Woods areas (NW Region) and to the southwest of Thunder Bay (NC Region). In the Geraldton / Longlac area of the eastern Central Plateau (NC Region), these soils tend to develop in clay tills (reworked lacustrine materials). Coarse fragment content in S6 soils is typically low (< 20%). Bt horizons are common in the profile. Lacustrine parent materials are often varved. The majority of S6 soils are calcareous. The forest humus condition is generally a thin fibrimor or humifibrimor, although mull and moder humus forms occur regularly (especially in the NW Region). These soils are usually classed as either Brunisols or Luvisols. In the NW Region, carbonates tend to be found deeper in the soil profile (> 50 cm) than in the NC Region. Sandy clays were not encountered in the NW Region.



### Moist / Sandy

#### General Description (n=101)

Moderately moist to very moist, sandy soils. Developed in a range of parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] -  $(6-15)^6$ ,  $(16-25)^2$ ,  $(1-5)^2$ 

Forest Humus Form: humifibrimor 4, fibrimor 4,

fibrihumimor 1

silty sand 2, v. fine sand 2, loamv Surface Texture:

fine sand 1, fine sand 1, sandy loam 1, medium sand 1, silt loam 1

C Texture: loamy fine sand 3, v. fine sand 2,

fine sand 2, medium sand 1,

coarse sand 1

 $(\le 15)^3$ ,  $(16-30)^3$ ,  $(31-50)^2$ . Depth to Mottles / Gley:

 $(51-75)^2$ 

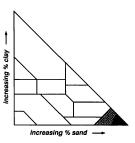
none 9, present 1 Depth to Carbonates:

mod. moist<sup>3</sup>, v. moist<sup>3</sup>, moist<sup>3</sup>/ Moisture Regime / Drainage:

imperfect 6, poor 3, mod. well 1

morainal<sup>3</sup>, glaciofluvial<sup>3</sup>,

lacustrine 3 fluvial 1



#### Typical Horizons

Mode of Deposition:

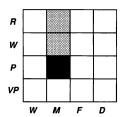
L, F, H, Ae, Bf, Bm, Cg

#### Forest Floor Cover and Associated Vegetation

S7 soils are most frequently associated with stands containing a significant component of jack pine and/or black spruce. Forest floor cover is often dominated by feathermoss, usually with patches of broadleaf litter.

#### Comments

S7 soils are most common in the Central Plateau and Superior sections of the NC Region. Coarse fragment content is generally low (< 20%). Mottles can occur at any depth in the profile. Calcareous conditions are rare in S7 soils throughout NW Ontario. The forest humus condition is generally a thin humifibrimor or fibrimor. These soils are commonly classified as Podzols or Gleysols, although some Brunisols are found. In the NW Region, S7 soils develop mainly in glaciofluvial deposits; in the NC Region, morainal and lacustrine parent materials are also common. Fibrimors are the predominant forest humus forms in the NW Region; humifibrimors are most common in the NC Region.



#### General Description (n=112)

Moderately moist to very moist, coarse loamy soils. Developed in a range of parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] - (6-15)<sup>5</sup>, (1-5)<sup>1</sup>, (16-25)<sup>1</sup>, (26-39)<sup>1</sup>

[O] - (6-15)<sup>1</sup>

Forest Humus Form: fibrimor <sup>4</sup>, humifibrimor <sup>2</sup>, fibric

peatymor<sup>1</sup>, fibrihumimor<sup>1</sup>,

other 2

Surface Texture: silty sand 3, sandy loam 2, loamy

fine sand <sup>1</sup>, loam <sup>1</sup>, silt loam <sup>1</sup>, loamy v. fine sand <sup>1</sup>

C Texture: silty sand 4, sandy loam 3, loam 1, loamy v. fine sand 1

Depth to Mottles / Gley:  $(31-50)^3$ ,  $(16-30)^2$ ,  $(\le 15)^2$ ,

 $(51-75)^2$ 

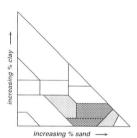
Depth to Carbonates: none  $^8$ , (>50)  $^1$ ,  $(\le 50)$   $^1$ 

Moisture Regime / Drainage: v. moist 4, mod. moist 3, moist 3 /

imperfect 6, poor 3

Mode of Deposition: morainal 4, glaciofluvial 3,

lacustrine<sup>2</sup>, fluvial<sup>1</sup>



#### Typical Horizons

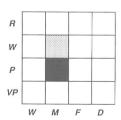
L, F, H, Ae, Bm, Cg

#### Forest Floor Cover and Associated Vegetation

S8 soils are associated with a broad range of vegetation conditions. Forest floor cover is accordingly variable.

#### Comments

S8 is a diverse Type found commonly throughout NW Ontario. When developed in morainal parent materials, S8 soils can have a high coarse fragment content. Generally, however, the percentage is low (< 20%). Mottles typically occur within 50 cm of the surface. The forest humus condition ranges across many humus forms and several thicknesses. Most of these soils are classed as Gleysols; Podzols and Brunisols occur infrequently. In the NW Region, soils of this Type develop commonly in glaciofluvial deposits; morainal and lacustrine parent materials predominate in the NC Region. Carbonates are more frequently encountered in the NC Region than in the NW Region. Fibrimor is the prevalent forest humus form in the NW Region; humifibrimors and fibrimors are equally probable in the NC Region. In both regions, other humus forms occur occasionally.



## Moist / Silty - Silt Loamy

#### General Description (n=55)

Very moist, silty or silt loamy soils. Developed mainly in lacustrine and glaciofluvial parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] - (6-15) 7, (16-25) 1, (1-5) 1

Forest Humus Form: fibrimor <sup>5</sup>, humifibrimor <sup>3</sup>,

fibrihumimor 1

Surface Texture: silt loam 4, sandy loam 1, loam 1,

silt 1, other 3

C Texture: silt loam 8, silt 2

Depth to Mottles / Gley:  $(\le 15)^3$ ,  $(31-50)^3$ ,  $(16-30)^2$ ,

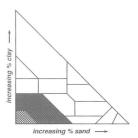
 $(51-75)^{1}$ 

Depth to Carbonates: none 6,  $(\le 50)^3$ ,  $(> 50)^1$ 

Moisture Regime / Drainage: v. moist 5, mod. moist 3, moist 2 / imperfect 6, poor 3, mod. well 1

Mode of Deposition: lacustrine <sup>4</sup>, glaciofluvial <sup>4</sup>,

morainal 1, fluvial 1



#### Typical Horizons

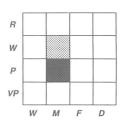
L, F, H, Ah, Ae, Bm, Cg, Ckg

#### Forest Floor Cover and Associated Vegetation

S9 soils are associated with a broad range of vegetation conditions. Forest floor cover is accordingly variable.

#### Comments

S9 occurs infrequently throughout NW Ontario. Silt loamy soils represent the dominant S9 condition; silts occur mainly to the northeast of L. Superior. Coarse fragment percentage is generally low (< 20%). Mottles and/or gley colours are usually found within 50 cm of the surface. B horizons (Bm, Bf, Bg, Bt and BC) can occur in various combinations or be absent from the profile altogether. The forest humus condition tends to be a thin fibrimor or humifibrimor. These soils are mainly classed as Gleysols or, less frequently, Brunisols. No silty soils were sampled in the NW Region, although some varved deposits may have had a higher silt content than was recorded. Fibrimor is the prevalent forest humus form in the NW Region; humifibrimors and fibrimors are equally probable in the NC Region. Calcareous \$9 soils occur most commonly to the northeast of L. Superior; when present, carbonates are usually found within 50 cm of the soil surface. Calcareousness is rare in the NW Region.



## Moist / Fine Loamy - Clavey

#### General Description (n=92)

Very moist, fine loamy or clayey soils. Typically developed in lacustrine parent materials.

#### Soil / Site Characteristics

Thickness of Organic Laver:  $[LFH] - (6-15)^6$ ,  $(16-25)^2$ ,  $(1-5)^4$ ,

Forest Humus Form: humifibrimor 3, fibrimor 3,

fibrihumimor 1 raw moder 1 fine

mull 1, medium mull 1

Surface Texture: clay<sup>3</sup>, silty clay loam<sup>1</sup>, silty clay<sup>1</sup>,

sandy clay loam 1, sandy clay 1, silt loam 1, clay loam 1, loamy fine

sand 1, sandy loam 1

C Texture: clay 4, silty clay loam 2, silty clay 2, clay loam 1, sandy clay loam 1,

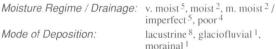
sandy clay 1

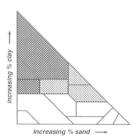
Depth to Mottles / Gley:  $(\leq 15)^4$ ,  $(16-30)^3$ ,  $(31-50)^2$ ,

 $(51-75)^2$ 

none 5,  $(\le 50)^4$ ,  $(> 50)^2$ Depth to Carbonates:

lacustrine 8, glaciofluvial 1, Mode of Deposition:





#### Typical Horizons

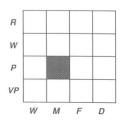
L, F, H, Ah, Bt, Cg, Ckg

#### Forest Floor Cover and Associated Vegetation

S10 soils are most commonly associated with shrub rich hardwood and mixedwood stands, often with balsam fir and/or black spruce as main conifer components. Balsam poplar and black ash stands are also found on S10 soils. Forest floor cover consists mainly of broadleaf litter with patches of Sphagnum and feathermoss.

#### Comments

S10 is most common in lacustrine materials southwest of Thunder Bay. Coarse fragment content is characteristically low (< 20%) in these soils. Mottles / gley and carbonates (when present) usually occur within 50 cm of the soil surface. Bt horizons are frequently present in the profile. The forest humus condition is variable, ranging from thin to thick and encompassing many different humus forms. Soils of this Type are most often classed as Gleysols, although some Luvisols and Brunisols occur. In the NC Region, the majority of S10 soils are calcareous; carbonates are less common in the NW Region. In the NW Region, clay soils represent the dominant S10 condition; in the NC Region, clay and fine loamy textures are equally probable.



## Moist / Peaty Phase

#### General Description (n=38)

Very moist, peaty phase mineral soils. The forest humus condition is a thick, typically fibric, peatymor. Developed in a range of parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [O] - (26-39)<sup>7</sup>, (16-25)<sup>3</sup>

Forest Humus Form: fibric peatymor 8, humic peatymor 1,

mesic peatymor 1

Surface Texture: v. fine sand 2, sandy loam 2, fine

sand 1, medium sand 1, silt loam 1,

silty sand 1, clay 1, loam 1

C Texture: silty sand 2, silt loam 2, sandy loam 1,

clay <sup>1</sup>, medium sand <sup>1</sup>, fine sand <sup>1</sup>, silt <sup>1</sup>, v. fine sand <sup>1</sup>, loamy v. fine

sand 1

Depth to Mottles / Gley:  $(\le 15)^3$ ,  $(31-50)^3$ ,  $(16-30)^2$ ,

 $(51-75)^{1}$ 

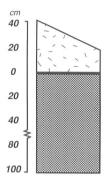
Depth to Carbonates: none  $^7$ ,  $(\le 50)^2$ ,  $(> 50)^1$ 

Moisture Regime / Drainage: v. moist 6, moist 2, mod. moist 2 /

imperfect 4, poor 3, v. poor 2

Mode of Deposition: lacustrine 3, glaciofluvial 3, organic 3,

fluvial 1, morainal 1



#### Typical Horizons

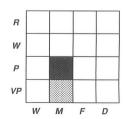
Of, Ah, Cg

#### Forest Floor Cover and Associated Vegetation

S11 soils are associated with moisture-tolerant vegetation conditions, most commonly black spruce stands. Forest floor cover is dominated by Sphagnum and feathermoss.

#### Comments

Although classified as a mineral soil condition, S11 is characterized by a 20-39 cm thick organic mat composed mainly of Sphagnum moss. Soils of this Type are typically situated in moist, low-lying, often depressional, landscape positions. Mottles or gley colours are typically found within 50 cm of the mineral surface. These soils are generally classed as "peaty phase" Gleysols. In the NC Region, calcareous S11 soils are most common in the eastern Central Plateau section; carbonates are not common in the NW Region. Soils of S11 may intergrade with those of S12F and S12S in areas with shallow peat deposits.



## Wet / Organic [Feathermoss]

#### General Description (n=96)

Moderately wet, organic soils with hummocky microtopography. Ground cover is dominated by feathermoss. Fibric and mesic peatymor forest humus forms are typical.

#### Soil / Site Characteristics

Thickness of Organic Laver:

Forest Humus Form:

Decomposition Class (top):

Decomposition Class (bottom):

Depth to Mineral Contact:

Moisture Regime / Drainage:

Mode of Deposition:

 $[O] - (\geq 40)^{10}$ 

fibric peatymor 6, mesic peatymor<sup>3</sup>, humic peatymor<sup>1</sup>

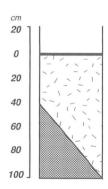
fibric 8, mesic 1, humic 1

fibric 4, mesic 3, humic 3  $(> 100)^6$ ,  $(40-60)^2$ ,  $(81-100)^1$ .

 $(61-80)^{1}$ 

mod, wet 4, wet 3, v. moist 2, v. wet 1 / v. poor 10

organic 10



### Typical Horizons

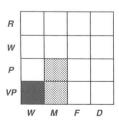
Of, Om, Oh

#### Forest Floor Cover and Associated Vegetation

Soils of S12F are associated with moisture-tolerant forest conditions. Black spruce, white cedar, tamarack and black ash stands are characteristic. Forest floor cover is dominated by a feathermoss / Sphagnum mat with patches of broadleaf and conifer litter.

#### Comments

S12F soils are most common in the Central Plateau section of the NC Region. They develop in wet, poorly drained, low-lying or depressional sites. Mottles or gley colours are typically present if mineral soil appears in the profile. Like those of S12S, these deep organic soils are chiefly derived from Sphagnum spp. and are typically classed as Fibrisols or Mesisols. Soils of S12F differ from those of S12S according to the degree of feathermoss cover on the ground surface; surface microclimatic conditions tend to be drier than in S12S soils. Carbonates occur infrequently, primarily in the NC Region. If desired, S12F can be divided into fibric and mesic / humic sub-groups using a ( $\geq 40$  cm Of +  $\leq 20$  cm Om/Oh) criterion.



## Wet / Organic [Sphagnum]

#### General Description (n=131)

Moderately wet, organic soils with strongly hummocky microtopography. Sphagnum moss dominates the ground cover. The forest humus form is typically a fibric peatymor.

#### Soil / Site Characteristics

Thickness of Organic Layer:  $[O] - (\ge 40)^{10}$ 

Forest Humus Form: fibric peatymor 8, mesic

peatymor 2, humic peatymor 1

Decomposition Class (top): fibric 10

Decomposition Class (bottom): fibric 5, mesic 3, humic 2

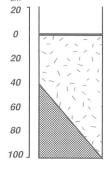
Depth to Mineral Contact:  $(>100)^6$ ,  $(40-60)^2$ ,  $(81-100)^1$ ,

(61-80) 1

Moisture Regime / Drainage: mod. wet<sup>5</sup>, wet<sup>3</sup>, v. moist<sup>2</sup>,

v. wet 1 / v. poor 9, poor 1

organic 10



# Mode of Deposition: **Typical Horizons**

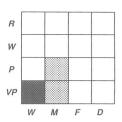
Of, Om

#### Forest Floor Cover and Associated Vegetation

S12S soils are associated with moisture-tolerant, conifer dominated forest conditions. Black spruce, white cedar and tamarack stands are characteristic. Forest floor cover is a continuous moss mat comprised mainly of Sphagnum.

#### Comments

S12S is common throughout NW Ontario, developing in wet, poorly drained, low-lying or depressional sites. These deep, organic soils are typically classed as Fibrisols or Mesisols. Mottles or gley colours are likely to be present if mineral soil appears in the profile. Carbonates are infrequently present in the NC Region; they were not sampled in the NW Region. If desired, S12S can be divided into fibric and mesic / humic sub-groups using a ( $\geq 40$  cm Of +  $\leq 20$  cm Om/Oh) criterion.



## Discontinuous Organic Mat on Bedrock

cm

#### General Description (n=8)

Discontinuous moss and lichen cover, with no mineral soil matrix, overlying bedrock. Bedrock is typically exposed. Developing on bedrock outcrops.

#### Soil / Site Characteristics

Thickness of Organic Layer:

[LFH] - (1-5)<sup>8</sup>, (6-15)<sup>1</sup>,

 $(0)^{\perp}$ 

none 10

Forest Humus Form: fibrimor 9, fibrihumimor 1 Surface Texture:

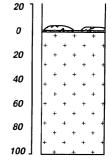
no mineral soil 10

Depth to Carbonates:

Moisture Regime / Drainage:

dry 8, mod. dry 2/ v. rapid 10

Mode of Deposition (Landform Type): bedrock 10



#### Typical Horizons

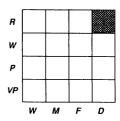
L. F. Bedrock

#### Forest Floor Cover and Associated Vegetation

Forest floor cover is dominated by feathermoss and lichen with patches of conifer litter. Bedrock is typically exposed (to varying degrees). SS1 soils are usually associated with sparse jack pine / black spruce or red and white pine stands, although aspen or birch may provide a hardwood component.

#### Comments

SS1 is encountered throughout NW Ontario, frequently associated with severe topography and steep slopes. Bare rock outcroppings, characteristic of SS1 soils, are variable in their areal extent. Mineral soil may be present in crevices or small depressions in the bedrock. The forest humus condition is typically a very thin fibrimor. Soils of this Type may intergrade with those of other shallow soil Types across, for example, ridge and swale bedrock landscapes.



## Extremely Shallow Soil on Bedrock

#### General Description (n=30)

Organic material, either alone or with a minimal soil matrix, overlying bedrock. Bedrock is encountered within 5 cm of any mineral soil surface.

#### Soil / Site Characteristics

Thickness of Organic Layer:  $[LFH] - (6-15)^6, (1-5)^2,$ 

(16-25)<sup>2</sup>
Forest Humus Form: fibrimor <sup>6</sup>.

humifibrimor 2, raw

moder 1, fibrihumimor 1

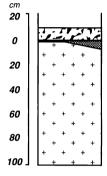
Surface Texture: no mineral soil 7,

v. coarse sand 1, other 3

Depth to Carbonates: none 10

Moisture Regime / Drainage: dry <sup>5</sup>, mod. dry <sup>5</sup> / v. rapid <sup>9</sup>, rapid <sup>1</sup>

Mode of Deposition (Landform Type): bedrock 7, morainal 3



#### Typical Horizons

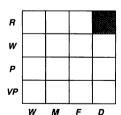
L. F. Bedrock

#### Forest Floor Cover and Associated Vegetation

SS2 soils are typically associated with black spruce / jack pine conifer stands. White pine and white birch stands also occur. Forest floor cover is mainly feathermoss and lichen interspersed with patches of conifer litter and, potentially, small areas of exposed bedrock.

#### Comments

Soils of SS2 occur throughout NW Ontario, primarily situated on crest and upper slope topographic positions (those with thicker organic mats are often found on lower and toe slope positions). Mineral soil, if present, is of minimal thickness. The forest humus condition is typically a thin fibrimor. These soils are frequently classed as Folisols. Some SS2 soils may occur on former outwash channels or lake margins where moving water or wave action has removed most of the mineral soil. SS2 soils differ from those of SS1 by virtue of a thicker and more continuous organic mat; they are distinguished from soils of SS3 by the thin (often absent) mineral matrix. Soils of these three Types may intergrade on shallow, bedrock landscapes.



## Very Shallow Soil on Bedrock

#### **General Description** (n=62)

Very shallow soils overlying bedrock. Bedrock is encountered within 20 cm of the mineral soil surface. Commonly developed in morainal deposits.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] - (6-15)<sup>4</sup>, (1-5)<sup>3</sup>, (16-25)<sup>2</sup>

Forest Humus Form: fibrimor <sup>7</sup>, humifibrimor <sup>2</sup>

Surface Texture: sandy loam <sup>3</sup>, silt loam <sup>2</sup>, loam <sup>1</sup>, loamy fine sand <sup>1</sup>, silty sand <sup>1</sup>,

loamy medium sand I

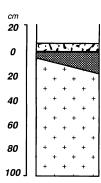
Depth to Mottles / Gley: none 10

Depth to Carbonates: none 10

Moisture Regime / Drainage: mod. dry 8, dry 2 / v. rapid 5,

rapid<sup>4</sup>, well<sup>1</sup>, mod. well<sup>1</sup> morainal<sup>6</sup>, glaciofluvial<sup>2</sup>,

lacustrine |



#### Typical Horizons

Mode of Deposition:

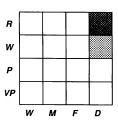
L, F, Bm, Bedrock

#### Forest Floor Cover and Associated Vegetation

SS3 soils are typically associated with black spruce / jack pine conifer stands. White birch is the most common hardwood species. Forest floor cover is mainly feathermoss and lichen interspersed with small patches of broadleaf and conifer litter; average lichen cover is higher in the NW Region. Small areas of exposed bedrock may occur.

#### **Comments**

SS3 occurs throughout NW Ontario, primarily associated with upper slope topographic positions. Mineral soil textures range broadly. These soils are commonly classed as either Brunisols or Regosols. The forest humus condition can vary significantly but is most commonly a thin fibrimor (especially in the NW Region); thicker, more humified organic layers occur more frequently in the NC Region. Soils of SS3 may intergrade with those of other SS Types on bedrock landscapes.



## Very Shallow Soil on Boulder Pavement

#### General Description (n=12)

Varying proportions of organic matter and mineral soil overlying boulder pavement. Boulders are encountered within 20 cm of the mineral soil surface. Developed primarily in morainal parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] - (6-15) 7, (26-39) 2,

 $(16-25)^{1}$ ,  $(1-5)^{1}$ 

Forest Humus Form: fibrimor <sup>8</sup>, fibrihumimor <sup>1</sup>, mull-

like moder 1

Surface Texture: no mineral soil <sup>6</sup>, silt loam <sup>2</sup>, silty

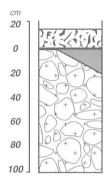
sand 1, loamy v. fine sand 1, silty

clay loam 1

Depth to Mottles / Gley: none 10
Depth to Carbonates: none 10

Moisture Regime / Drainage: mod. dry<sup>7</sup>, dry <sup>3</sup> / v. rapid <sup>8</sup>, rapid <sup>2</sup>

Mode of Deposition: morainal <sup>7</sup>, organic <sup>3</sup>



#### Typical Horizons

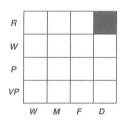
L. F. Boulder Pavement

#### Forest Floor Cover and Associated Vegetation

SS4 soils are primarily associated with black spruce dominated stand conditions. Forest floor cover is mainly feathermoss with varying proportions of broadleaf and conifer litter.

#### Comments

SS4 is encountered infrequently throughout NW Ontario. Of limited areal extent, these soils develop across a wide range of topographic positions. They are commonly associated with glacial spillways or talus slopes where washing of a bouldery deposit has removed the mineral matrix. The interstices of the boulders contain large air spaces, organic matter or very small amounts of mineral soil. Occasionally, a thin secondary deposit of mineral soil will overlie the boulders. Soils of this Type have a significant (> 50%) coarse fragment component. The forest humus condition is typically a thin fibrimor. When they form a boulder cap overlying a (usually deep) mineral soil, SS4 soils may grade into bouldery tills.



## Shallow - Moderately Deep / Sandy

#### General Description (n=56)

Shallow to moderately deep, sandy soils. Bedrock depth below the mineral soil surface ranges between 20 and 100 cm. Developed primarily in morainal parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] - (6-15)7, (1-5)2, (16-25)1

Forest Humus Form: fibrimor 6, humifibrimor 3,

fibrihumimor 1

Surface Texture: sandy loam 2, silty sand 1, loamy

medium sand <sup>1</sup>, loamy fine sand <sup>1</sup>, fine sand <sup>1</sup>, silt loam <sup>1</sup>, v. fine sand <sup>1</sup>, loamy v. fine sand <sup>1</sup>

C Texture: not present <sup>5</sup>, fine sand <sup>1</sup>, loamy

fine sand <sup>1</sup>, medium sand <sup>1</sup>, coarse sand <sup>1</sup>, v. fine sand <sup>1</sup>, loamy coarse

sand 1

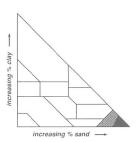
Depth to Mottles / Gley: none 10
Depth to Carbonates: none 10

Moisture Regime / Drainage: mod. fresh 4, mod. dry3, dry 2,

fresh <sup>1</sup> / rapid <sup>4</sup>, v. rapid <sup>3</sup>, well <sup>2</sup>

Mode of Deposition: morainal 7, glaciofluvial 2,

lacustrine 1, fluvial 1



#### Typical Horizons

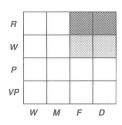
L. F. H. Ae. Bm. C. Bedrock

#### Forest Floor Cover and Associated Vegetation

SS5 soils are typically associated with mixedwood and conifer stands containing a significant component of black spruce and/or jack pine. Forest floor cover is usually dominated by feathermoss with varying proportions of broadleaf and conifer litter.

#### Comments

SS5 occurs throughout NW Ontario, typically associated with upper slope topographic positions. These are dry to fresh soils with C horizon textures ranging from very coarse to very fine sands. Coarse fragment content is often high (> 35 %). Carbonates are rarely encountered. Soils of this Type are usually classed as Brunisols or Podzols. In the NW Region, the forest humus condition is typically a thin fibrimor; in the NC Region, humifibrimors and fibrimors are equally probable. SS5 soils may intergrade with those of S1 and S2.



## Shallow - Moderately Deep / Coarse Loamy

#### General Description (n=187)

Shallow to moderately deep, coarse loamy soils. Bedrock is encountered between 20 and 100 cm below the mineral soil surface. Usually developed in morainal parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>2</sup>, (16-25)<sup>1</sup>

Forest Humus Form: fibrimor <sup>7</sup>, humifibrimor <sup>2</sup>

Surface Texture: silty sand 3, sandy loam 3, loam 2,

silt loam 1

C Texture: not present <sup>7</sup>, silty sand <sup>1</sup>, sandy

loam 1, loam 1, loamy v. fine

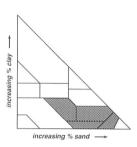
sand 1

Depth to Mottles / Gley: none 10
Depth to Carbonates: none 10

Moisture Regime / Drainage: mod. fresh<sup>6</sup>, mod. dry <sup>4</sup>, fresh <sup>1</sup> /

rapid 5, well 4, v. rapid 1

Mode of Deposition: morainal <sup>8</sup>, glaciofluvial <sup>2</sup>



#### Typical Horizons

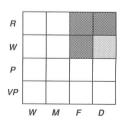
L, F, Ae, Bm, Bedrock

#### Forest Floor Cover and Associated Vegetation

SS6 soils are associated with a wide variety of stand conditions. Often, a significant component of black spruce and/or jack pine is present. Forest floor cover is composed of varying proportions of feathermoss, broadleaf litter and conifer litter.

#### Comments

SS6 is a diverse Type found very commonly throughout NW Ontario. These moderately dry to fresh soils develop typically on upper slope topographic positions. Coarse fragment content is often high (> 35%). Carbonates are rarely encountered. The forest humus condition is typically a thin fibrimor. Soils of this Type are commonly classed as either Brunisols or Podzols. SS6 soils in the NW Region are generally drier than those in the NC Region. Soils of this Type may intergrade with those of S3.



## Shallow - Moderately Deep / Silty - Fine Loamy - Clayey

#### General Description (n=37)

Shallow to moderately deep, fine-textured soils. Bedrock is encountered between 20 and 100 cm below the mineral soil surface. Developed primarily in morainal parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] - (6-15)<sup>7</sup>, (1-5)<sup>2</sup>, (16-25)<sup>1</sup>

Forest Humus Form: fibrimor 5, humifibrimor 3,

fibrihumimor 1

Surface Texture: silt loam <sup>5</sup>, loam <sup>1</sup>, sandy loam <sup>1</sup>.

silty sand 1, silt 1, clay 1

C Texture: not present <sup>6</sup>, silt loam <sup>2</sup>, silty clay

loam 1, silt 1, sandy clay loam 1

Depth to Mottles / Gley: none 10

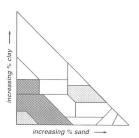
Depth to Carbonates: none 9,  $(\le 50)$  1

Moisture Regime / Drainage: mod. fresh<sup>5</sup>, fresh<sup>3</sup>, mod. dry<sup>1</sup> /

well<sup>5</sup>, rapid<sup>3</sup>, mod. well<sup>1</sup>

Mode of Deposition: morainal 7, lacustrine 1, fluvial 1,

glaciofluvial 1



#### Typical Horizons

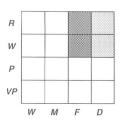
L, F, Ae, Bm, Bedrock

#### Forest Floor Cover and Associated Vegetation

SS7 soils are associated with a wide variety of vegetation conditions. Black spruce and white cedar dominated stands are common. Forest floor cover is a combination of moss, broadleaf litter and conifer litter, depending on the stand composition.

#### Comments

This is an uncommon Type throughout NW Ontario. Silt loamy soils represent the dominant SS7 condition although the Type potentially includes silty, fine loamy and clayey soils. Clayey textures were not sampled. Despite the prevalence of morainal parent materials in NW Ontario, high coarse fragment content is uncommon in SS7 soils. Carbonates are rarely encountered. Soils of this Type are generally classed as Brunisols. The forest humus condition is typically a thin fibrimor, especially in the NW Region; humifibrimors are common in the NC Region. Soils of SS7 may intergrade with those of S4, S5 and S6.



C Texture:

## Shallow - Moderately Deep / Mottles - Gley

#### General Description (n=73)

Shallow to moderately deep, fresh to very moist soils. Bedrock is encountered between 20 and 100 cm below the mineral soil surface. Developed primarily in morainal parent materials.

#### Soil / Site Characteristics

Thickness of Organic Layer: [LFH] - (6-15)7, (1-5)2, (16-25)1

Forest Humus Form: fibrimor <sup>5</sup>, humifibrimor <sup>2</sup>, fibrihumimor <sup>1</sup>, fine mull <sup>1</sup>

Surface Texture: sandy loam<sup>3</sup>, silty sand<sup>2</sup>, silt loam<sup>1</sup>, loamy fine sand<sup>1</sup>,

loamy v. fine sand <sup>1</sup>, fine sand <sup>1</sup> not present <sup>5</sup>, silty sand <sup>1</sup>, silt

loam  $^{1}$ , sandy loam  $^{1}$ , loam  $^{1}$ 

Depth to Mottles / Gley:  $(16-30)^4$ ,  $(\le 15)^3$ ,  $(31-50)^3$ ,  $(51-75)^1$ 

Depth to Carbonates: none 10

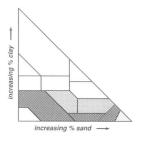
Moisture Regime / Drainage: fresh 3, v. moist 3, mod. moist 2,

v. fresh <sup>1</sup>, moist <sup>1</sup>, mod. fresh <sup>1</sup> / imperfect <sup>5</sup>, poor <sup>3</sup>, mod. well <sup>1</sup>,

rapid 1

Mode of Deposition: morainal 7, lacustrine 1,

glaciofluvial 1



#### Typical Horizons

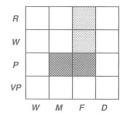
L, F, Ae, Bm, Cg, Bedrock

#### Forest Floor Cover and Associated Vegetation

SS8 soils commonly support black spruce dominated conifer stands. In the NC Region a range of hardwood and mixedwood stand conditions also occurs. Forest floor cover is usually dominated by feathermoss although Sphagnum and broadleaf litter can have extensive coverage.

#### Comments

SS8 occurs throughout NW Ontario, developing across a range of topographic positions. Depth to bedrock is usually greater than 50 cm. Although, technically, any soil texture is a possibility, most of the SS8 soils sampled in NW Ontario belong to the fine sandy, coarse loamy or silty texture class groupings. Coarse fragment percentage ranges from none to over 50% of the soil volume. Carbonates are rarely encountered. The forest humus condition varies considerably but is primarily a thin fibrimor or humifibrimor. Mottles and/or gley colours typically occur within 50 cm of the mineral soil surface. In keying, mottles and/or gley colours within 15 cm of bedrock are to be disregarded; these conditions are likely due to slow lateral water movement along the rock surface rather than to a fluctuating high water table. Profile development is variable in these soils and their classification includes Gleysols, Brunisols and Podzols.



## Shallow - Moderately Deep / Organic - Peaty Phase

#### General Description (n=15)

Shallow to moderately deep, organic and peaty phase (mineral) soils. Bedrock is generally encountered between 50 and 100 cm below the soil surface. Ground cover may be dominated by either Sphagnum or feathermoss. The forest humus form is typically a fibric peatymor.

#### Soil / Site Characteristics

Thickness of Organic Layer:  $[O] - (\ge 40)^8$ ,  $(16-25)^1$ .

 $(26-39)^{-1}$ 

Forest Humus Form: fibric peatymor <sup>7</sup>, humic

peatymor<sup>2</sup>, mesic peatymor<sup>1</sup> fibric<sup>8</sup>, mesic<sup>1</sup>, humic<sup>1</sup>

Decomposition Class (top):
Decomposition Class (bottom):

mesic <sup>5</sup>, fibric <sup>3</sup>, humic <sup>2</sup>

Depth to Mineral Contact:

 $(40-60)^3$ ,  $(81-100)^3$ ,  $(61-80)^2$ ,  $(<40)^2$ 

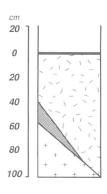
Moisture Regime / Drainage:

mod. wet<sup>7</sup>, moist<sup>1</sup>, v. fresh<sup>1</sup>, mod. dry<sup>1</sup> / v. poor<sup>7</sup>.

mod. dry<sup>1</sup> / v. poor <sup>7</sup>, imperfect <sup>1</sup>, mod. well <sup>1</sup>, rapid <sup>1</sup>

Mode of Deposition: organic <sup>9</sup>, glaciofluvial <sup>1</sup>,

fluvial 1



#### Typical Horizons

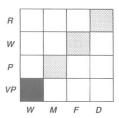
Of, Om, Bedrock

#### Forest Floor Cover and Associated Vegetation

SS9 soils are associated with moisture-tolerant vegetation conditions. Black spruce, white cedar, tamarack and black ash stands are typical. Forest floor cover is dominated by a continuous Sphagnum / feathermoss carpet.

#### Comments

SS9 is an uncommon soil condition throughout NW Ontario. These shallow, organic / peaty phase soils are limited in areal extent, generally developing in depressional landscape positions where drainage is impeded by bedrock. Although mineral soil may be present, the majority of SS9 soils sampled in NW Ontario consisted of organic material overlying bedrock. Mottles or gley colours are likely to be present if mineral soil appears in the profile, although moisture regime ranges broadly. Carbonates are rarely encountered. Soils of this Type may be classed as Fibrisols, Mesisols or Humisols. SS9 soils may intergrade with those of S11, S12S and S12F at the margins of deep soil deposits. If desired, SS9 organic soils can be divided into fibric and mesic / humic sub-groups as suggested for S12S and S12F.



## 4. Applying The Classification

# 4.1. Graphical Presentation of the Vegetation Types

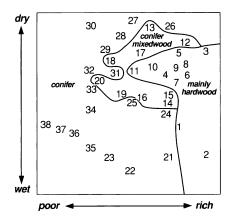
The plotted diagrams shown on the following pages and in the Vegetation Type Factsheets (Section 2.3) are based on a computer-assisted "ordination" analysis of vegetation data collected during the NWO FEC program. Ordination (Hill 1979, Gauch 1982) is a mathematical procedure that synthesizes and graphically summarizes large, complex datasets into a simple, readable form. The ordination presented here represents an "executive summary" of *all* of the abundance information for *all* vegetation species recorded in over 2100 NWO FEC field plots.

Each of the 38 plotted points (*V1* - *V38*) in the ordination diagram represents an average vegetational composition for a V-Type. Types which are close together on the ordination (e.g. *V20* and *V33*) tend to be more alike in terms of their general vegetation conditions than those which are far apart (e.g. *V27* and *V2*). The distance between any two points (V-Types) graphically illustrates (and mathematically represents) the relative degree of similarity or difference between those Types.

Although neither axis is calibrated to an absolute scale, there are two main gradients that can be generally inferred along the axes of this ordination. Along axis 1, from left to right, the gradient is from nutrient-poor to nutrient-rich. Axis 2, from bottom to top, represents a wet to dry gradient. Thus, the ordination effectively provides a pictorial representation within which the V-Types can be related to moisture/nutrient conditions as well as to patterns of average vegetational composition. In this regard, the ordination is very similar to the "edaphic grid" employed for biogeoclimatic classification of forest sites (Klinka et al 1979, Corns and Annas 1986).

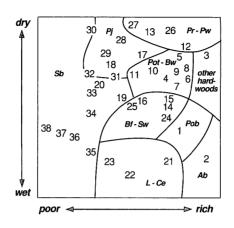
## Applying the Classification

In the following ordination, the three main groupings from the Vegetation Type key (see Section 2.1.1) are delineated on the NWO FEC V-Type ordination.

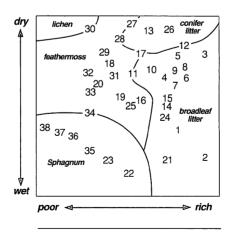


Information about various soil/site or vegetation parameters can be overlain on the V-Type ordination. In addition to elucidating individual relationships between these parameters and the Vegetation Types, such two-dimensional overlays help to demonstrate groups of V-Types which share similar conditions. In the diagrams presented on the next two pages, the major tree species, forest floor cover, dominant soil texture classes, and general soil moisture regimes are overlain on the ordination. The soil texture and moisture regime overlays may be compared to actual correlations between V- and S-Type groupings, tabulated in Section 4.3.

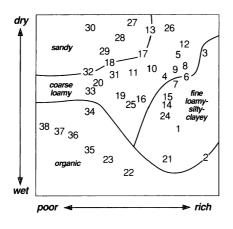
Depending on forest management interests, other overlays can be developed for the ordination which effectively group the NWO FEC V-Types according to similar responses to particular management activities. Examples of such management oriented overlays are presented in a companion NWO FEC manual, *Northwestern Ontario Forest Ecosystem Interpretations* (Racey et al 1989).



Major Tree Species Groupings
(see Section 2.1.5 for nomenclature definitions)

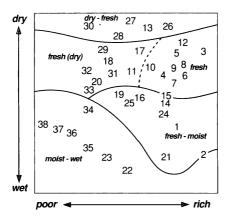


Forest Floor Cover



Soil Texture (C Horizon) Classes

(see Section 2.2.4. for definitions)



Soil Moisture Regime Classes

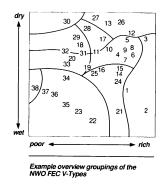
(see Section 2.2.4 for definitions)

## 4.2. Overview Groupings of NWO FEC Types

The relatively large number of Vegetation (38) and Soil (22) Types embodied in the NWO FEC provides for a high degree of resolution in distinguishing forest ecosystems throughout NW Ontario. From a user perspective, however, this number of Types may seem rather imposing. In fact, very few forest management concerns require the degree of resolution offered by the NWO FEC. As discussed in Section 4.1, the Types can be logically organized and easily aggregated according to a variety of criteria. Differing management objectives will suggest different groupings of the Vegetation and Soil Types depending on the response of individual Types to specific management activities (Racey et al 1989).

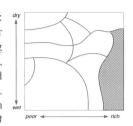
This section presents an example set of V-Type groupings. In this case, 11 groups of *ecologically similar* V-Types are designated, and briefly described, on the basis of general vegetation and soil/site conditions. The groups are also delineated on the V-Type ordination.

The 11 groups presented here provide a generalized overview of some common forest ecosystems in NW Ontario, using NWO FEC V-Types to define them. In the field, these groupings typically represent broader landscape units than do individual Vegetation or Soil Types but retain the potential to respond similarly to *certain* management activities. Using a factsheet approach, Racey et al (1989) describe these groups in greater detail as silvicultural Treatment Units, including some forest management implications associated with the Treatment Units.

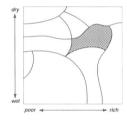


## Applying the Classification

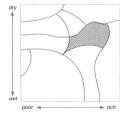
Miscellaneous Hardwoods and Mixedwoods (V1, V2, V3): Productive and floristically diverse stands of balsam poplar (V1), black ash (V2) or other hardwood species (V3), including red ash, bur oak, basswood, Manitoba maple and yellow birch, in the overstory. Understory conditions are typically shrub and herb rich. Forest floor cover is predominantly broadleaf litter. These stands are usually found in small, localized pockets, often on river floodplains or in protected valley bottoms; stands of V3 are essentially confined to the Quetico / Rainy River area. Generally occurring on deep, rich, fresh to moist, poorly drained, fine-textured mineral soils; V2 also occurs on organic substrates. Common NWO FEC Soil Types include S6, S8, S9, S10 and S12F.



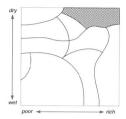
White Birch Hardwood and Mixedwood (V4): Hardwood and mixedwood stands in which white birch is, typically, the only hardwood species in the overstory; balsam fir, white spruce, black spruce and jack pine are common co-species in mixedwood canopies. The understory is usually herb and shrub rich. Forest floor cover is predominantly broadleaf litter. Occurring generally on deep to moderately deep, fresh to moist, coarse-textured, non-calcareous mineral soils; very shallow soils are occasionally encountered. Common NWO FEC Soil Types include S1, S2, S3, S7, SS6 and SS8.



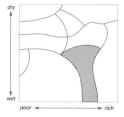
Aspen Hardwood and Mixedwood (V5 - V11): Stands ranging from pure hardwoods (V5), with an aspen or aspen - birch overstory, to hardwood mixedwoods (V6 - V11) containing minor proportions of balsam fir, white spruce, black spruce or jack pine in the canopy. The understory is usually shrub and herb rich, often with dense patches of Acer spicatum, Corylus cornuta, balsam fir, Aralia nudicaulis, Diervilla lonicera and Aster macrophyllus. Forest floor cover is primarily broadleaf litter. Typically occurring on deep, fresh, well-drained, upland mineral soils ranging widely in texture; coarse fragment content is often high. Common NWO FEC Soil Types include S1, S2, S3, S4 and S6.



Red or White Pine Conifer and Mixedwood (V12, V13, V26, V27): Stands of red and/or white pine with (V12, V13) or without (V26, V27) a hardwood overstory component. Within white pine stands (V12, V26) the understory is typically shrub rich; understory conditions of red pine stands (V13, V27) range from shrub and herb rich to extremely poor. The forest floor is typically covered by needle litter, although extensive feathermoss-mats occur in some red pine stands. These stands are most common in the Quetico / Rainy River area. Occurring on dry to fresh, rapidly drained, non-calcareous, coarsetextured, upland mineral soils; coarse fragment content is often high. Common NWO FEC Soil Types include S1, S2, S3 and SS6.

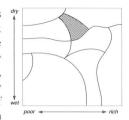


Balsam Fir - White Spruce Mixedwood and Conifer (V14, V15, V16, V21, V24, V25): Extremely variable mixed stands containing balsam fir and white spruce (also white cedar in V21) in the overstory; other canopy components commonly include black spruce, trembling aspen, white birch and jack pine. This group of V-Types characteristically comprises productive, floristically diverse stands which are likely to intergrade across a range of ecological factors. The understory ranges from very shrub and herb rich to relatively sparse; balsam fir is typically abundant in the shrub layer. Forest floor cover consists of feathermoss, broadleaf litter and conifer litter in varying proportions. Occurring across a broad range of site and mineral soil conditions. Common NWO FEC Soil Types include S1, S2, S3, S4, S6, S10 and SS6.

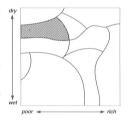


## Applying the Classification

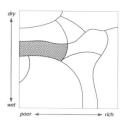
Jack Pine / Shrub Rich (V17, V28): Stands with jack pine as the main overstory species, ranging from pure, even-aged jack pine stands (V28) to jack pine mixedwoods (V17). The understory consists primarily of a well-developed herb / low shrub layer with scattered clumps of taller, often broadleaved, shrubs; Diervilla lonicera and Aralia nudicaulis are frequently abundant. Forest floor cover consists of varying proportions of feathermoss, broadleaf litter and conifer litter, depending on overstory composition and understory density. Occurring typically on upland, rapidly drained, dry to fresh, coarsetextured mineral soils. Common NWO FEC Soil Types include \$1, \$2, \$3\$ and \$56\$.



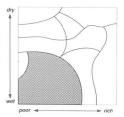
Jack Pine / Feathermoss (V18, V29): Stands with jack pine as the main overstory species, ranging from pure, even-aged jack pine stands (V29) to jack pine mixedwoods (V18). The understory is characteristically open and usually dominated by ericaceous species in the dwarf shrub layer; scattered clumps of Alnus crispa, black spruce or balsam fir comprise a sparse tall shrub layer. Forest floor cover is a continuous carpet of feathermoss. Occurring on upland, rapidly drained, dry to fresh, coarse-textured mineral soils; typically associated with deep, sandy, glaciofluvial or lacustrine materials containing few coarse fragments. Common NWO FEC Soil Types include S1, S2, S3 and SS6.



Black Spruce - Jack Pine / Feathermoss (V19, V20, V31, V32, V33): Conifer or mixedwood stands with black spruce and/or jack pine as the main canopy species; minor overstory elements include trembling aspen, white birch and balsam fir. The understory is variable in structure, abundance and species composition: black spruce, balsam fir and ericaceous species are common shrub layer elements in all V-Types; broadleaved species such as Aralia nudicaulis, Diervilla lonicera, Aster macrophyllus and Corylus cornuta can be abundant in V19 and V31; understory conditions in V20, V32 and V33 are typically herb and shrub poor. Forest floor cover is a characteristic carpet of feathermoss (broken by patches of litter in V19 and V31) with occasional pockets of Sphagnum in wet depressions. Occurring across a broad range of soil and site conditions but most frequently on fresh, coarse-textured mineral soils; shallow soils are frequently encountered, especially in *V20* and *V33*. Common NWO FEC Soil Types include S1, S2, S3, S6, S7, S8, SS3, SS6 and **SS8**.

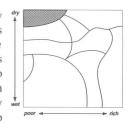


Black Spruce / Wet Organic (V22, V23, V34 - V37): Lowland black spruce (V34 - V37), white cedar (V22) and tamarack (V23) stands, with occasional occurrences of other conifers in the canopy. Understory conditions vary from herb and shrub rich (V22, V23, V35, V36 and elements of V34) to poor (V34 and V37). Ericaceous species dominate the dwarf shrub layer in all V-Types; Alnus rugosa can be abundant in V22, V23, V34 and V35; graminoid cover is typically high in V23. The forest floor has rolling to hummocky microrelief, with high cover by Sphagnum and/or feathermoss; scattered wet or flooded depressions and patches of broadleaf or graminoid litter are common in V22, V23 and V35. Occurring predominantly on wet, organic soils, although mineral soils are frequently encountered (especially in the NW Region) in V34, V36 and V37. Common NWO FEC Soil Types include S8, S11, S12F and S12S.

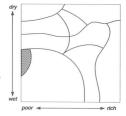


## Applying the Classification

Jack Pine - Black Spruce / Blueberry / Lichen (V30): Sparsely stocked jack pine and/or black spruce stands. The understory is open with scattered clumps of black spruce shrubs; Vaccinium spp. dominate in the herb / dwarf shrub layer. The forest floor is characterized by abundant lichen cover. Occurring on dry to fresh, rapidly drained, coarse-textured soils; typically on shallow soils over bedrock although soil conditions can vary from talus slopes and bare bedrock ("non-soils") to deep mineral soils. Common NWO FEC Soil Types are S2, SS1, SS3 and SS6.



Black Spruce / Leatherleaf / Sphagnum (V38): Poorly stocked, wetland black spruce stands with stunted, widely spaced trees. The shrub layer is typically dominated by Chamaedaphne calyculata and Ledum groenlandicum, often in abundance, with scattered clumps of black spruce. Species diversity in the herb layer is extremely low. Ground cover is a continuous Sphagnum/feathermoss mat. Occurring on deep, wet, organic soils (S12S).



## 4.3. Vegetation Type / Soil Type Correlations

Relationships between NWO FEC Vegetation and Soil Types are extremely variable within NW Ontario. In most circumstances, it would not be possible to accurately predict the Soil Type on a given site knowing only the Vegetation Type (or vice versa). However, there are recognizable trends of general correlation between groupings of the Types. For example, in the NWO FEC sample over 80% of the pine species V-Types (V12, V13, V17, V18, V26-V29) occurred on dry - fresh, sandy or coarse loamy soils (S1-S3, SS5, SS6).

The tables presented in this section summarize the generalized correlations between Vegetation and Soil Type groupings. The groupings are logical aggregations of the Types based on similarities in primary diagnostic criteria from the respective keys. V-Types are grouped by general vegetation (both overstory and understory) conditions; these groups are described in Section 4.2. Soil Types are aggregated by soil depth and texture, then stratified within these categories by moisture regime (texture class and moisture regime groupings are defined in Section 2.2.4). Soil and vegetation groupings are organized on the tables along a generalized moisture gradient.

Values within the tables are percent frequencies for the joint occurrences of the various soil / vegetation groupings. The first table summarizes occurrence of Soil Type / moisture regime groupings within the V-Type groups (read down to total 100%). The second table summarizes occurrence of the vegetation conditions within each soil group (read across to total 100%). Assignment of Soil Types to depth / texture categories is as follows:

 Shallow
 SS1, SS2, SS3, SS4

 Sandy
 S1, S2, S7, SS5

 Coarse Loamy
 S3, S8, SS6, SS8

 City
 S1, S2, S7, SS5

Silty **\$4**, **\$9** 

Fine Loamy - Clayey S5, S6, S10, SS7
Organic S11, S12F, S12S, SS9

## Applying the Classification ————

read down	Pj - Sb / Lichen		Sb - Pj / Feathermoss		Birch	_	Misc. Hardwoods	rganic	Sb / Leatherleaf
Soil Type / Moisture Regime Grouping	Pj - Sb	Pine	Sb - Pj	Aspen	White Birch	Bf - Sw	Misc. I	Sb / Organic	97/ <i>q</i> S
Shallow / Dry	29	4	6	0	0	1	0	1	0
Sandy / Dry	14	27	12	11	7	9	0	0	0
Coarse Loamy / Dry	12	6	5	2	4	4	0	1	0
Shallow / Fresh	5	1	2	0	6	2	1	0	0
Sandy / Fresh	19	25	16	18	18	12	6	0	0
Coarse Loamy / Fresh	12	22	19	23	34	18	4	3	0
Silty / Fresh	0	3	6	9	1	9	5	2	0
Fine Loamy - Clayey / Fresh	2	5	9	19	3	19	23	3	0
Sandy / Moist	5	2	6	4	6	3	2	3	0
Coarse Loamy / Moist	2	2	11	7	17	8	15	10	5
Silty / Moist	0	1	3	2	3	4	8	1	0
Fine Loamy - Clayey / Moist	0	2	3	5	1	8	19	5	0
Organic / Moist	0	0	1	0	0	1	6	21	5
Organic / Wet	0	0	1	0	0	1	10	50	90

read across ——	Pj - Sb / Lichen		Sb - Pj / Feathermoss	-	White Birch	A	Misc. Hardwoods	Sb / Organic	Sb / Leatherleaf
Soil Type / Moisture Regime Grouping	Pj - S	Pine	Sb-F	Aspen	White	Bf - Sw	Misc.	3/qs	7/ <b>qs</b>
Shallow / Dry	17	24	53	1	0	3	0	3	0
Sandy / Dry	2	40	28	18	2	8	0	0	0
Coarse Loamy / Dry	7	31	<i>3</i> 5	10	4	10	0	3	0
Shallow / Fresh	7	11	50	0	14	14	4	0	0
Sandy / Fresh	2	30	29	23	4	9	2	0	0
Coarse Loamy / Fresh	1	22	30	25	7	11	1	2	0
Silty / Fresh	0	9	30	32	1	19	4	4	0
Fine Loamy - Clayey / Fresh	0	8	24	34	1	19	10	4	0
Sandy / Moist	2	8	42	20	5	8	2	12	0
Coarse Loamy / Moist	1	4	37	16	7	10	8	17	0
Silty / Moist	0	6	36	13	4	19	15	8	0
Fine Loamy - Clayey / Moist	0	6	18	21	1	19	19	15	0
Organic / Moist	0	0	10	1	0	4	7	77	1
Organic / Wet	0	0	3	0	0	2	5	81	9

Vegetation Type groupings are as follows (see Section 4.2):

Pj - Sb / Lichen V30

Pine V12, V13, V17, V18, V26, V27, V28, V29

Sb - Pj / Feathermoss V19, V20, V31, V32, V33 Aspen V5, V6, V7, V8, V9, V10, V11

White Birch V4

Bf - Sw V14, V15, V16, V21, V24, V25

Misc. Hardwoods V1, V2, V3

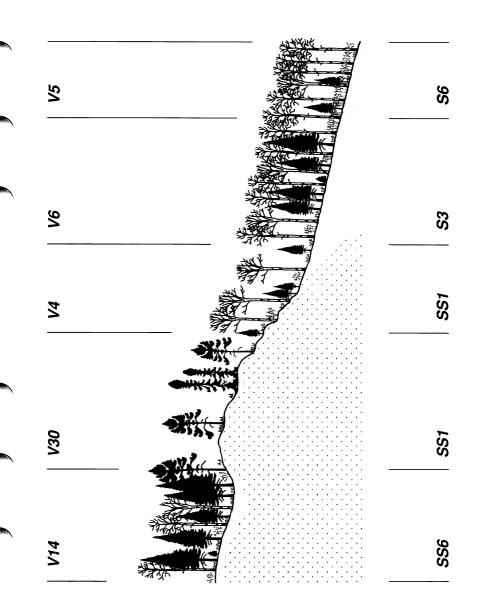
Sb / Organic V22, V23, V34, V35, V36, V37

Sb / Leatherleaf V38

where: Pj - jack pine, Sb - black spruce, Bf - balsam fir, Sw - white spruce

# 4.4. Schematic Landscape Cross-Sections

The landscape cross-sections shown here are based on observations taken along actual transects in the field. Using common examples, typical sequences of Vegetation Types, with their associated Soil Types, are shown for different toposequences. Obviously, the diagrams of simple, single-line transects cannot depict all of the juxtapositions of Vegetation and Soil Types that will be found in the landscape. Also, no indication of areal extent is provided. Nonetheless, these diagrams can effectively and very simply illustrate common landscape / Vegetation Type / Soil Type relationships in NW Ontario.



	<del></del>
<b>8</b> 23	 S12S
2	S12S
	S12S
75 	8
67. 	81
V24	988

# 4.5. NWO FEC Forest Management Interpretations

Recently, site classification researchers have been successful in integrating a wide variety of forest management interpretations into site classification systems (e.g. Comeau et al 1982, Green et al 1984, Corns and Annas 1986, Coates and Haeussler 1987, Kotar et al 1988, Jones 1989, Zelazny et al 1989). The NWO FEC system provides a framework within which such management interpretations can be adapted, developed and iteratively refined for NW Ontario.

A separate field manual (Northwestern Ontario Forest Ecosystem Interpretations, Racey et al 1989) specifically deals with a range of forest management interpretations for NWO FEC Vegetation and Soil Types. Various provisional interpretations are presented using several approaches (e.g. factsheets, two-way tables and ordination overlays). These interpretations, and others reported elsewhere (e.g. Carmean 1987, Wickware et al 1989, Sims 1989, LeBlanc and Towill 1989), will evolve over time as new information becomes available and as feedback and input from field staff is received and compiled.

The following list suggests some potential areas where forest management interpretations could be developed in the medium and short terms using the NWO FEC system:

#### Medium Term:

- Prime Site Management of Timber Resources
- Timber Management Planning
- Strategic Land Use Planning
- Class Environmental Assessment for Timber Management
- Wildlife Habitat Interpretation
- Integrated Resource Management
- Recreation and Tourism Planning

#### Short Term:

#### Timber Harvesting

- season of harvest
- logging method / cut pattern
- site operability
- windthrow hazards

#### Resource Renewal and Maintenance

- soil/site degradation potential
- site quality and productivity
- vegetation competition potential
- species selection of planting stock
- · site preparation options
- equipment selection
- tending and release
- habitat assessment

#### Forest Protection

- · area fire planning
- insect and disease vulnerability
- prescribed burning
- forest fire behaviour (fuel loading / ranking)

NWO FEC forest management interpretations should not supercede any knowledge gained by forest managers through systematic observation and experience — interpretations are intended as guidelines only. When site-specific treatments are being planned, it is always preferable to evaluate sites individually and to revise or alter management interpretations as required. New developments and techniques will also dictate a need for periodic updates and modifications to many forest management interpretations — as practices and scientific knowledge evolve, so should the interpretations.

# 4.6. Use of the NWO FEC System in Pre-Cut Assessments

Pre-cut survey information facilitates the preparation of operational prescriptions on a site-specific basis for forests allocated for harvest. Planning for forest access, harvest, renewal and maintenance activities is often challenging because of the number of factors which must be addressed or considered during the process. In NW Ontario, a pre-cut assessment procedure which incorporates NWO FEC information can help identify harvest and regeneration constraints or opportunities, and can provide a good site-specific basis for decision-making (Towill et al 1988).

Pre-harvest information may contribute to forest management decisions in many areas. For example, efficient location of forest access routes can benefit from an advance knowledge of terrain conditions and availability of roadbuilding materials. Considerations of method and season of harvest, harvesting equipment selection, integrated resource management concerns and early identification of unmerchantable stands can be facilitated by pre-cut survey data. Silvicultural treatment and maintenance options, including species and stock type selection, site preparation equipment needs, competition control and tending requirements can be more effectively evaluated, in advance, with pre-cut survey information on hand.

Pre-cut survey information is required at a scale complementary to the level of management being planned for an area. Sampling intensity and stratification is determined by specific objectives and the size of area to be covered. In Ontario, pre-cut survey sampling is usually stratified on Forest Resource Inventory (FRI) stand polygons. There is always a trade-off, however: more intensive sampling is costly and time-consuming, while less intensive sampling raises margins of error and reduces sensitivity to ecosystem variability.

Towill et al (1988) outline several steps in preparing for and undertaking a pre-cut survey incorporating the NWO FEC system:

- 1) organize background information including maps, photos and other materials;
- organize the work to be done by setting up the sampling strategy and design, conducting photo interpretation as necessary and assembling equipment;
- prepare, in the field, to collect information according to the planned sampling scheme and match ground sampling locations to aerial photos or a map base;
- use prepared tally forms and follow some standardized data collection procedure at points along survey lines or grids;
- 5) after the field program, collate and organize the information. Make forest management interpretations.

**Pre-cut Assessment Tally Form:** A tally form that is organized in a logical format can make field data collection and post-field collation and interpretation of information more efficient. The procedure should be field-tested and streamlined before operational use. Codes and abbreviations for terms can help to speed up field recording.

# Example tally form for Pre-Cut Assessment in NW Ontario (Front)

(Towill et al 1988)

# Pre-Cut Survey Tally Form Front Side

_	Basemap/Township	Stand No./Stratum
dmir	Management Unit	Area
•	Date	Surveyors
NWO FEC Admin	V-Туре	S-Type
	Sp. Comp. FRI	Ocular Opc Opc
	Stocking FRI	Sweep Crown Density
ion	Species	Stand Condition (disease, insects, blowdown, form, vigour)
crip	Age	Johnson, John, Hgost,
Stand Description	Height	
stanc	DBH avg-r	
V2	Veneer % S. Log Pulp	
	Understory and Veg.	
ects	Terrain	
Asp	Stoniness	Rock Outcrops
Stocking Physical Aspects	Moisture	Drainage
g.		
king	BAF	
Stoc	No. of Pts.	

The type of information requested on the tally form is obviously important, but the amount must be kept to a minimum. Recorded information should include field notes regarding significant silvicultural or ecological factors that may not be part of the standardized data collection regime.

# Example tally form for Pre-Cut Assessment in NW Ontario (Back)

(Towill et al 1988)

# Pre-Cut Survey Tally Form Reverse Side

Season	
Residuals	
Access · Road Chance	Map Attached
Wildlife Habitat Potential	
Other Comments	

# A Step-by-Step Survey Procedure Incorporating NWO FEC Methodology

an Example for Possible Adaptation to Pre-Cut Survey

#### Step 1.

# Conduct a quick assessment of the general stand and site conditions prior to NWO FEC Typing

Carefully choose the location for Vegetation and Soil Typing (see Sections 2.1.3 and 3.1.3). Note general terrain features such as surface shape, dominant landform condition and vegetation cover as these can help in selecting a plot location that is representative of the surrounding area.

#### Step 2.

#### **Determine the Vegetation Type** (see Section 2)

Physically lay out (or estimate) a 10 X 10 m plot that will serve as the sampling unit for NWO FEC Vegetation Typing. The plot should be representative of the surrounding forest stand and understory vegetation conditions. Take note of the overstory mix of species, in particular separating coniferous from hardwood components, as you move around within the plot. Work through the V-Type key and compare Factsheets. Several divisions of the key require familiarity with some common understory plants of NW Ontario; if necessary, refer to Section 6 or the companion NWO FEC plant guide (Baldwin and Sims 1989) for plant identification aids.

#### Step 3.

#### **Determine the Soil Type** (see Section 3)

Auger or excavate a soil pit to a 100 cm depth from soil surface, or to a bedrock contact. Then:

- a) If organic Of, Om and/or Oh horizons ≥ 20 cm in depth (S11, S12F, S12S, SS9), determine the depth to mineral soil. If this depth is ≥ 40 cm and there is no bedrock contact within 100 cm of soil surface (S12F, S12S), then estimate the relative ground cover of Sphagnum to feathermoss in the 10 m X 10 m plot. Key out and compare Factsheets. If bedrock is encountered (SS9) or the depth of organic horizons is < 40 cm (S11), key out and compare Factsheets.
- b) If it is a shallow to moderately deep (<100 cm) mineral soil (SS1-SS8), determine the soil depth. If the depth is  $\leq 20$  cm (SS1-SS4), key out and compare Factsheets. If there are mottles/gley >15 cm above bedrock or boulder pavement (SS8), key out

and compare Factsheets. Otherwise (SS5-SS7), determine the C horizon (or else the lower B) texture class (see Section 5.1) before keying out and comparing Factsheets.

c) If it is a deep mineral soil (S1-S10), determine the dominant C horizon texture class. If the soil is stratified, determine the effective soil texture (see Section 5.2) for assigning both the soil Moisture Regime (MR) and the S-Type. Determine the soil MR (see Section 5.2; a quick method for allocating to broad MR categories solely for the purposes of NWO FEC S-Typing is on the next page). Key out and compare Factsheets.

#### Step 4.

#### Record ancillary / additional information

You may wish to take note of other vegetation, soil and/or site factors that may be limiting or of concern for certain forest management activities (e.g. see Section 3.3). Features such as excess surface stoniness, steep slopes or a considerable amount of windthrow can be noted on a Pre-Cut Survey Form in the field.

#### Step 5.

#### Carry on an "ongoing assessment / evaluation of landscape changes"

Between station points when transect or strip sampling, continue to generally assess and note the vegetation cover, landform features and dominant soil / site characteristics, particularily when abrupt or significant changes are encountered. It may be possible to relax or modify sampling intensities in areas where significant changes do not occur (Towill et al 1988).

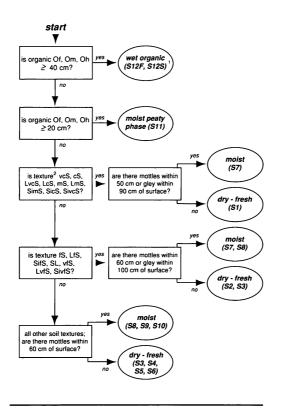
#### Step 6.

# Correlate NWO FEC Types and other ancillary / additional information with forest management interpretations (Usually carried out as a post-field activity)

This may be done by referring, for example, to *Northwestern Ontario Forest Ecosystem Interpretations* (Racey et al 1989). If desired, allocate to Treatment Units for broader level management purposes. You may wish to develop your own interpretations based on current needs and practices. As use of the NWO FEC continues, new forest management interpretations will be developed and others updated. Use NWO FEC allocations to assist in photo-interpretation and mapping activities, or integrate NWO FEC information with other management tools as possible to help implement a more ecologically sound approach. Use the NWO FEC information to plan your management activities and to communicate with other forest managers and users.

# Allocation of Deep (≥ 100 cm) Mineral Soils to Broad Soil Moisture Regime Categories Suitable for NWO FEC S-Type Determination

The following diagram presents an example of how the technical process of NWO FEC S-Typing can be streamlined to maximize sampling efficiency in the field. Such devices should be used *in conjunction* with the S-Type key and Factsheets (see Section 3.5) for accurate S-Type determination.



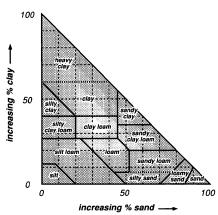
final S-Type allocation should be achieved using the NWO FEC S-Type key, Section 3.5.

<sup>&</sup>lt;sup>2</sup> parent material (C) texture class

# 5. Soil Description

### 5.1. Soil Texture

**Texture Triangle:** The texture triangle (Working Group on Soil Survey Data 1978; Ontario Institute of Pedology 1985) illustrates interrelationships of the *texture classes*. Each texture class is shown in the triangle according to percentage amounts of the 3 primary particle fractions — sand, silt and clay. In the texture triangle, percentage composition of sand and clay are represented along the horizontal and vertical axes, respectively. Percentage composition of silt is not shown but may be inferred along an imaginary axis that runs from upper right (low % silt composition) to lower left (high % silt) in the triangle.



Standard abbreviations are used throughout this manual for texture classes:

C	- clay	Si	- silt	S	- sand
SC	- sandy clay	SiS	- silty sand	vfS	<ul> <li>very fine sand</li> </ul>
SCL	- sandy clay loam	SiL	- silt loam	fS	- fine sand
CL	- clay loam	SiC	- silty clay	mS	- medium sand
		SiCL	- silty clay loam	cS	<ul> <li>coarse sand</li> </ul>
		L	- loam	vcS	- very coarse sand
		SL	- sandy loam		

- loamy sand

LS

# Soil Description

The texture triangle should be consulted on a regular basis when field texturing. When attempting to assign a field sample to the most appropriate texture class, it can help with decision making. This is particularily true when one is trying to distinguish among closely related texture classes or dealing with "borderline" textures, i.e. those that have sand / silt / clay components that place them on the line between two or three possible classes.

The texture class for any sample with greater than 50% sand content (see chart for manual determination of soil texture) should be described more precisely by noting the size class of the dominant sand fraction (e.g. loamy *coarse* sand (LcS) or *very fine* sandy loam (vfSL)). To do this, the sample is compared to a "sand fraction card", available as a small insert in the back of the *Field Manual for Describing Soils* (Ontario Institute of Pedology 1985); the card contains small presorted samples of the 5 sand fractions (vfS, fS, mS, cS, vcS).

Texture classes may also be modified when coarse fragments occupy >20% of the soil volume. For volumes between 20% and 50%, use the coarse fragment class name as well as the texture class name (e.g., *cobbly* LS). For volumes >50%, use the additional modifier "very" (e.g. *very gravelly* SiCL).

Class names and sizes for primary particles and coarse fragments:

Class Name	Diameter (mm)				
Primary Particles (<2 mm)					
C	< 0.002				
Si	0.002	-	0.05		
vfS	0.05	-	0.10		
fS	0.10	-	0.25		
mS	0.25	-	0.50		
cS	0.50	-	1.0		
vcS	1.0	-	2.0		
Coarse Fragments (>2 mm)					
gravelly	2.0	-	80		
cobbly	80	-	250		
stony	>250				

#### Texture Field Tests

\*Moist Cast Test - Moist soil is compressed by clenching it in the hand. When the hand is released, if the soil holds together (i.e. forms a cast), the strength of the cast is tested by tossing it from hand to hand. The more durable the cast, the more clay in the soil.

\*Ribbon Test - Moist soil is rolled into a long thin shape and then squeezed out between the thumb and forefinger to form the longest and thinnest ribbon possible. The longer the ribbon, the more clay in the soil. Soils with high silt content will tend to flake rather than ribbon.

#### Feel Tests:

Graininess Test - Soil is rubbed between the thumb and fingers to assess the percentage of sand (sand feels grainy).

Dry Feel Test - For soils with >50% sand. Soil is rubbed in the palm of the hand to dry it. Individual sand particles are separated and their sizes estimated. The sand particles are then allowed to fall out of the hand and the amount of remaining finer material (silt and clay) is noted.

*Puff Test* - Done in conjunction with (or instead of) the dry feel test. After the soil is rubbed dry and the sand particles are separated, blow lightly on the palm of the hand and note the proportion of fine, floury material which is removed by the puff of breath.

Stickiness Test - Soil is wetted and compressed between the thumb and forefinger. The degree of stickiness is determined by noting how strongly it adheres to the thumb and forefinger upon release of pressure and how much it stretches. Stickiness is a characteristic of clay content in the soil.

\*Taste Test - A small amount of soil is worked between the front teeth. Sand is distinguished as individual grains which grit sharply against the teeth. Silt particles produce a general fine grittiness, but individual grains cannot be identified. Clay particles have no grittiness.

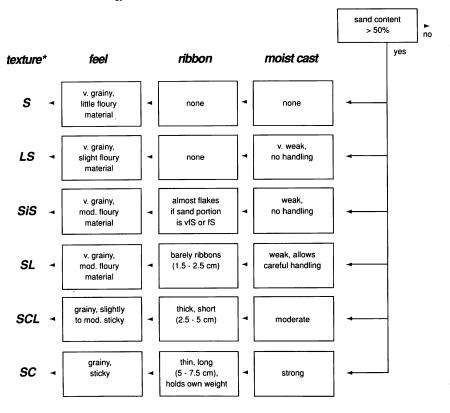
\*Shine Test - A small amount of moist soil is rolled into a ball and rubbed once or twice against a hard, smooth object such as a knife blade or thumb nail. A shine on the rubbed surface indicates clay in the soil.

<sup>\*</sup> tests conducted on a soil sample that is at or near a "field moisture level", i.e. a fresh condition; no visible water is present but a small amount of moisture can be observed on the palm of the hand when a sample is very tightly squeezed and then released.

# Soil Description

#### Manual determination of soil texture

(after Ontario Institute of Pedology 1985)

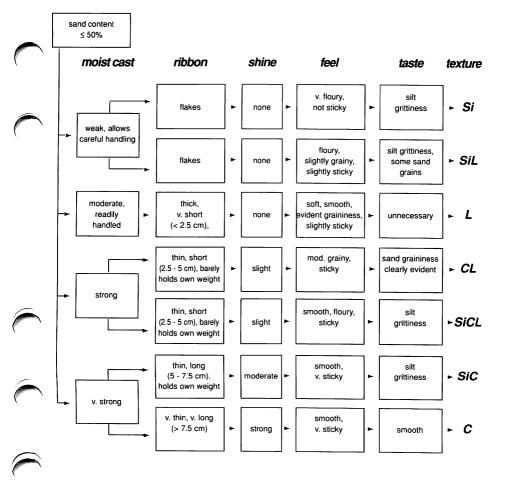


#### Floury Material

"little" < 10% by volume
"slight" - 10 - 30% by volume
"moderate" 31 - 50% by volume

dominent sand fraction size should be determined for all textures with > 50 % sand content (vfS, fS, mS, cS, vcS)

### Manual determination of soil texture (ctd.)



## Soil Description

#### Pore Pattern

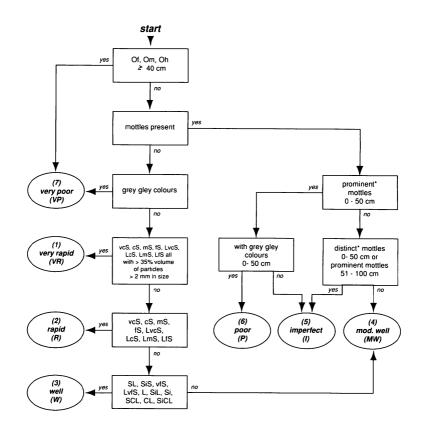
Pore pattern (see deep soil moisture regime charts) is an indication of the number and size of spaces (pores) between soil particles (Ontario Institute of Pedology 1985). It is the pore patterns which provide the drainage and moisture retention characteristics of a soil. Pore pattern classes are inferred from soil texture, structure and compaction; significant compaction can increase the pore pattern, usually by one class.

### Symbols Used in the Deep Soil Moisture Regime Charts (pp. 150, 151)

g	presence of distinct or prominent mottles, indicative of periodic saturation
G	presence of grey gley colours, indicative of prolonged saturation
s	slope, expressed as a percentage, which could result in significant surface run-off
all slopes	the "normal" site with no slope or drainage restrictions
R/W	most probable drainage class(es); the dominant drainage class is shown first (see the deep soil drainage chart for definitions, p. 149)
Of.Om.Oh	organic horizons (see Sections 5.3, 5.4 and 5.6)

## Estimation of drainage classes for deep soils

(after Ontario Institute of Pedology 1985)



<sup>\*</sup> see definition of distinct and prominent mottles in Field Manual for Describing Soils (OIP, 1985)

# Estimation of pore pattern and moisture regime for deep, dry to fresh soils (after Ontario Institute of Pedology 1985)

### Deep ( ≥ 100 cm), Dry to Fresh Mineral Soils

Mineral Soil	Pore	Soil Moisture Regime				
Texture (uncompacted parent material)	Pattern	Dry Dry Ø	Mod. Dry	Fresh Mod. Fresh	Fresh 2	V. Fresh
All Material > 2 mm	Extremely Open	all slopes				
vcS, cS, LvcS, LcS, SivcS, SicS	V. Open		all slopes	g:101 - 180 or G: 151 - 200	g: 81 - 100 or G: 121 - 150 MW/I	g: 51 - 80 or G: 91 - 120
mS, LmS, SimS	Open		all slopes	g:101 - 180 or G: 181 - 240	g: 81 - 100 or G: 151 - 180 MW/I	g: 51 - 80 or G: 91 - 150
fS, LfS, SifS	Mod. Open			all slopes	g: 101 - 150 or G: 151 - 210	g: 61 - 100 or G: 121 - 150
SL, vfS, LvfS, SivfS	Mod. Retentive				all slopes	g: 61 - 120 or G: 151 - 210
L, SiL, SCL, * structured SiC and C (aggregates < 10 mm)	Retentive				all slopes	g: 61 - 120
Si, SiCL, CL, SC, * structured SiC and C (aggregates > 10 mm)	V. Retentive			s > 100%	s < 100%	g: 61 - 120
* structureless SiC and C	Mod. Restricted			s > 70 %	s < 70%	g: 61 - 120

<sup>\*</sup> see description of soil structure in Field Manual for Describing Soils (OIP, 1985)

# Estimation of pore pattern and moisture regime for deep, moist to wet soils (ctd)

#### Deep ( ≥ 100 cm), Moist Mineral Soils

### Wet Organic Soils

Moist			Wet		
Mod. Moist	Moist	V. Moist	Mod. Wet	Wet	V. Wet
4	5	6	7	8	9

Pore	Mineral Soil
Pattern	Texture
	(uncompacted parent material)

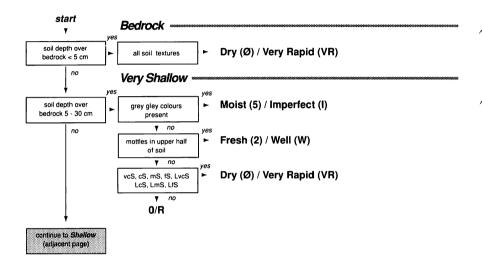
g: 31 - 50 or G: 61 - 90 MW/I g: 31 - 50 or G: 61 - 90 MW/I g: 41 - 60 or G: 61 - 120 MW/I g: 41 - 60 or G: 91 - 150	g: 16 - 30 or G: 45 - 60 I/P g: 16 - 30 or G: 45 - 60 I/P g: 21 - 40 or G: 45 - 60 I/P	g: 6 - 15 or G: < 45 P/I g: 6 - 15 or G: < 45 P/I g: 6 - 20 or G: < 45 P/I g: 6 - 20 or G: < 45	Of: 60 - 160 or Om: 40 - 100 or Oh: 40 - 100 with g: 0 - 5 if g > 5 use mineral soil criteria	Of: >160 or Om: > 100 or Oh: > 100 with upper part not saturated all year and G present to top of mineral soil	Of: >160 or Om: > 100 or Oh: > 100 or Saturation to Surface all year and G present to top of mineral soil
g: 46 - 60	g: 31 - 45	g: 6 - 30			
g: 46 - 60	g: 31 - 45	g: 6 - 30			
g: 46 - 60	g: 31 - 45	g: 6 - 30	VP	VP	VP

All Material > 2 mm
vcS, cS, LvcS, LcS, SivcS, SicS
mS, LmS, SimS
fS, LfS, SifS
SL, vfS, LvfS, SivfS
L, SiL, SCL, * structured SiC and C (aggregates < 10 mm)
Si, SiCL, CL, SC, * structured SiC and C (aggregates > 10 mm)
' structureless SiC and C

<sup>\*</sup> see description of soil structure in Field Manual for Describing Soils (OIP, 1985)

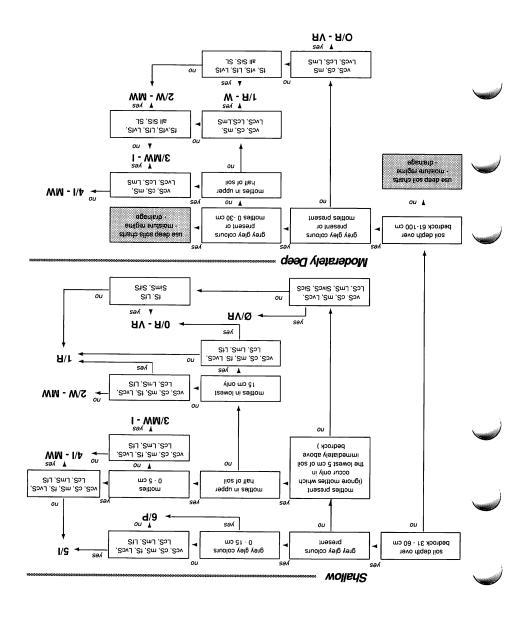
### Estimation of moisture regime and drainage for shallow soils

(after Ontario Institute of Pedology 1985)



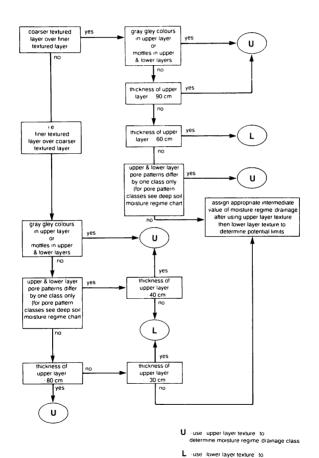
Note - it is difficult to differentiate between adjacent detailed (numbered) moisture regime / drainage classes because even a small difference in soil depth within the very shallow soils results in a large difference in the moisture retained for plant growth.

Consequently the broad moisture regime / drainage classes are indicated first. The numbered/lettered classes shown in the brackets merely indicate the centres of the broad classes



# Choosing the effective texture for determining moisture regime / drainage in stratified mineral soils > 60 cm over bedrock

(after Ontario Institute of Pedology 1985)



determine moisture regime drainage class

# 5.3. Soil Horizon Descriptions

Common horizon designations and their meanings for forest soils encountered in NW Ontario [for more details and additional descriptors refer to *The Canadian System of Soil Classification* (Canada Soil Survey Committee, Subcommittee on Soil Classification 1978)]:

### Symbol Description

- **L,F,H** organic horizons developed mainly from leaves, needles and twigs, possibly with some feathermoss (see Section 5.6); does not include the living moss layer, if present
- Ah dark-coloured, surface mineral horizon, enriched with organic matter (<17% organic carbon by weight)
- **Ae** light-coloured surface horizon, characterized by a loss of iron, aluminum, organic matter and/or clay
- **AB** transition horizon between the **A** and **B** horizons
- **Bt** brownish subsurface horizon enriched with clay that has been moved from the **Ae** horizon; platey structure
- **Bm** brownish subsurface horizon with only a slight addition of iron, aluminum and/or clay
- **Bf** reddish-brown subsurface horizon with significant accumulation of iron, aluminum and/or organic matter
- **BC** transition horizon between the **B** and **C** horizons
- c relatively unweathered soil material within which the soil profile has developed

# Soil Description

- k suffix modifier for horizon designation, usually used with **B** or **C**, denoting the presence of calcium and/or magnesium carbonates that will effervesce with 10% hydrochloric acid (HCl)
- g suffix modifier for horizon designation, usually used with B or C, indicating distinct or prominent mottling and/or grey gley colours. The two conditions are differentiated with a lower case "g" for mottling and an upper case "G" for gleys
- j used with suffixes e,f,g and t to denote a "weak expression" of the modifying condition (e.g. Bfj, Ckgj)
- **Of, Om,** organic horizons developed mainly from mosses (especially Sphagnum) sedges and rushes (see Section 5.4, 5.6)

#### Roman Numerals

Roman numeral *II* preceding horizon designation indicates a significant change in texture (parent material) within the profile, e.g. a silt loam overlying coarse sand

# 5.4. Estimation of Organic Soil Decomposition

von Post Scale of Decomposition: The von Post scale is used to estimate the degree of decomposition in organic soil materials. In this field test, first squeeze a sample of organic material within a closed hand to remove excess water. Then squeeze the sample a final time and observe: 1) the distinctness of the plant structure in the material both before and after it is squeezed; 2) the colour of the solution that is expressed from the sample during squeezing; 3) the proportion of the original sample that extrudes between the fingers during squeezing; 4) the nature of the residual material in the hand. Ten classes are defined (after Ontario Institute of Pedology 1985):

### Fibric [Of]

1. Undecomposed plant structure unaltered; yields only clear, light yellow-brown coloured water

Almost plant structure distinct; yields only clear, light yellow-brown coloured water

3. Very Weakly plant structure distinct; yields distinctly turbid brown water; no peat substance passes between the fingers; residue not mushy

4. Weakly plant structure distinct; yields strongly turbid brown water; no peat substance escapes between the fingers; residue rather mushy

### Mesic [Om]

5. Moderately
Decomposed

plant structure clear but becoming indistinct; yields much turbid brown water; some peat escapes between the fingers; residue very mushy

6. Strongly
Decomposed

plant structure somewhat indistinct but clearer in the squeezed residue than in the undisturbed peat; yields much turbid brown water; about a third of the peat escapes between the fingers; residue strongly mushy

### Humic [Oh]

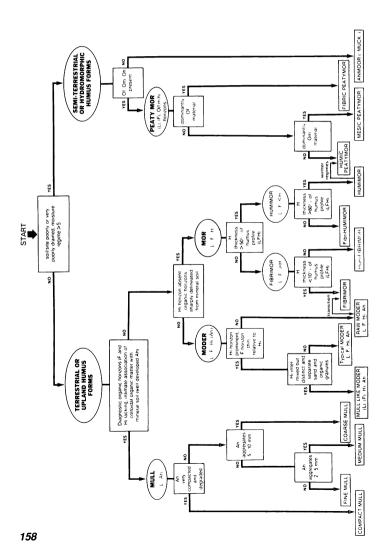
Strongly plant structure indistinct but recognizable; about half of the peat escapes between the fingers

B. Very Strongly plant structure very indistinct; about two-thirds of the peat escapes between the fingers; residue almost entirely of resistant remnants such as root fibres and wood

9. Almost Completely plant structure almost unrecognizable; nearly all of the peat escapes between the fingers

10. Completely plant structure unrecognizable; all of the peat escapes between the fingers

## 5.5. Forest Humus Forms



(Ontario Institute of Pedology 1985) Classification of forest humus forms

# 5.6. Description of Forest Humus Horizons

These definitions follow the conventions of the *The Canadian System of Soil Classification* (Canada Soil Survey Committee, Subcommittee on Soil Classification 1978).

### Symbol Description

- **L,F,H** organic horizons developed primarily from the accumulation of leaves, twigs and woody materials with or without a minor component of mosses (but not including the living moss layer of the forest floor); usually not saturated with water for prolonged periods; containing >17% organic carbon (approximately 30% organic matter) by weight
- L organic horizon characterized by an accumulation of mainly leaves (and needles), twigs and woody materials; most of the original structures are easily discernible
- organic horizon characterized by an accumulation of partly decomposed organic matter derived mainly from leaves, twigs and woody materials; some of the original structures are difficult to recognize; the material may be somewhat altered by soil fauna as in a *moder* (see Section 5.5), or it may be a partly decomposed mat permeated by fungal hyphae as in a *mor*
- organic horizon characterized by an accumulation of decomposed organic matter in which the original structures are indiscernible; differing from the **F** horizon by having greater humification chiefly due to the action of soil organisms; it may be sharply delineated from the mineral soil as in a mor (see Section 5.5), where humification is chiefly dependent on fungal activity, or it may be (partly) incorporated into the mineral soil as in moders and mulls (see **Hi** horizon)
- **Hi** organic horizon characterized by an accumulation of spherical or cylindrical organic granules (animal droppings); intermixing with mineral particles is common; genetically it is an intermediate stage between an **H** and an **Ah** horizon

## Soil Description

Ah	mineral $\boldsymbol{A}$ horizon enriched with organic matter; containing $\leq 17\%$ organic carbon (approximately 30% organic matter) by weight
Of, Om, Oh	organic horizons developed mainly from the accumulation of mosses, rushes and woody material; containing > 17% organic carbon (approximately 30% organic matter) by weight
Of (fibric)	<b>O</b> horizon consisting of fibric (the least decomposed) materials (von Post 1-4); containing large amounts of distinct fibre (see Section 5.4)
Om (mesic)	an intermediately decomposed <b>O</b> horizon (von Post 5-6) with properties between those of fibric and humic materials (see Section 5.4)
Oh (humic)	<b>O</b> horizon consisting of humic materials (von Post 7-10); containing only small amounts of well preserved fibre with most of the substrate at an advanced stage of decomposition (see Section 5.4)

# 5.7. Landform / Mode of Deposition Classes

These definitions are based on those of the landform classification in *The Canadian System of Soil Classification* (Canada Soil Survey Committee, Subcommittee on Soil Classification 1978).

Mode of Deposition	Description
aeolian	well-sorted, poorly compacted sediments which have been transported and deposited by wind action
colluvial	heterogeneous mixture of materials which has reached its present position due to direct, gravity-induced movement; usually associated with steep slopes
fluvial	sediments, usually stratified and well-sorted, which have been transported and deposited by flowing water (i.e. rivers and streams)

and deposited by streams flowing from, on or under melting glacial ice

lacustrine sediments, usually sorted and stratified, which have either settled from suspension in standing bodies of fresh water or have

accumulated at their margins through wave action

morainal a landform composed of an accumulation of glaciotill, built by

glacier ice and having a variety of relief forms, often including many

closed dispersions

organic soil materials which have developed dominantly from organic

deposits (i.e. containing >17% organic carbon or approximately 30%

organic matter by weight); see Section 5.6

sloping accumulation of fragmental rock (colluvial material) lying at talus

the base of a cliff or steep slope

till an unsorted and unstratified mixture of clay, silt, sand, gravel,

cobbles and boulders deposited directly by glacier ice

# 6. Plant Recognition

### 6.1. Introduction

This section will assist with field recognition of the understory species used in the Vegetation Types allocation key (Section 2.3). Additional forest plants which are common in NW Ontario, including all of the species named in the Vegetation Type Factsheets, are described in a companion NWO FEC volume - *Field Guide to the Common Forest Plants in Northwestern Ontario* (Baldwin and Sims 1989). Users of the NWO FEC system are encouraged to employ this plant guide. It is fully illustrated with line drawings and emphasizes field identification through examination of simple characters. It also illustrates the distribution of individual species among the NWO FEC Vegetation Types. Other useful references for plant identification in NW Ontario include *The New Britton and Brown Illustrated Flora of the NE United States and Adjacent Canada* (Gleason 1952), *Shrubs of Ontario* (Soper and Heimburger 1982) and *Newcomb's Wildflower Guide* (Newcomb 1977).

The plants described here are organized into three main categories, according to their form or common growth habit: *Shrubs* - perennial woody plants, not including the forest tree species; *Herbs* - plants with no persistent woody stem above the ground (except for certain dwarf woody species of indeterminate habit which we include here); *Mosses & Lichens*. The category to which a species has been assigned is indicated in the top outer corner of its description page. Within each category, species are arranged alphabetically according to their scientific names. To use this section, first decide which category an unknown plant belongs to, then turn to the appropriate pages and compare the illustrations with the unknown. If one illustration appears similar, carefully compare characters described in the text (*especially the italicized diagnostic characters*) with those of the unknown specimen. If no illustrations or descriptions match the specimen, then:

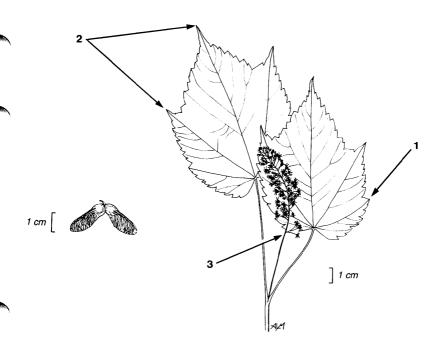
- a) check other categories (e.g. some low woody plants are included in the Herbs category).
- b) consult a more comprehensive reference, such as the NWO FEC plant guide (Baldwin and Sims 1989).

# Plant Recognition

In addition to the scientific names, common English names are given. Remember that scientific names are universal and exclusive (i.e. the name designated for each species is governed by strict international rules). Common names, on the other hand, may vary regionally or apply to several quite different species. To avoid confusion, the use of scientific names is encouraged. In this section the scientific names and most of the common names follow *The Flora of Canada* (Scoggan 1978), *Mosses of Eastern North America* (Crum and Anderson 1981) and *How to Know the Lichens* (Hale 1969).

# Acer spicatum Lam. Aceraceae (Maple Family)

# Mountain Maple



**General** - erect shrub up to 3 m high; branchlets purplish-grey, *minutely hairy*, older branches greenish-grey to black; terminal bud slightly stalked; often forming thickets.

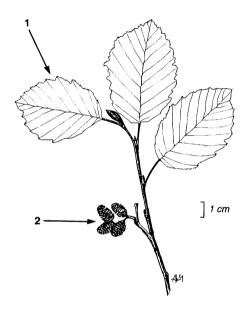
**Leaves** - opposite; with 3 prominent lobes and 2 obscure lobes near the base <sup>1</sup>, the main lobes abruptly sharp-pointed <sup>2</sup>; margins coarsely and irregularly toothed; lower surface with fine hairs, especially near the midrib.

**Flowers** - in dense, upright, long-stalked clusters at the branch ends<sup>3</sup>; individual flowers small (< 1 cm across), greenish-yellow; appearing after the leaves have emerged in late May and early June.

Fruit - paired keys (each about 2 cm long), borne in clusters; developing in July and August.

# *Alnus rugosa* (Du Roi) Spreng. Betulaceae (Birch Family)

# Speckled Alder



**General** - shrub or small tree up to 4 m high; branchlets light reddish-brown, hairy, not sticky; older twigs dark brown to purplish-black, hairless, *speckled with conspicuous*, *light warty dots*, pith 3-sided; often growing in clumps or thickets, hummock-forming.

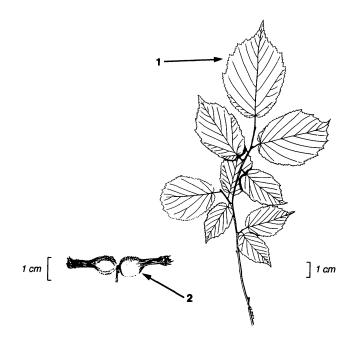
**Leaves** - alternate; egg-shaped or broadly oval, rounded to slightly heart-shaped at the base, pointed at the tip; *margins coarsely and unevenly double-toothed* <sup>1</sup>; with prominent, ladder-like veins; more or less hairy along the veins underneath.

**Flowers** - borne on catkins; male catkins slender, scaly, hanging on long stalks, elongating in the spring to 5-8 cm, opening in April or May; female catkins smaller, erect, cone-like, in small clusters at the branch ends.

**Fruit** - winged seeds borne in small (about 1 cm long), dark, roundish, woody cones (female catkins); cones without stalks or on short (< 1 cm) stalks<sup>2</sup>; cones persistent for a year or more after releasing the seeds.

# Corylus cornuta Marsh. Betulaceae (Birch Family)

### **Beaked Hazel**



**General** - coarse shrub up to 3 m high, often forming dense thickets; branchlets sparsely hairy; older twigs smooth, grey, often appearing somewhat mottled or striped, without conspicuous warty dots.

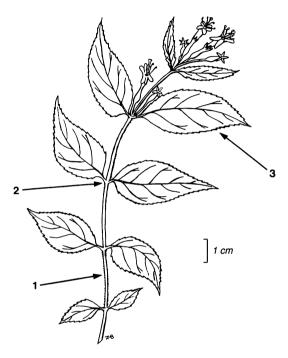
**Leaves** - alternate; egg-shaped to broadly oval, tapering to a point at the tip, rounded or heart-shaped at the base; *margins irregularly and coarsely double-toothed* <sup>1</sup>, often with distinctive "shoulders" below the middle; usually somewhat hairy beneath.

**Flowers** - male flowers borne on catkins, female flowers in small clusters; male catkins elongating to about 5 cm; female flowers concealed in buds with crimson, hair-like styles protruding; opening in late April and May.

**Fruit** - solitary or in small clusters; a round, hard-shelled nut enclosed in a *bristly husk with an elongated beak* <sup>2</sup>; ripening in late August and September.

# Diervilla lonicera Mill. Caprifoliaceae (Honeysuckle Family)

### Bush Honeysuckle



**General** - low, erect or arching shrub, < 1 m high; branchlets green or reddish, often with 2 fine ridges of minute hairs  $^{1}$ .

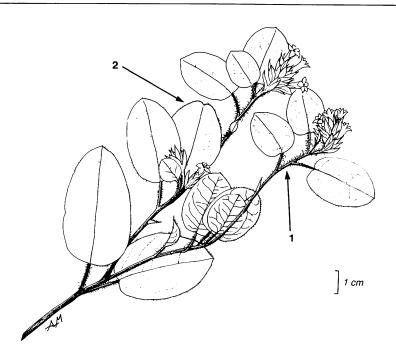
**Leaves** - opposite<sup>2</sup>; narrowly egg-shaped to lance-shaped, the tip long-tapering and sometimes curving, the base rounded often asymmetrical; margins sharply toothed<sup>3</sup>, usually with a fringe of short hairs; surfaces generally hairless.

**Flowers** - in small clusters (often 3 flowers) at the branch ends or in the leaf angles; individual flowers funnel-shaped with 5 yellow lobes, becoming reddish with age; appearing in June and early July.

Fruit - a slender, brown capsule tipped with a thread-like beak; July to September.

# Epigaea repens L. Ericaceae (Heath Family)

### **Trailing Arbutus**



General - prostrate, vine-like evergreen; stems and branches trailing, wiry, covered with bristly brown hairs 1.

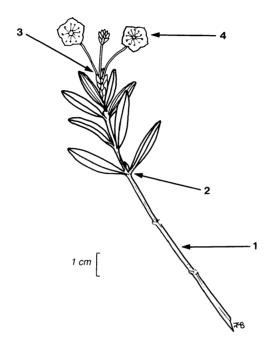
**Leaves** - alternate; somewhat leathery; up to 7 cm long; oval, oblong or broadly eggshaped, bluntly pointed at the tip, the base rounded or heart-shaped; leafstalk hairy, up to half the length of the blade; margins entire with a fringe of brownish hairs (ciliate)<sup>2</sup>.

**Flowers** - in small, crowded clusters in the leaf angles and at the branch ends; individual flowers approx. 1 cm long, waxy-looking, white or pinkish, spicily fragrant, tubular to funnel-shaped with 5 spreading lobes; appearing in May.

Fruit - a small, round, 5-lobed capsule; developing in August.

# Kalmia polifolia Wang. Ericaceae (Heath Family)

**Bog Laurel** 



**General** - low, straggling shrub, usually < 40 cm high; relatively unbranched; stems with conspicuous nodes, sharply 2-edged and flattened at alternate right angles in the internodes <sup>1</sup>; hairless.

**Leaves** - opposite<sup>2</sup>; evergreen, leathery, with no leafstalks; narrowly elliptic to lance-shaped; margins entire and inrolled; dark green, hairless and shiny above, conspicuously whitened with short, woolly hairs beneath.

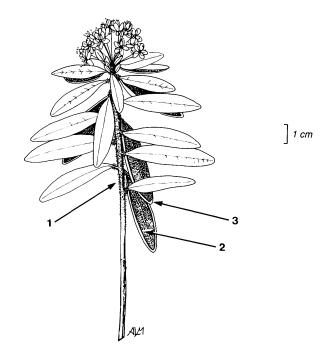
**Flowers** - in clusters at the branch ends <sup>3</sup>; individual flowers conspicuous and showy <sup>4</sup>, approximately 1 cm across, saucer-shaped, magenta with 5 spreading lobes, on long slender stalks; appearing in June.

Fruit - a small (6-7 mm long), brown, oval capsule with a long protruding style; appearing in July and August.

# Ledum groenlandicum Oeder

Labrador Tea

# Ericaceae (Heath Family)



**General** - low, spreading, evergreen shrub to 1 m high; often forming extensive patches; branchlets densely covered with curly brown hairs 1.

Leaves - alternate; firm, leathery, fragrant when crushed; oval to narrowly elliptic; upper surface dark green, somewhat wrinkled, hairless; lower surface densely covered with brown, woolly hairs 2; margins entire, inrolled 3.

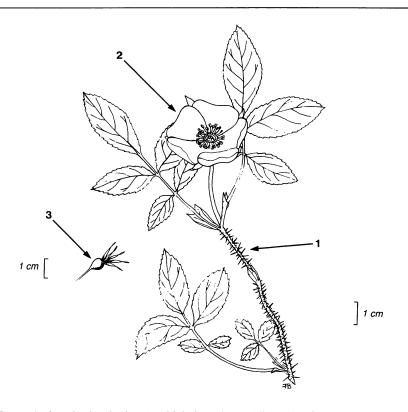
Flowers - in dense, showy clusters at the branch ends; individual flowers small (approx. 1 cm across), on slender stalks, with 5 separate, white petals; appearing in late May and June.

Fruit - a small (5-7 mm long) brown capsule with a protruding, hair-like style; splitting from the base; appearing in late July and August.

# Rosa acicularis Lindl.

### Prickly Wild Rose

Rosaceae (Rose Family)



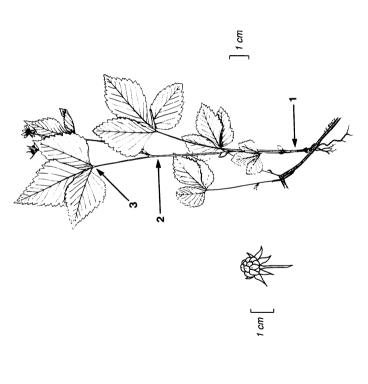
**General** - low, bushy shrub < 1 m high; branches reddish, densely covered with straight, slender thorns <sup>1</sup>.

**Leaves** - alternate; compound with 5 or 7 sharply toothed, oval to oblong leaflets; axis of leaf minutely hairy, usually glandular (use hand lens); with a pair of glandular, leaf-like stipules at the leaf base.

**Flowers** - usually solitary at the branch ends; *large* (5-7 cm diameter), showy flowers with 5 pink petals <sup>2</sup>; appearing in June and July.

Fruit - a bright red, many-seeded "rose hip" 3; ripening in late August and September.

# Dwarf Raspberry

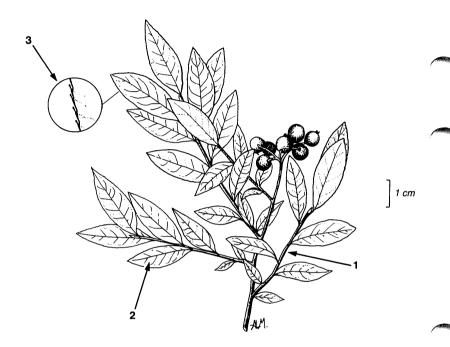


General - low, trailing perennial with runnerlike stems and erect, herbaceous, leafy branches 1; upright stems softly hairy but without thorns 2. Leaves - alternate; compound, 3-foliolate 3; leaflets diamond- or egg-shaped, tapering to a point; margins sharply toothed; surfaces essentially hairless. Flowers - on slender, glandular-hairy stalks from the branch ends; 1-3 flowers in a loose cluster; individual flowers with 5 petals, white or occasionally pale pink, erect at the base; appearing in May and June.

Fruit - a round, dark-red raspberry; ripening from July to September.

# Vaccinium angustifolium Ait. Ericaceae (Heath Family)

### Low Sweet Blueberry



**General** - low, branching shrub < 50 cm high, usually forming large patches (often in association with V. myrtilloides); branchlets greenish with small warty dots, essentially hairless  $^1$ .

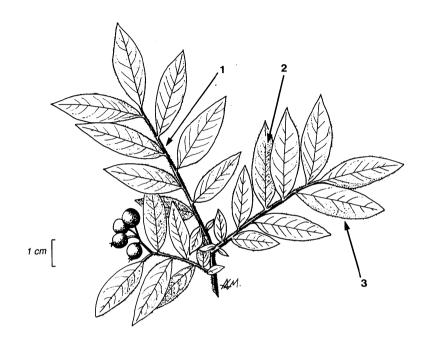
**Leaves** - alternate; oval to narrowly elliptic or even lance-shaped, tapering at both ends; thin, bright green, hairless <sup>2</sup> or with a few hairs along the veins beneath; margins minutely toothed with glandular teeth <sup>3</sup>.

**Flowers** - in crowded clusters; individual flowers bell- or urn-shaped with 5 fused lobes, white or pale pink, approx. 5 mm long; appearing in May and early June.

*Fruit* - a bright blue berry with a whitish, powdery coating; ripening in late July and August.

# Vaccinium myrtilloides Michx. Ericaceae (Heath Family)

## Velvet Leaf Blueberry



**General** - low, branching shrub < 50 cm high, often forming large patches (usually in association with *V. angustifolium*); branchlets densely velvety hairy <sup>1</sup>, bark often peeling from older stems revealing crowded, warty dots.

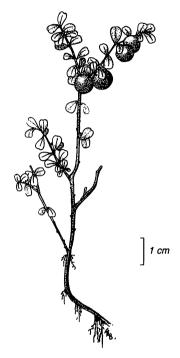
**Leaves** - alternate; oval to narrowly elliptic, tapering at both ends; thin, soft, covered by downy hairs (at least the lower surface)<sup>2</sup>; margins entire and finely hairy<sup>3</sup>.

**Flowers** - in crowded clusters; individual flowers bell-shaped or cylindrical with 5 fused lobes, white or tinged with pink, approx. 5 mm long; appearing in May and early June.

**Fruit** - a dark blue berry with a whitish, powdery coating; ripening in late July and August.

# Vaccinium vitis-idaea L. Ericaceae (Heath Family)

# Mountain Cranberry



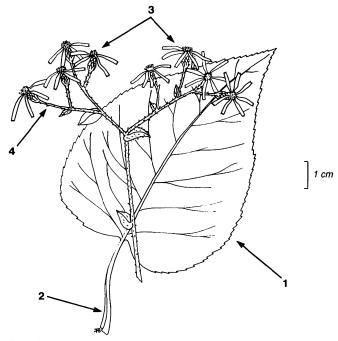
**General** - low, prostrate, mat-forming, evergreen shrub; stems slender, trailing or erect, with peeling bark; branches erect, < 15 cm high.

**Leaves** - alternate; small (< 1.5 cm long), firm and leathery; elliptic to inversely eggshaped, the tip rounded, blunt or indented, tapering at the base to a short leafstalk; dark green, shiny and hairless above, pale and *dotted with dark glands* beneath; margins entire and inrolled.

**Flowers** - in small clusters at the branch ends; individual flowers small (approx. 5 mm long), white or pinkish, bell-shaped with 4 slightly spreading lobes; appearing in June and July.

Fruit - a dark red berry; ripening in August and September.

### Large-leaved Aster



**General** - perennial with creeping rhizomes, often forming dense patches of single-leaved, vegetative individuals; flowering stems up to 1 m high, usually hairy, with a short, woody base.

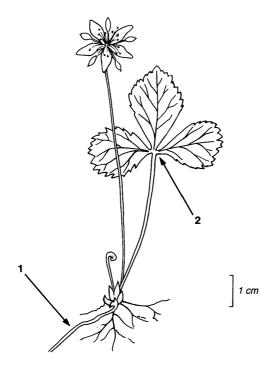
**Leaves** - alternate on the flowering stem; most commonly encountered as basal leaves of non-flowering individuals; basal leaves very large (up to 20 cm long and 15 cm wide)<sup>1</sup>, firm, thick, usually hairy, coarsely toothed, tapering to a pointed tip, heart-shaped at the base, on long leafstalks without a fringe of fine hairs<sup>2</sup>; upper stem leaves reduced, essentially stalkless.

**Flowers** - in a loose, open, *flat-topped*<sup>3</sup> inflorescence with sticky hairs<sup>4</sup>; individual flower heads daisy-like, sparse, with 9-20 purple to pale blue rays; appearing in August.

*Fruit* - small, linear seeds with fluffy, bristle-like hairs; forming a small dandelion-like ball for each flower head; appearing in September.

# Coptis trifolia (L.) Salisb. Ranunculaceae (Buttercup Family)

### Goldthread



**General** - low, small perennial with basal, 3-foliolate leaves and leafless flower stalks from a *slender*, *golden rhizome* <sup>1</sup>.

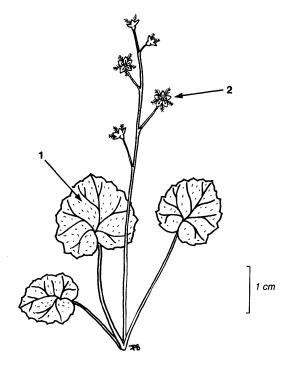
**Leaves** - shiny, evergreen, somewhat leathery, divided into 3 stemless leaflets  $^2$  each obscurely lobed and with rounded teeth.

**Flowers** - usually single on a naked stalk 5-15 cm high; individual flowers white, delicate, star-shaped, with 5-7 parts, about 1 cm wide; appearing in late May and June.

Fruit - a few slender, beaked capsules in a loosely spreading cluster; appearing in July and August.

# Mitella nuda L. Saxifragaceae (Saxifrage Family)

### Naked Mitrewort



**General** - small, perennial herb spreading by rhizomes and often runners; solitary, erect flowering stem glandular-hairy, *leafless*, < 20 cm high.

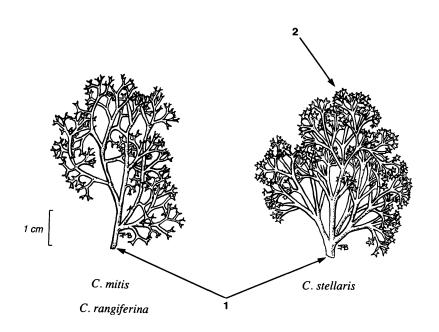
**Leaves** - basal; round to kidney-shaped; margins slightly lobed or doubly round-toothed; on long leafstalks; with scattered, erect, bristly hairs <sup>1</sup>.

**Flowers** - in a sparse spike-like inflorescence; individual flowers small (< 1 cm wide), saucer-shaped with 5 fringed, greenish petals<sup>2</sup>; appearing in May and June.

Fruit - a capsule with shiny, black seeds; ripening in July and August.

Cladina spp. Cladoniaceae

### Reindeer Lichens



**General** - erect, much branched, "shrubby" ground lichens forming colonies, often extensive, of intertwined stems; scale-like "squamules" lacking; stems rounded in cross-section 1, hollow, surfaces appearing "cottony" (use hand lens), finely branched, the branch-angles open.

### Cladina stellaris (Opiz) Brodo

yellowish-grey lichen forming distinct, compact, coral or cauliflower-like heads 2.

### Cladina rangiferina (L.) Harm.

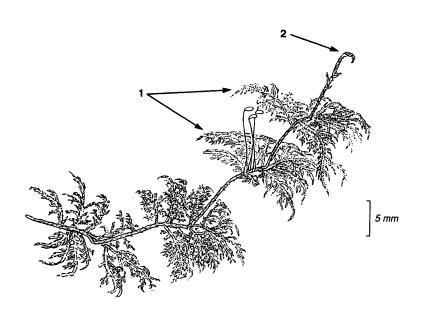
ashy-grey lichen forming scattered, entangled masses without distinct coral-like heads.

### Cladina mitis (Sandst.) Hale & Culb.

similar in form to C. rangiferina but distinguishable by its yellowish-grey colour.

# Hylocomium splendens (Hedw.) BSG. Hylocomiaceae

Stair-step Moss



**General** - yellow to brownish-green feathermoss of delicate appearance; forming loose mats; stems and branches reddish, covered with tiny green scales; stems stiff and wiry, bi- to tripinnate in horizontal fronds forming stepwise layers 1, each frond originating from the centre of the previous year's layer with an arched shoot 2.

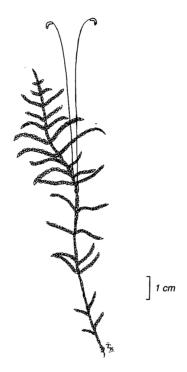
**Leaves** - loosely overlapping on the main stem, more tightly arranged on the branches; egg-shaped to oblong, sharply pointed at the tip; concave, with 2 short mid-ribs (use hand lens); margins turned inwards, with tiny teeth (use hand lens).

**Sporophytes** - scattered along the stems; stalks reddish, smooth, twisted when dry; capsules brown to reddish-brown, egg-shaped to cylindrical, horizontal, smooth except wrinkled at the mouth when dry.

Pleurozium schreberi (Brid.) Mitt.

Schreber's Moss

Hylocomiaceae



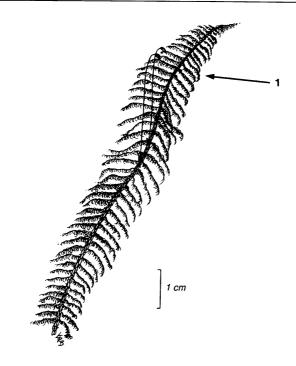
General - robust, prostrate feathermoss often forming extensive mats on the forest floor; light green to yellowish green, somewhat glossy; stems red, pinnately branched.

**Leaves** - loosely overlapping on the stem giving the branches a somewhat succulent appearance when wet; egg-shaped to broadly oval, rounded at the tip; very concave, no apparent mid-rib (2 very short ones at the base); margins turned inwards, entire or with tiny teeth at the tip (use hand lens).

**Sporophytes** - scattered individually along the stems; stalks red, smooth, often twisted when dry; capsules brown to reddish-brown, cylindrical, curved, horizontal, smooth.

Ptilium crista-castrensis (Hedw.) De Not. Hypnaceae

Plume Moss



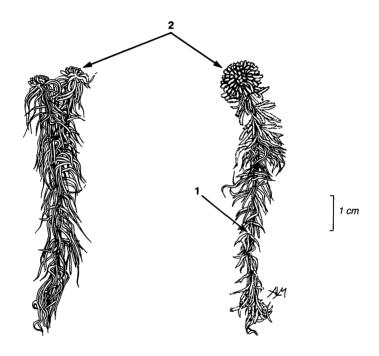
**General** - shiny, delicate, bright green feathermoss growing in tight, often extensive, mats on the forest floor; stems semi-erect, regularly pinnately branched with a distinct plume-like appearance 1; branches progressively shorter towards both the base and tip of the frond.

**Leaves** - stem leaves larger than the branch leaves; all leaves tightly overlapping; eggshaped to lance-shaped, *tapering to a long point which is strongly curled downwards and/or sideways*; concave with longitudinal folds or pleats and 2 short (less than 1/2 the leaf length) midribs or none; margins minutely toothed (use hand lens).

**Sporophytes** - scattered individually along the stem; stalks reddish, smooth, slightly twisted when dry; capsules brown to reddish-brown, oblong to cylindrical, horizontal.

Sphagnum spp. Sphagnaceae

**Peat Mosses** 



**General** - a distinctive group of species typically growing in wet habitats; forming loose mats or densely tufted hummocks, often over extensive areas where accumulations of dead plants form peat deposits of varying thicknesses; stems erect, usually not forked; branches in clusters along the stem 1, crowded at the stem tip to form a dense "head" 2; the various species range from small, slender plants to large, robust individuals, with colours from bright green to yellowish, purple, red and brown.

# 6.5 Index to the Scientific and Common Names of Illustrated Plant Species

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