BOREAL ECOSYSTEMS OF THE FORT NELSON AREA OF NORTHEASTERN BRITISH COLUMBIA

by

RICHARD M. ANNAS
B.S.F., University of British Columbia

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Department of Botany

The University of British Columbia
2075 Wesbrook Place
Vancouver, Canada
V6T 1W5

Date Oct. 22/77

ABSTRACT

An ecosystem study, based on the concept and approach of biogeoclimatology (sensu the Krajina school of ecosystem classification), was conducted in the boreal forest of northeastern British Columbia in the Fort Nelson area. The prime purpose of this study was to produce an ecological classification of forested ecosystems of the area. The resulting classification was based on an analysis of as many environmental and vegetational characteristics as feasible. Interpretations of the environmental and vegetational analyses presented attempt to explain the factors which conspicuously contribute to ecosystem processes and development.

The vegetation from 95 phytogeocoenotic plots was classified into 6 orders, 10 alliances and 15 associations and the soils were classified into 17 subgroups, some with their gleyed variations. Detailed soil analysis and descriptions are major components of the ecosystem descriptions. The ecosystems are summarized environmentally by their projection on an edatopic grid of moisture and nutrient regimes.

An elemental ash analysis was carried out on surface organic horizons. Ca and Mg content appear to be good indicators of the positions that ecosystems occupy on the edatopic grid. Additionally, mor humus of black spruce ecosystems was compared with moder humus of aspen ecosystems. It is confirmed

that moder humus has properties which are more conducive to high biological activity than does mor humus.

It is concluded that the cold boreal climate , flatness of the terrain, prevailingly fine textured soil parent material, and fairly frequent forest fires are the dominant environmental factors influencing ecosystem structure and dynamics in the study area.

The fine texture of the parent material frequently causes very slow percolation of water through soils which produces semi-stagnant water conditions instead of the rich seepage sites of more easily drained materials in other areas. Sufficient moisture is retained in these fine textured soils to prevent xeric conditions from developing, even in shedding topographic positions.

The cold temperatures reduce biological activity of the area to the point where nutrient poor, mor humus conditions develop. Mor humus promotes degradation of soils. However, this process is greatly inhibited by frequent forest fires. These fires maintain aspen stands as a fire climax which retards the development of strong acidity, so characteristic in mor humus of black spruce stands (the theoretical climatic climax).

The general flatness of the terrain results in poor drainage of the area and favours the development of bogs. In high moors, a permafrost layer consistently occurs.

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Chapter I

INTRODUCTION

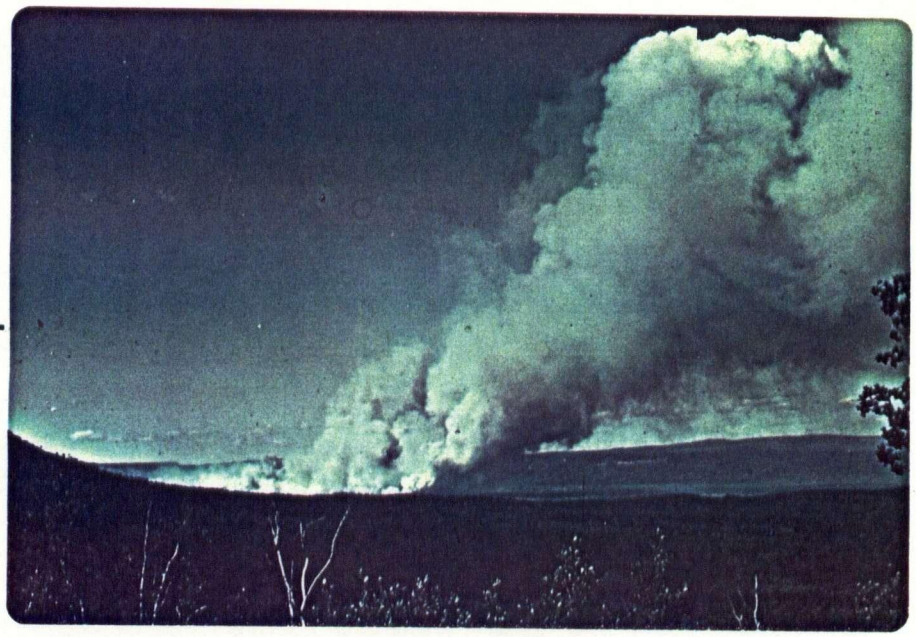
One of the most extensive forest zones in the world is the boreal forest which, south of the arctic tundra, forms a broad belt of forest across both North America and Eurasia. In Eurasia this zone has been referred to as the eurosiberian domain of conifers (Pineto - Piceetum) by Tüxen (in Knapp, 1965) to the Siberian term taiga (Major, 1969). Various other non-scientific terms range from the "great north woods" to the dark coniferous forests. In North America, this forest is sometimes called the taiga (La Roi, 1967), but it is usually simply referred to as the boreal forest.

This investigation concerns itself with one small area of this vast forested zone, the northeastern part of British Columbia.

Objectives

The basic objectives of the study are to produce a classification of forest ecosystems in the boreal forest

The Boreal Forest





Figs. 1 & 2 Looking east from Steamboat Mt. towards the Fort Nelson Lowlands. Fire is a characteristic phenomena of the boreal forests. Below, the effects of fire and drainage patterns are evident on the landscape. Poorly drained areas are slow to regenerate.

[Boreal White and Black Spruce Biogeoclimatic Zone of the Canadian Boreal Forest (Krajina, 1965)] of the Fort Nelson area in northeastern British Columbia and to elucidate some leading environmental relationships between vegetation and soils. It is now a well established fact that such basic ecological studies are required for sound mangement of renewable living resources. The nature and extent of ecosystems must be known before they can be managed properly. This is the first attempt to develop an ecological classification of the boreal zone in British Columbia.

Approach and terminology

The basic methods utilized in this study were those developed by Krajina and his students at the University of British Columbia over the past 25 years. The basic methods have previously been utilized for studies in most of the biogeoclimatic zones in British Columbia by Brayshaw (1955), McMinn (1957), Mueller-Dombois (1959), Orloci (1961, 1964), Bell (1964), Peterson (1964), Wade (1965), Brooke (1966), Eady (1971 Cordes (1972), Wali (1969), Beil (1969), Fraser (1970), Brooke et al (1970), Kojima (1971), Revel (1972), Klinka (1976), amongst others. In publications, Krajina (1933, 1959, 1960, 1965, 1969, 1971, 1972) has discussed the philosophy, terminology and use of his biogeocoenotic classifications. Additionally, the above

authors have described the methodology and approach in detail. Therefore, only a few pertinent points will be given here.

The basic ecosystem unit utilized in this study is the biogeocoenose as defined by Sukachev (1944) and by Sukachev and Dylis (1964). This ecosystem unit is considered to be a specific case of the ecosystem defined by Tansley (1935). The level at which the ecosystem is studied is that of the plant community (as used by the Zürich-Montpellier school of phytosociology) and the polypedon (as defined by the Canadian System of Soil Classification).

Each "type of plant community" (plant association sensu Braun-Blanquet) and each type of soil (at the series level) are considered to be a basic ecosystem type. In this study, since many series are not defined, soils are classified only to subgroup. For pragmatic reasons, ecosystems are grouped into plant associations for presentation in this study. Each different type of soil, on which a given plant association occurs, must however, be considered as a separate basic ecosystem type.

Methods utilized, to group plant communities into associations, follow the Zürich-Montpellier school of phytosociology (in Braun-Blanquet, 1932). This methodology is

described by Mueller-Dombois and Ellenberg (1974), and Whittaker (1975). In respect to methodology, Moore et al. (1970) and Shimwell (1972) share the view that so-called "traditional" methods give very good results and understanding for the amount of input required and that they are generally more efficient than strictly quantitative methods. This method assumes that vegetation is the best ecosystem integrator.

A useful view of ecosystems is through the following formula (Dokuchaev, 1898; Jenny, 1941 and Major, 1951).

$$\text{Vegetation/soil} = \int (\text{climate, organisms, relief, parent material, time}).$$

Since the present study was conducted within one macroclimate, the differences in vegetation and soils of the various ecosystems are primarily caused by changes in one or more of the factors on the right of the equation other than climate (if the difference was due to a different macroclimate, one would be dealing with a different biogeoclimatic zone or subzone). As much as possible, this present study concerns itself with recognizing the various types of ecosystems within a biogeoclimatic subzone and attempts to explain the causal factors which account for the differences between these types.

The Study Area

Most of the study area lies within the southern fringe of the permafrost region, the boundary of which is roughly equivalent to the -1° C (30° F) mean annual isotherm (Brown, 1967). Tarnocai (1974), in an unpublished map of peatland regions of British Columbia, considers all of the area covered by this study to be in the region of "Subarctic Bogs and Fens". His lower latitudinal boundary for this region is slightly lower than the -1° C mean annual isotherm.

The portion of the boreal forest under study is considered by Knapp (1965) to be a transition area at the eastern slope of the northern Rocky Mountains, with occurrences of species typical of western North America. Halliday (1937) considers the Fort Nelson area to belong to the Mackenzie Lowlands and Upper Liard sections of the boreal forest. The region of this study falls into what Rowe (1959) terms the Upper Mackenzie and Upper Liard sections of the boreal forest. The study area is centered in the largest part of the boreal forest found in British Columbia. Figure 3 shows the Boreal White and Black Spruce Biogeoclimatic Zone as delineated by Krajina (1973).

This area differs from the eastern boreal forest by the absence of such tree species as Abies balsamea

and infrequent occurrence of Pinus banksiana. These species are replaced in the west by Abies lasiocarpa and Pinus contorta. In addition, the western boreal forests contain Betula resinifera, as well as B. papyrifera.

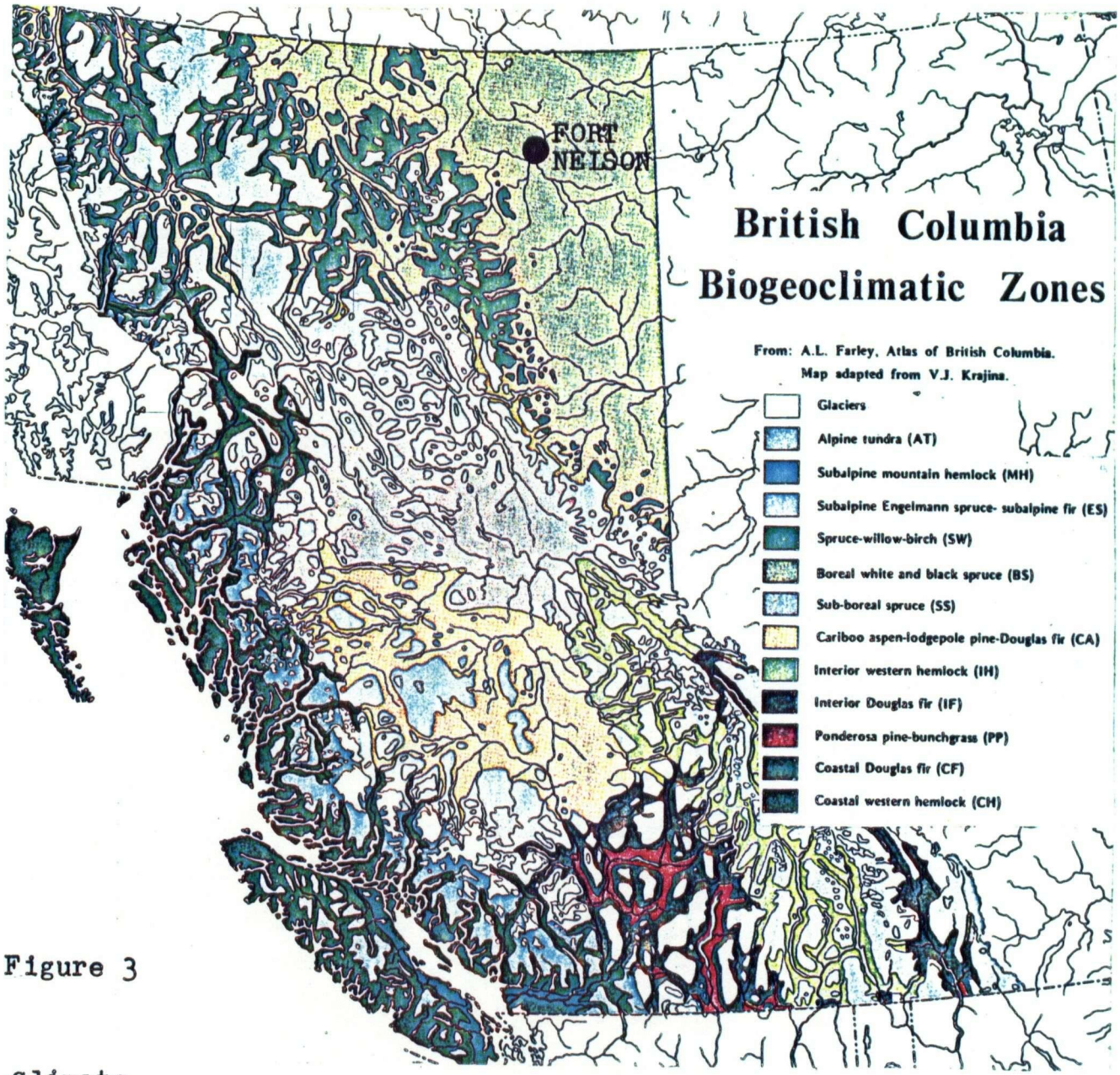


Figure 3

Climate

The climate of the study area has been characterized as a microthermal continental boreal climate (Dfc after Köppen)

by Krajina (1969). The following climatic statistics are from Environment Canada's "Temperature and Precipitation, 1941 - 1970" for British Columbia.

Total annual precipitation at Fort Nelson (the center of the study area) averages 45 cm per year, with 40% occurring in June, July and August. The mean annual temperature is -1.3° C at the Fort Nelson airport. The mean daily temperatures for January and July are -23° C and 16.7° C respectively. Mean daily minimum temperatures for these two months are -28° C and 10° C respectively. The area averages 219 frost days during the year with only July being frost free. A summary of the climate of Fort Nelson, which was produced by Krajina (unpublished notes), is shown in Fig. 4.

The study area is characterized by long cold winters and cool summers. Kendrew and Kerr (1955) report that in areas north of latitude 55° N, the days are short in the winter with little effective sunshine. During the summer, however, the long day length and sunshine foster better plant growth than air temperature would suggest.

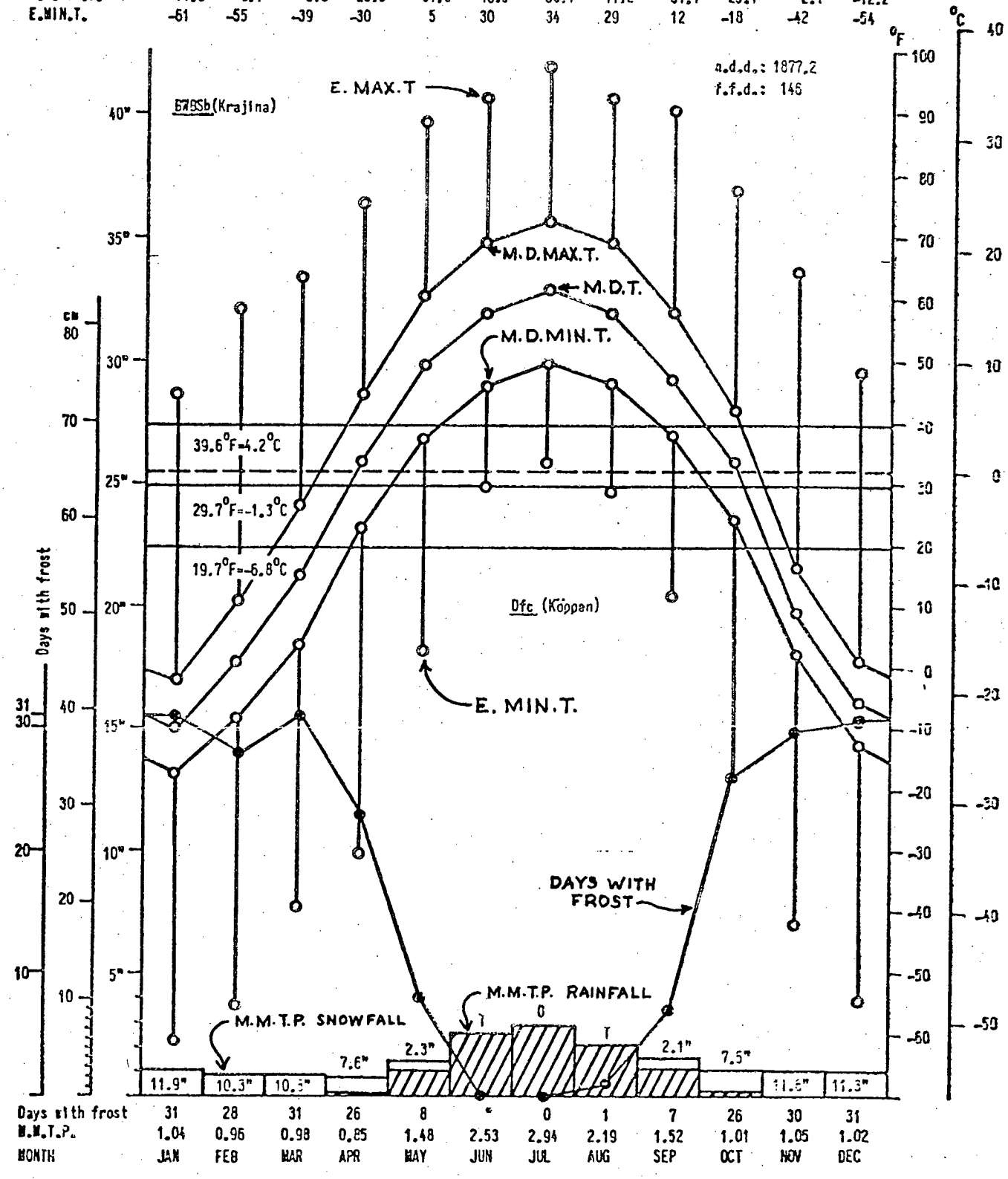
Physiography

The study area lies within the Interior Plains of North America which extend into British Columbia in the north-

CLIMATIC SUMMARY

FORT NELSON AIRPORT 58°50'N, 122°35'W, 1230' ASL. Record: 30-34 years.
Months above 50°F: 3, below 32°F: 5, A.M.T.P. 17.57", A.M.S.F. 75.4", snow % A.M.T.P.: 42.91, days with frost, yearly: 219.

E.MAX.T.	45	59	64	76	89	93	98	93	91	78	65	49
M.D.MAX.T.	-1.9	11.0	27.2	45.2	61.0	69.6	73.4	70.2	58.3	43.0	17.0	1.6
M.D.T.	-9.8	1.3	15.5	34.1	49.4	58.1	62.1	58.7	47.9	34.1	9.9	-5.3
M.D.MIN.T.	-17.6	-8.4	3.8	23.0	37.8	46.5	50.7	47.2	37.4	25.1	2.7	-12.2
E.MIN.T.	-61	-55	-39	-30	5	30	34	29	12	-18	-42	-54



Days with frost	31	28	31	26	8	*	0	1	7	26	30	31
M.M.T.P.	1.04	0.96	0.98	0.85	1.48	2.53	2.94	2.19	1.52	1.01	1.05	1.02
MONTH	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC

Figure 4

east section of the province. Holland (1964) considers the Interior Plains to be represented in British Columbia by the Alberta plateau and its subdivision, the Fort Nelson Lowland. The Fort Nelson Lowland is arbitrarily separated from the rest of the Alberta plateau at the 700 m (2000') contour level. The interior plains, in the Fort Nelson area, are underlain by gently tilting sedimentary rocks of Cretaceous Age which were deposited in alluvial, deltaic and marine environments (Taylor and Stott, 1968). Basically, these sedimentary rocks are marine shales of the Buckinghorse formation and sandstones of the Sikanni formation which both belong to the Fort St. John Group of sedimentary rocks (Taylor and Stott, 1968).

The area around Fort Nelson was over-ridden by continental ice sheets during the Pleistocene. According to Holland (1964), the Keewatin ice sheet, which originated in a center west of Hudsons Bay, flowed southwestward and westward across the Fort Nelson Lowland, transporting boulders and drift from precambrian parent rocks in the east. The maximum advance sheet was considered to be west of Fort Nelson where it was relatively thin (Holland, 1964). Taylor and Stott (1968) reported thin or absent glacial deposits on higher lands, but thick deposits in adjacent lowlands such as at the Fort Nelson airport where 232 meters (760') of glacial drift

overlie bedrock. In general, soil parent materials can be related directly to underlying bedrock except for certain areas of sand and alluvial bottomlands (Valentine, 1971).

Three major rivers drain the Fort Nelson area: the Prophet, Muskwa, and Fort Nelson. (Figs. 5, 18, 90 and 91). In general, much of the Fort Nelson Lowland is poorly drained due to the flat or gently rolling topography and the fine textured soils and parent material. This has resulted in the formation of many small lakes and bogs since deglaciation. The pattern of vegetation development is therefore greatly affected.

Valentine (1971) found it difficult to separate clays of lacustrine origin from morainal deposits derived from the soft marine shales of the Buckinghorse formation. This factor, coupled with the lack of any geomorphological study of the area, led him to the development of a terrain system based on the recurring patterns of surface materials, morphology and geology. Four such terrain systems were described by Valentine (1971). (See Figs. 5, 6, 7, & 8).

The very gently inclined plain of the Fort Nelson Lowland, with its low relief and low surface water runoff, is described by Valentine as the Buckinghorse Terrain System.

Mineral parent materials are mostly derived from the silty marine shales of the Buckinghorse formation. This generally poorly drained terrain system is very extensive, especially east of Fort Nelson.

The higher hills above the Buckinghorse Terrain System, such as the Poplar Hills west of Fort Nelson, are classed as the Sikanni Terrain System. These areas are generally composed of sandstones and interbedded silty shales of the Sikanni formation. Drainage is generally better than on the Buckinghorse Terrain System due to increased slopes, however, on flat or gently inclined areas, bog development is generally present due to impeded drainage.

Areas, where sands and gravels were deposited over the Buckinghorse Terrain System during deglaciation, are considered to be part of the Chuatse Terrain System. Where these deposits are thick enough to rise above the general level of the Buckinghorse Terrain System, or are adjacent to the rivers or downcut streams, the soils are well drained. Otherwise the general flatness of the terrain restricts soil drainage.

The valley slopes and alluvial bottomlands of streams, which have cut through the plain, are placed

into the Muskwa Terrain System. This system includes the remnants of previous stream channels as well as the present rivers.

Terrain Systems



Figs. 5 & 6 Above, looking north along the Muskwa River. Fort Nelson is on the left. The valley bottom, with its slopes, belong to the Muskwa Terrain System. The flat plain belongs to the Buckinghorse Terrain System. Although not visible above, fluvial material was often deposited over the Buckinghorse Terrain System, especially along the edges of the rivers. This was termed the Chuatse Terrain System by Valentine. The lodgepole pine, growing on the dunes in the photo **below** belongs to the Chuatse Terrain System. The terrain systems used here were developed and described by Valentine (1971).



Terrain Systems

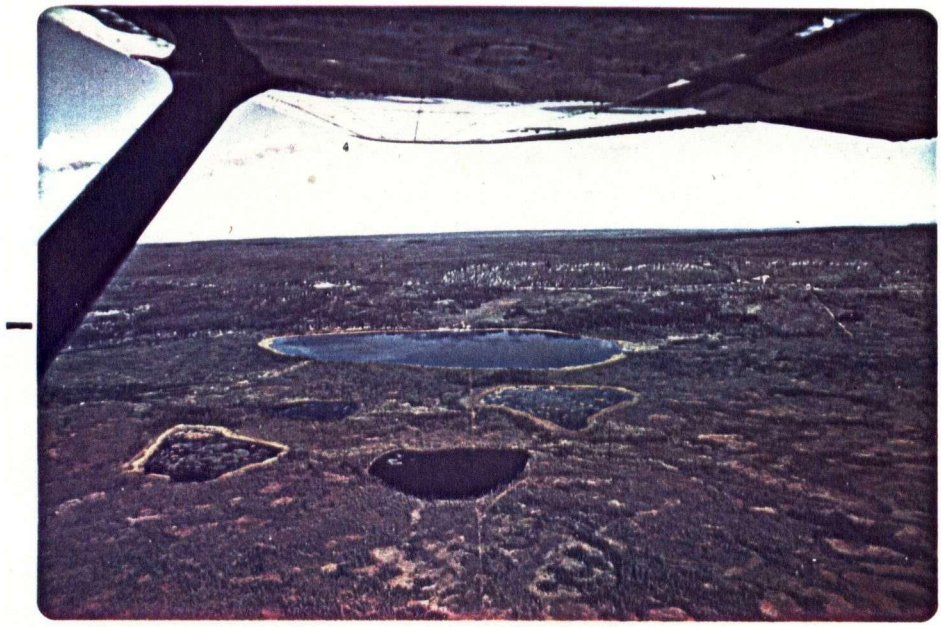


Fig. 7 The poorly drained Buckinghorse Terrain System in the foreground. The Sikanni Terrain System behind Parker Lake (the larger lake) rises in the background.

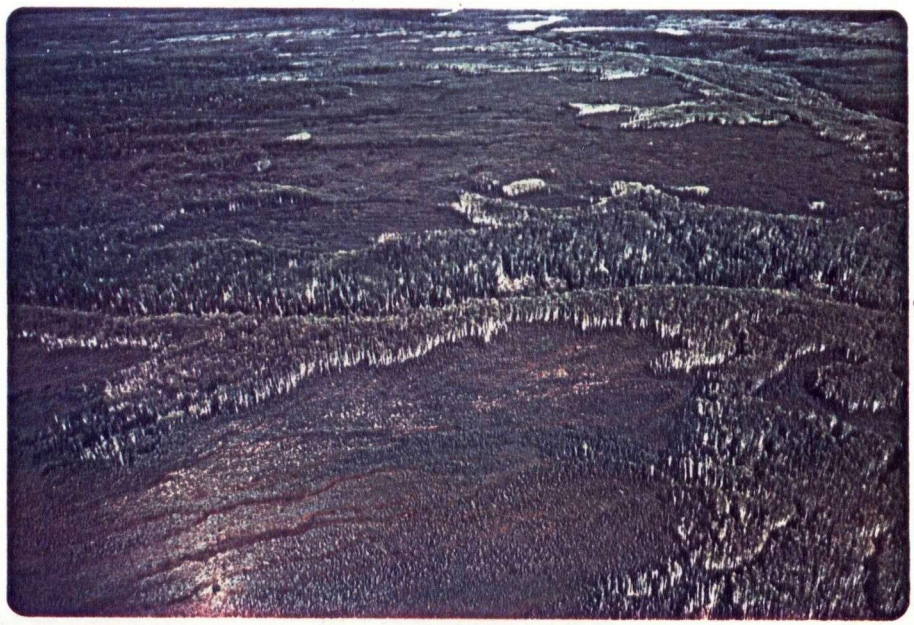


Fig. 8 Effects of drainage where fluvial materials are deposited over the Buckinghorse Terrain System. Here the gradients between communities are sharp.

Chapter II

METHODS

Vegetation Analysis and Synthesis

As mentioned earlier, the basic method utilized for describing vegetation is that developed by the phytosociologists of the Zürich-Montpellier school as modified by Krajina (1933-1972).

A two week reconnaissance trip was made by V. J. Krajina and the author to the study area during the early summer of 1970. Notes were made on the types and distributions of plant communities and potential sampling sites were noted. Additionally, a comprehensive collection of plants was made and the plants identified.

Sample sites were selected on the following basis:

(1) The community had to occur repeatedly on the landscape.

(2) The community had to be homogeneous, both vegetationally

and environmentally. (3) The community had to be large enough to accommodate a 400 sq m sample plot if forested and a 100 sq m sample plot if non-forested.

Additionally, where possible, only the oldest forest stands were sampled and only those which were not subject to human disturbance. Plots were placed subjectively within the plant community in an area which was judged to best represent that community. An attempt was also made to select sample areas which would indicate the variation of environmental conditions under which a given plant association would occur.

For each plot, qualitative and quantitative environmental information was collected on the following physiographic features: % slope, exposure, latitude, longitude, elevation, and landform. Estimates of % cover of litter and humus, exposed mineral soil, rock, and decaying wood were additionally made for each plot.

Vegetation in each plot was analysed as follows: All vascular plants, bryophytes, and lichens were identified and listed for each vegetation layer. Vegetation layers were defined as below.

A (tree) layer: A_1: Dominant trees, whose crown extended above the general canopy.

A_2: Co-dominant trees, whose crowns formed the bulk of the upper canopy.

A_3: Suppressed trees or trees whose crowns were overtopped by the co-dominant and dominant trees. These trees were over 5 m in height.

B (shrub) layer: B_1: Woody plants over 2 m but less than 5 m.

B_2: Woody plants less than 2 m in height.

C (herb) layer: All herbaceous plants regardless of height. This layer included small woody plants such as Arctostaphylos uva-ursi, Vaccinium vitis-idaea, and Salix myrtillifolia.

D (moss) layer: Dh: Bryophytes and lichens occurring on humus and mineral soil.

Dw: Bryophytes and lichens occurring on dead and decaying wood.

Dr: Bryophytes and lichens occurring on rocks.

When establishing plots, the species significance of each vegetation layer was estimated according to the Domin-Krajina scale which is defined in the following table (taken from Klinka, 1974).

Symbol	Code	Corresponding cover value(%)	Description
+	-1	0.2	very sparsely present, dominance very small (0.1 - 0.3%)
1	1	0.7	sparsely present, dominance small (0.3 - 1.0%)
2	2	1.5	very scattered, dominance small (1.0 - 2.2%)
3	3	3.5	scattered to plentiful, dominance 2.2 - 5.0%
4	4	7.5	often present, dominance 5. - 10%
5	5	17.5	often present, dominance 10 - 25%
6	6	29. 0	any number of individuals, dominance 25 - 33%
7	7	41.5	any number of individuals, dominance 33 - 50%
8	8	62.5	any number of individuals, dominance 50 - 75%
9	9	87.5	any number of individuals, dominance over 75%

Table 1 Species Significance

When averaging species significance, assumed values representing the midpoints of the units of the Domin-Krajina scale were assigned for each class (corresponding cover value in the above Table). Species vigor was assessed as follows.

0 - species dead
+ - vigor poor
1 - vigor fair
2 - vigor good
3 - vigor excellent

Judging species vigor is very difficult, unless a species is known throughout its entire range of growing conditions. Therefore, in many cases, no value was given to the species

for vigor in this study.

In the vegetation tables presented in the next chapter, for each plot, every species is represented by a number such as 4.2. The first number represents species significance which in this case would be 4. The number after the decimal place (2) represents vigor.

The symbols used in the last three columns of the vegetation tables are as follows: P represents % presence (in this particular study presence and constancy are identical since within each association plot size was constant), MS represents mean significance, and RS represents range of significance.

Vegetation tables were constructed by tentatively placing the plots into plant associations with the assistance of a computer and then carefully examining the associations for floristic similarity. A computer program was developed at the University of British Columbia for mechanically handling relevés and producing association tables (see Klinka, 1974).

A summary synthesis table of all associations is presented on page 246. The constancy classes utilized in

this table are after Braun-Blanquet (1932) and are as follows.

class	% of the plots
I: rare	1 - 20
II: seldom present	21 - 40
III: often present	41 - 60
IV: mostly present	61 - 80
V: constantly present	81 - 100

Table 2 Constancy

The vegetation classification hierarchy is, along with the characterizing suffixes, as follows.

Order	-	etalia
Alliance	-	ion
Association	-	etum
Subassociation	-	etosum
Variant	-	osum

Soil Analysis

One soil pit was dug in each plot. The various horizons were described and sampled. Descriptions included thickness of horizons, stoniness, root distribution, depth to

water table, depth to permafrost, parent material, position on slope, and landform. The soils were tentatively classified in the field as to subgroup.

Soil samples were immediately air dried after sampling. In the laboratory, they were sieved through a 2 mm mesh screen and the fraction smaller than 2 mm in size was further analysed.

Analytical methods used are those described by Harris and Lavkulich (1972). Determination of soil pH was done in a 1:1 soil water suspension for mineral soils and a 1:4 soil water suspension for organic soils. Total nitrogen was determined by the "Semi-micro Kjeldahl" method. Soil organic matter was determined by the Walkley-Black or Titrimetric method. Phosphorus was determined through the modified method described by Harris and Lavkulich (1972). Exchangeable cations and total exchange capacity were carried out by the neutral NH_4OA_c method. Partical size analysis was carried out by the hydrometer method using a computer program. Further details on these methods are given by Day (1950), Jackson (1958), and Black (1965).

A modified method, for partical size analysis, was tested for soil samples with high pH, which indicated high

carbonates in the soil. Carbonates, when present, may tend to cement small soil particles together. The analysis will therefore, show a coarser texture for the soil than is really the case. To overcome this problem, some of the soil samples with high pH were treated to destroy the carbonates. Concentrated HCl was added to the sample and heated until no further bubbles were released. The acid was then removed by suspending the sample in distilled H_2O and centrifuging the sample. The water was poured off and the washing and centrifuging procedure was repeated twice more to remove all the excess acid. The sample was then treated by the normal procedure. Results, from samples treated by both methods, showed essentially no differences. Results obtained from samples with carbonates removed are marked with an asterisk in the soil tables.

The determination of total nitrogen, soil organic matter, phosphorus, and total cation exchange capacity was done in the Pedology Laboratory, Department of Soil Science, University of British Columbia. Exchangeable cations were determined on a Perkin-Elmer Atomic Absorption Spectrophotomter Model 303, with a digital concentration readout.

The results of the soil analysis are presented in the next chapter adjacent to the plant association tables.

Chapter III

UNITS OF THE BOREAL WHITE AND BLACK SPRUCE BIOGEOCLIMATIC ZONE

This chapter deals with the individual plant associations, alliances, and orders as they appear in the synopsis of units (Table 3, page 26). Individual plant associations numbered in table 3 additionally are projected on the edatopic grid (Fig. 9, page 28).

The discussions of individual plant associations are preceeded by reference tables which are consistently positioned at the beginning for easy referral. Individual plant associations begin with an extraction of the characteristic combination of species, followed by tables showing environmental and physical characteristics of individual plots, plant association tables and soils tables. The "Characteristic Combination of Species" table was developed by extracting the most commonly occurring species (presence $>$ 60%) from the plant association tables. "Characteristic species", for a particular association, are marked with an asterisk in the "Characteristic Combination of Species" tables.

Zonal Species for British Columbia

The Boreal White and Black Spruce (BWBS) Biogeoclimatic zone in the Fort Nelson area is characterized by the following "combination of plants". These plants are prevalent in the zone or are more common in the BWBS zone than in other zones in British Columbia.

A: Trees

Picea glauca	Pinus contorta	P. balsamifera
P. mariana	P. banksiana	Betula papyrifera
Larix laricina	Populus tremuloides	B. resinifera (B. neoalaskana)

B: Shrubs

Alnus crispa	Ledum groenlandicum	Salix bebbiana
A. tenuifolia	Ribes oxyacanthoides	S. planifolia
Betula glandulifera	R. glandulosum	Shepherdia canadensis
(B. pumila)	Rosa acicularis	Vaccinium vitis-idaea var. minus

C: Herbs

Aralia nudicaulis	Geocaulon lividum	Mitella nuda
Calamagrostis canadensis	Goodyera repens	Petasites palmatus
Cornus canadensis	Habenaria obtusata	Pyrola asarifolia
Equisetum arvense	H. orbiculata	P. chlorantha
E. pratense	Linnaea borealis	P. secunda
E. scirpoides	Listera cordata	Rubus pubescens
E. sylvaticum	Maianthemum canadense	Smilacina trifolia
Galium boreale	Mertensia paniculata	Viola renifolia

D. Bryophytes and Lichens

Aulacomnium palustre	S. fuscum	C. mitis
Dicranum acutifolium	S. recurvum	C. rangiferina
D. undulatum	S. subfulvum	Cladonia gracilis
Drepanocladus uncinatus	S. subnitens	Icmadophila ericetorum
Hylocomium splendens	Tomenthypnum nitens	Peltigera aphthosa
Pleurozium schreberi		P. canina
Ptilium crista-castrensis	Cladina alpestris	P. malacea
Sphagnum capillaceum	C. arbuscula	P. polydactyla

TABLE 3

SYNOPSIS OF THE SYNSYSTEMATIC UNITS IN THE PRESENT STUDY

ORDER	ALLIANCE	ASSOCIATION
1. PICEETALIA GLAUCAE	1. Piceion glaucae	1. Hylocomio (splendentis) - Linnaeo (borealis) - Aralio (nudicaulis) - Viburno (edulis) - Populo (tremuloidis) - Piceetum glaucae
		2. Hylocomio (splendentis) - Mitello (nudae) - Equiseto (pratensis) - Viburno (edulis) - Piceetum glaucae
		3. Pleurozio (schreberi) - Hylocomio (splendentis) - Lycopodio (annotini) - Ledo (groenlandici) - Picco (glaucae - marianae) - Pinetum contortae
2. PICEETALIA MARIANAE	2. Cladino (mitis) - Pinion contortae (- banksianae)	4. Cladino (mitis) - Peltigero (aphthosae) - Pleurozio (schreberi) - Arctostaphylo (uvae-ursi) - Pinetum contortae
	3. Pleurozio (schreberi) - Piceion marianae	5. Ptilio (cristae-castrensis) - Hylocomio (splendentis) - Pleurozio (schreberi) - Piceetum marianae
		6. Hylocomio (splendentis) - Pleurozio (schreberi) - Equiseto (sylvatici) - Piceetum marianae
	4. Sphagno (fusci) - Rubo (chamaemori) - Piceion marianae	7. Aulacomnio (palustris) - Tomenthypno (nitentis) - Equiseto (scirpoidis) - Ledo (groenlandici) - Salico (myrtillifoliae) - Nano-Piceetum marianae
	5. Aulacomnio (palustris) - Salico (myrtillifoliae) - Piceion marianae	8. Sphagno (fusci) - Rubo (chamaemori) - Oxyccoco (microcarpi) - Ledo (groenlandici) - Piceetum marianae
3. LARICETALIA LARICINAE	6. Menyantho (trifoliatae) - Laricion laricinae	9. Sphagno (capillacei - recurvi) - Menyantho (trifoliatae) - Pyrolo (asarifoliae) - Oxyccoco (palustris) - Betulo (glanduliferae) - Laricetum laricinae
		10. Hylocomio (splendentis) - Ptilio (cristae-castrensis) - Pleurozio (schreberi) - Equiseto (arvensis) - Mitello (nudae) - Smilacino (trifoliae) - Larico (laricinae) - Piceetum marianae
4. POPULETALIA BALSAMIFERAE	7. Populion balsamiferae	11. Equiseto (pratensis) - Pyrolo (asarifoliae) - Alno (tenuifoliae) - Populetum balsamiferae
		12. Populo (balsamiferae) - Alnetum tenuifoliae
	8. Salicion interioris	13. Salicetum interioris
5. (SPIRAEO-) MYRICETALIA GALIS	9. Drepanoclado (vernicosi) - Menyantho (trifoliatae) - Myricion galis	14. Drepanoclado (vernicosi) - Calliergono (gigantei) - Menyantho (trifoliatae) - Myricetum galis
6. SPHAGNO (MAGELLANICI) - SCHEUCHZERIETALIA PALUSTRIS	10. Sphagno (magellanici) - Sarracenio (purpureae) - Scheuchzerion palustris	15. Sphagno (magellanici) - Sarracenio (purpureae) - Oxyccoco (microcarpi) - Scheuchzerio (palustris) - Andromedetum polifoliae

The Edatopic Grid

In Fig. 9, the ecosystems of this study area (from table 3) have been projected onto theoretical ordinates of moisture and nutrients. The grid utilized in this study was first proposed by Pogrebniak (1930) and was used extensively by Krajina (1969). According to Jones (1969), such ordination projections were utilized by Wiedemann (1929) for Finnish site-types and by Eneroth (1931) and Arnborg (1953) for Swedish site-types. Jones (1969), after reviewing the work of Rowe (1956), Hodgkins (1960), Bakuzis and Hansen (1959), Waring and Major (1964), and Pluth and Arneman (1965), concluded that such ordination techniques show promise for better understanding and evaluation of sites.

Krajina (1969) has defined the units on the edatopic grid as follows: The trophotopes or soil nutrient regimes as

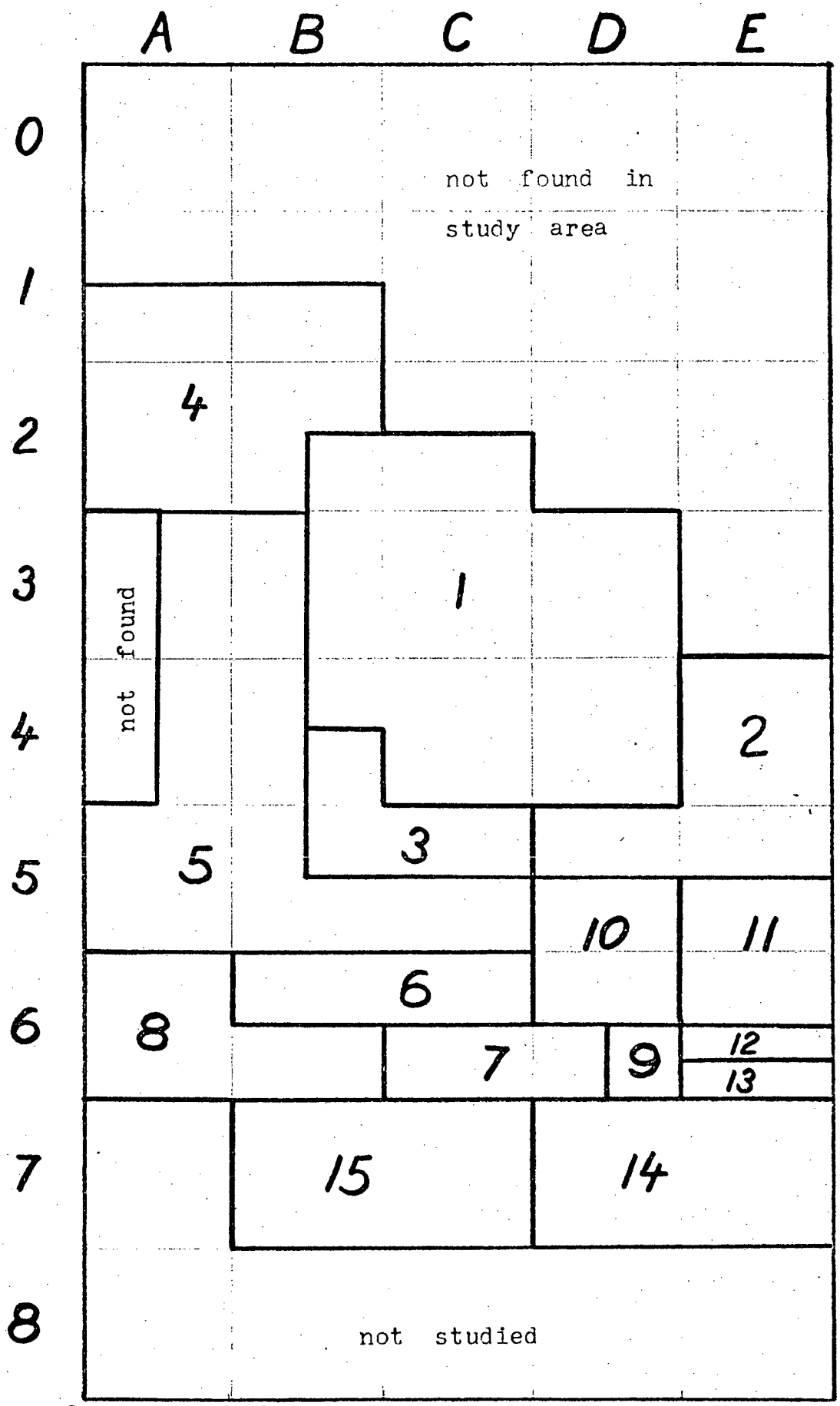
A - oligotrophic
B - submesotrophic
C - mesotrophic
D - subeutrophic
E - eutrophic

and the hygrotopes or soil moisture regimes as

0 - very xeric
1 - xeric
2 - subxeric
3 - submesic
4 - mesic
5 - subhygric
6 - hygric
7 - subhydric
8 - hydric.

PROJECTION OF STUDIED ECOSYSTEMS ON EDATOPIC GRID

(Associations per Table 3)



ORDER I

Piceetalia glaucae Annas et Krajina (Piceetalia glaucae-marianae Krajina 1969 p.p.)

The order Piceetalia glaucae occupies the better forest sites in the Fort Nelson area. When this order is projected on the edatopic grid (Fig. 9), it occurs on hygrotopes from subxeric to subhygric and on trophotopes from submesotrophic to eutrophic. In this study, the order is represented by a single alliance (Piceion glaucae) with three plant associations. The soils of the Piceetalia glaucae consist of Orthic Gray Luvisols, Cumulic Regosols, Degraded Eutric and Dystric Brunisols (and their gleyed variations) and Rego Gleysols.

Vegetation of the Piceetalia glaucae is characterized by the following order and alliance character species:

Picea glauca	Ribes triste
Populus tremuloides	Rubus pubescens
Betula papyrifera	Viola renifolia
Viburnum edule	Galium boreale
Alnus crispa	Actaea rubra
Shepherdia canadensis	Aster ciliolatus
Ribes oxyacanthoides	Rhytidiadelphus triquetrus
Amelanchier alnifolia	

One plant association, the Pleurozio (schreberi) - Hylocomio (splendentis) - Lycopodio (annotini) - Ledo (groenlandici) - Piceo (glaucae - marianae) - Pinetum contortae (Lodgepole Pine - Clubmoss), bears many affinities to the Piceetalia marianae order and could conceivably be placed in the Piceetalia marianae. Floristically, the Piceetalia glaucae has many affinities with both the Laricetalia laricinae and Populetalia balsamiferae orders. These latter orders occupy richer and moister sections of the edatopic grid than those of Piceetalia glaucae.

Alliance 1 Piceion glaucae Wali et Krajina 1973 [Pleurozio (schreberi) - Piceion glaucae Revel et Krajina 1972]

It can be assumed, since only one alliance is distinguished here, that the vegetational and environmental characteristics are the same as those of the order Piceetalia glaucae. There are only three plant associations belonging to this alliance whose description follows in subsequent pages. Since plant association no. 3 has some characteristics of the Piceetalia mariana, in the hierarchy of plant associations of the area, it represents a transition to the latter order.

PLANT ASSOCIATION 1

ASPEN - WHITE SPRUCE

Hylocomio (splendentis) - Linnaeo (borealis) -
Aralio (nudicaulis) - Viburno (edulis) -
Populo (tremuloidis - Piceetum glaucae

Characteristic Combination of Species

Layer	Constants (presence > 60%) * characteristic	Characteristic non - constants > II
Tree	Populus tremuloides	
	Picea glauca	
Shrub	Alnus crispa	Lonicera dioica
	Viburnum edule	
	Rosa acicularis	
	Shepherdia canadensis	
Herb	Linnaea borealis	
	Cornus canadensis	
	Rubus pubescens	
	Aralia nudicaulis*	
	Pyrola secunda	
	Mertensia paniculata	
	Mitella nuda	
	Lathyrus ochroleucus	
	Viola renifolia	
	Pyrola asarifolia	
Moss	Hylocomium splendens	Eurhynchium pulchellum
	Ptilium crista-castrensis	

Table 4

ASPEN - WHITE SPRUCE

Hylocomio (splendentis) - Linnaeo (borealis) - Aralio (nudicaulis) - Viburno (edulis) - Populo (tremuloidis) - Piceetum glaucae

Plot No	2	3	4	8	13	14	20	37	40	7	15	16	19	26	32	33	38
Elevation in M	440	470	460	400	430	425	450	430	435	400	470	440	360	415	375	375	320
Latitude	58° 51'	58° 52'	58° 52'	58° 33'	58° 48'	58° 48'	58° 48'	58° 48'	58° 48'	58° 33'	58° 48'	58° 49'	58° 47'	58° 48'	58° 47'	58° 47'	58° 47'
Longitude	122° 57'	122° 58'	122° 60'	122° 17'	122° 44'	122° 44'	122° 43'	122° 44'	122° 44'	122° 17'	122° 43'	122° 42'	122° 42'	122° 48'	122° 43'	122° 43'	122° 39'
Exposure	W	S	S	SE	SW	S	S	S	S	N	S	N	N	W	--	--	NW
Slope Gradient %	6	9	1	1	11	10	1	6	8	1	1	7	1	1	0	0	22
Percent Coverage																	
Total A	75	70	80	72	40	45	36	70	78	65	85	75	56	70	71	50	69
A_1	74	68	75	70	15	30	22	40	60	45	30	22	25	24	50	18	10
A_2	5	5	8	3	35	18	18	25	20	25	30	40	30	40	12	30	30
A_3	1	5	2	8	10	3	12	15	12	+	45	25	10	15	20	15	40
Total B	77	69	82	25	25	85	90	80	82	64	8	18	65	3	29	6	16
B_1	50	17	16	20	10	21	24	52	31	10	1	5	30	-	4	2	1
B_2	40	52	75	65	18	76	82	50	64	61	8	17	40	3	28	6	16
C	17	13	38	34	30	45	62	40	38	48	4	21	30	8	16	24	14
D	1	2	2	—	33	1	1	1	2	1	60	47	51	70	31	84	78
Dw	3	4	5	5	50	1	1	4	4	1	14	30	25	14	4	7	11
Percent Coverage																	
Litter	93	90	87	90	94	83	91	85	88	93	77	75	65	76	82	84	86
Decaying Wood	7	6	8	5	5	12	10	8	2	3	14	18	30	16	6	8	6
Mineral Soil	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--
Rock	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hygrotope							Subxeric			Mesic							
Trophotope							Submesotrophic			Subeutrophic							
Parent Material							Morainal		Lacustrine		Fluvial						

Table 5

ASPEN - WHITE SPRUCE

BOREAL WHITE & BLACK SPRUCE ZONE
PAGE 1

PLOT NUMBER	002	003	004	008	013	014	020	037	040	007	015	016	019	026	032	033	038					
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																		P	MS	RS
A1																						
1 POPULUS TREMULOIDES	8.3	8.3	8.	8.	.	6.2	6.2	7.2	8.3	.	5.3	5.3	4.2	5.2	7.2	.	.	.	.	76.5	6.6	4-8
2 PICEA GLAUCA	.	.	.	.	5.2	.	.	.	3.2	.	4.2	.	4.2	4.2	4.2	5.2	4.2	.	.	47.1	3.8	3-5
3 PINUS CONTORTA	.	.	.	.	.	.	.	.	.	.	.	4.3	3.2	.	.	.	.	.	.	11.8	1.4	3-4
4 POPULUS BALSAMIFERA	2.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11.8	+.1	1-2
5 BETULA PAPYRIFERA	.	.	.	.	.	.	.	.	.	.	8.	.	.	.	.	.	.	.	.	5.9	3.5	8-8
A2																						
POPULUS TREMULOIDES	4.2	4.	4.	+.	5.2	5.2	5.2	6.2	5.2	.	3.2	4.2	4.2	1.2	4.2	.	3.2	.	.	88.2	4.7	+-6
PICEA GLAUCA	.	.	.	.	5.2	.	.	.	2.2	.	5.2	5.2	5.2	7.2	4.2	6.2	6.2	.	.	52.9	5.0	2-7
BETULA PAPYRIFERA	.	.	.	2.	.	.	.	.	.	5.	4.2	.	.	.	.	.	.	.	.	17.6	2.4	2-5
POPULUS BALSAMIFERA	.	1.	.	.	.	.	.	.	.	.	.	1.1	.	.	.	.	.	.	.	11.8	+.0	1-1
PINUS CONTORTA	.	.	.	.	.	.	.	.	.	.	.	5.2	.	.	.	.	.	.	.	5.9	2.0	5-5
A3																						
PICEA GLAUCA	.	.	.	.	2.1	3.2	2.2	1.2	4.2	.	6.2	5.2	4.2	4.2	4.2	5.2	7.2	.	.	70.6	4.6	1-7
BETULA PAPYRIFERA	1.2	.	.	3.	1.1	3.2	.	.	3.2	+.	4.2	+.0	.	.	.	1.2	.	.	.	52.9	2.1	+-4
POPULUS TREMULOIDES	+.1	.	2.	.	.	.	2.2	5.2	3.2	.	4.2	1.0	.	.	1.2	.	.	.	.	47.1	2.7	+-5
6 PICEA MARIANA	.	.	.	.	1.1	.	.	.	.	.	4.2	3.2	2.2	4.	3.2	1.1	1.2	.	.	47.1	2.4	1-4
POPULUS BALSAMIFERA	.	1.	.	.	.	.	.	.	.	.	.	.	.	+.1	.	.	.	.	.	11.8	+.0	+-1
7 ABIES LASIOCARPA	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.0	+-+
PINUS CONTORTA	.	.	.	.	+.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.0	+-+
B1																						
8 ALNUS CRISPA	4.	2.	.	5.	4.2	1.2	4.2	5.2	6.2	5.	.	4.3	6.2	.	.	.	+.2	.	.	70.6	4.6	+-6
PICEA GLAUCA	7.	4.	5.	.	.	3.2	4.2	6.2	.	.	1.1	.	.	.	1.2	1.0	.	.	.	52.9	4.2	1-7
9 SALIX BEBBIANA	1.	3.	4.	.	.	3.2	4.2	4.2	.	3.	.	.	.	.	.	.	.	.	.	41.2	2.8	1-4
POPULUS TREMULOIDES	.	.	+.	.	.	3.2	4.2	1.2	.	.	.	.	.	.	1.2	.	.	.	.	29.4	1.6	+-4
PICEA MARIANA	.	.	.	.	+.1	2.2	.	.	.	.	1.2	1.2	1.1	.	.	.	.	.	.	29.4	+.6	+-2
10 VIBURNUM EDULE	1.	.	.	.	.	.	+.3	.	.	.	.	.	1.2	+.3	.	.	.	.	.	23.5	+.0	+-1
11 AMELANCHIER ALNIFOLIA	.	.	.	.	.	4.2	4.3	.	+.2	.	.	.	.	.	.	.	.	.	.	17.6	1.8	+-4
12 BETULA RESINIFERA	.	+.	.	.	.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	11.8	+.5	+-3
BETULA PAPYRIFERA	.	.	.	.	1.1	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	11.8	+.0	+-1
13 SALIX SCOULERIANA	.	+.	.	.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	11.8	+.0	+-1
14 ALNUS TENUIFOLIA	.	.	.	.	.	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	5.9	+.0	1-1
POPULUS BALSAMIFERA	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.0	1-1
15 CORNUS STOLONIFERA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.0	+-+
16 SHEPHERDIA CANADENSIS	.	.	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.0	+-+
B2																						
VIBURNUM EDULE	4.	5.	8.	4.	4.2	4.2	5.2	5.2	6.2	5.	4.2	5.3	4.2	3.2	4.2	2.2	4.2	.	.	100.0	5.2	2-8
17 ROSA ACICULARIS	4.	4.	4.	5.	5.1	4.2	4.2	5.2	6.2	5.	2.2	4.3	5.2	2.2	5.2	4.2	4.2	.	.	100.0	5.1	2-6
SHEPHERDIA CANADENSIS	2.	4.	4.	.	1.1	7.3	6.2	4.2	3.2	.	+.2	.	.	2.2	4.2	.	2.3	.	.	70.6	4.2	+-7
18 RIBES OXYACANTHOIDES	2.	+.	.	.	1.1	3.3	.	3.	3.2	+.	.	3.3	.	.	.	+.2	1.2	.	.	58.8	2.0	+-3
CORNUS STOLONIFERA	4.	4.	3.	2.	3.1	1.1	.	2.2	4.2	.	.	.	.	.	.	.	2.2	.	.	52.9	2.8	1-4
ALNUS CRISPA	+.	.	.	2.	+.1	.	.	.	2.2	1.	.	1.2	3.2	.	.	.	3.2	.	.	47.1	1.5	+-3
POPULUS TREMULOIDES	.	.	.	+.	2.1	1.2	.	.	.	.	+.1	1.2	.	3.2	1.2	.	1.2	.	.	47.1	1.2	+-3
19 LONICERA DIOICA	.	3.	.	.	+.+	1.2	1.2	+.	1.2	.	1.2	+.1	.	.	.	.	.	.	.	47.1	1.1	+-3
AMELANCHIER ALNIFOLIA	.	+.	.	+.	+.+	5.3	4.2	+.	.	.	.	.	+.2	.	.	.	.	.	.	41.2	2.4	+-5

Table 6

PLOT NUMBER	002	003	004	008	013	014	020	037	040	007	015	016	019	026	032	033	038					
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																		P	MS	RS	
PICEA GLAUCA	3.	.	.	+.	.	1.2	.	3.2	2.2	3.	.	.	.	.	.	.	.	.	35.3	1.6	+-3	
20 RIBES TRISTE	3.	.	.	.	+.1	.	.	.	.	.	.	.	.	.	.	+.2	.	+.2	23.5	+.7	+-3	
21 LEDUM GRCENLANDICUM	.	.	.	.	.	.	.	.	.	.	.	.	.	+.1	.	+.2	1.2	+.2	23.5	+.C	+-1	
PICEA MARIANA	.	.	.	.	1.+	.	.	.	.	.	.	.	.	1.1	.	.	.	.	11.8	+.C	1-1	
BETULA PAPYRIFERA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	.	11.8	+.C	+-1	
SALIX BEBBIANA	+.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	11.8	+.0	+-1	
22 RUBUS IDAEUS	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	+.2	.	.	11.8	+.C	+-+	
ALNUS TENUIFOLIA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+	
23 RIBES GLANDULOSUM	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	5.9	+.0	+-+	
24 SORBUS SCOPULINA	.	.	.	.	.	.	.	.	.	.	.	+.1	.	.	.	.	.	.	5.9	+.0	+-+	
C																						
25 LINNAEA BOREALIS	3.	3.	4.	2.	5.2	6.3	5.2	5.2	6.2	2.	1.2	3.3	4.2	1.2	+.2	4.2	4.2	.	100.0	4.8	+-6	
26 CORNUS CANADENSIS	4.	4.	4.	3.	4.2	3.2	4.2	4.2	4.2	3.	4.2	4.2	5.2	4.2	4.2	5.2	4.2	.	100.0	4.5	3-5	
27 RUBUS PUBESCENS	4.	4.	2.	3.	3.1	+.1	4.2	4.2	4.2	+.	2.2	3.3	.	1.2	1.2	1.2	+.2	.	94.1	3.3	+-4	
28 ARALIA NUDICAULIS	2.	+.	4.	4.	3.1	4.2	4.2	4.2	6.2	6.	3.2	4.3	.	.	.	+.2	+.2	.	82.4	4.3	+-6	
29 PYROLA SECUNDA	.	+.	.	+.	3.2	+.2	1.2	+.2	+.2	.	+.2	1.2	+.2	1.2	1.2	+.2	+.2	.	82.4	1.2	+-3	
30 MERTENSIA PANICULATA	3.	4.	2.	.	1.1	.	3.2	2.2	3.2	1.	1.1	3.2	.	.	1.2	2.2	+.2	.	76.5	2.5	+-4	
31 MITELLA NUDA	4.	2.	+.	+.	1.1	.	.	2.2	1.2	1.	.	2.3	.	1.2	1.2	2.2	2.2	.	76.5	2.C	+-4	
32 LATHYRUS OCHROLEUCUS	+.	2.	1.	+.	3.1	3.2	2.2	1.2	2.2	.	1.2	2.2	.	.	+.2	.	.	.	70.6	1.8	+-3	
33 VIOLA RENIFOLIA	3.	1.	+.	.	+.1	.	.	+.2	+.2	.	+.2	1.3	1.2	1.2	+.2	1.2	.	.	70.6	1.2	+-3	
34 PYROLA ASARIFOLIA	.	.	2.	3.	2.1	.	3.2	3.2	2.2	1.	+.1	1.2	+.2	.	+.2	.	.	.	64.7	1.5	+-3	
35 MAIANTHEMUM CANADENSE	.	2.	1.	+.	3.2	.	3.2	1.2	1.2	.	1.2	1.2	4.2	.	.	.	.	.	58.8	2.1	+-4	
36 EPILOBIUM ANGUSTIFOLIUM	.	3.	3.	.	.	1.2	3.2	1.2	+.2	.	.	+.2	+.1	.	1.2	+.2	.	.	58.8	1.6	+-3	
37 GALIUM BOREALE	.	1.	1.	.	1.1	2.2	3.2	1.2	1.2	.	1.2	1.2	.	.	.	.	1.2	.	58.8	1.4	1-3	
38 ACTAEA RUBRA	.	+.	+.	+.	.	.	.	+.2	+.2	.	+.2	+.2	.	1.2	+.2	.	+.2	.	58.8	+.2	+-1	
39 PYROLA CHLORANTHA	.	.	.	.	+.+	2.2	.	+.2	+.	.	+.1	.	+.2	.	+.2	.	+.2	.	47.1	+.3	+-2	
40 VACCINIUM VITIS-IDAEA	.	.	.	.	.	.	.	+.2	+.2	.	.	.	3.2	2.2	1.2	1.2	+.2	.	41.2	1.1	+-3	
41 PETASITES PALMATUS	.	+.	1.	.	+.1	.	.	.	+.2	.	.	.	.	.	.	+.2	4.2	.	35.3	1.3	+-4	
42 CALAMAGROSTIS CANADENSIS	+.1	2.	2.	+.	+.1	.	.	.	.	.	.	.	1.1	.	.	.	.	.	35.3	+.7	+-2	
43 GOODYERA REPENS	.	.	.	.	+.+	.	.	.	.	.	.	+.2	.	2.2	.	2.2	1.2	.	29.4	+.7	+-2	
44 HABENARIA ORBICULATA	.	.	.	.	2.+	.	.	+.2	.	.	.	1.3	+.2	+.2	.	.	.	.	29.4	+.3	+-2	
45 ASTER CILIOLATUS	.	.	.	.	+.1	.	.	2.2	+.2	.	+.2	+.2	.	.	.	.	.	.	29.4	+.1	+-2	
46 FRAGARIA VIRGINIANA	.	.	.	.	.	.	.	.	+.2	.	.	.	.	1.2	+.2	.	.	.	17.6	+.0	+-1	
47 CORALLORHIZA TRIFIDA	+.	.	.	.	.	.	.	.	.	.	.	.	.	+.2	.	.	.	+.	17.6	+.C	+-+	
48 EQUISETUM SYLVATICUM	.	.	.	+.	.	.	.	.	.	+.	.	+.2	.	.	.	.	.	.	17.6	+.C	+-+	
49 VICIA AMERICANA	.	.	.	.	.	3.2	2.2	.	.	.	.	.	.	.	.	.	.	.	11.8	+.9	2-3	
50 GALIUM TRIFLORUM	1.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11.8	+.C	+-1	
51 EQUISETUM SCIRPOIDES	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.2	.	.	11.8	+.0	+-+	
52 GEOCAULON LIVIDUM	.	.	.	.	.	.	.	.	.	.	.	.	+.2	.	+.	.	.	.	11.8	+.0	+-+	
53 LYCOPODIUM COMPLANATUM	.	.	.	.	.	.	.	.	.	.	.	.	4.2	.	.	.	.	.	5.9	1.2	4-4	
AMELANCHIER ALNIFOLIA	.	.	.	.	.	.	.	2.2	.	.	.	.	.	.	.	.	.	.	5.9	+.0	2-2	
54 CALYPSO BULBOSA	.	.	.	.	.	.	.	.	.	.	.	.	.	1.2	.	.	.	.	5.9	+.C	1-1	
55 CINNA LATIFOLIA	.	.	.	.	.	.	.	.	.	1.	.	.	.	.	.	.	.	.	5.9	+.C	1-1	
56 EQUISETUM ARVENSE	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.0	+-+	
57 EQUISETUM PRATENSE	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.5	+.C	+-+	
58 FRAGARIA BRACTEATA	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.0	+-+	
59 LYCOPODIUM ANNOTINUM	.	.	.	.	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.0	+-+	
60 SMILACINA TRIFOLIA	.	.	.	.	.	.	.	.	.	.	.	.	+.2	.	.	.	.	.	5.9	+.0	+-+	

Table 6 (continued)

ASPEN - WHITE SPRUCE

BOREAL WHITE & BLACK SPRUCE ZONE
PAGE 3

PLOT NUMBER	002	003	004	008	013	014	020	037	040	007	015	016	019	026	032	033	038			P	MS	RS
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																					
DH																						
61 HYLOCOMIUM SPLENDENS	1.	2.	2.	.	6.	1.	+.	2.	3.	1.	8.	7.	7.	8.	6.	6.	8.	.	.	94.1	5.7	+-8
62 PTILIUM CRISTA-CASTRENSIS	1.	1.	+.	.	2.	.	+.	.	1.	1.	1.	.	3.	1.	1.	7.	3.	.	.	76.5	3.3	+-7
63 PLEUROZIUM SCHREBERI	1.	.	+.	.	.	.	+.	.	.	.	.	1.	1.	3.	+.	.	5.	1.	.	.	.	52.9	2.3	+-5
64 EURHYNCHIUM PULCHELLUM	.	+.	+.	.	+.	+.	.	.	+.	+.	.	.	.	.	.	+.	.	.	.	41.2	+.0	+-+
65 PELTIGERA APHTHOSA	.	.	+.	.	1.	.	.	.	.	.	.	.	.	.	1.	1.	1.	1.	.	35.3	+.5	+-1
66 PELTIGERA CANINA	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	1.	.	.	4.	.	17.6	1.2	+-4
67 PELTIGERA POLYDACTYLA	+.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	1.	.	.	.	17.6	+.0	+-1
68 BRACHYTHECIUM ASPERRIMUM	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	11.8	+.C	+-+
69 DICRANUM ACUTIFOLIUM	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	+.	.	.	.	11.8	+.0	+-+
70 DICRANUM FUSCESCENS	.	.	.	.	.	.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	11.8	+.0	+-+
71 PLAGIOMNIUM CUSPIDATUM	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11.8	+.0	+-+
72 DICRANUM UNDULATUM	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.0	1-1
73 BRACHYTHECIUM ALBICANS	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
74 BRACHYTHECIUM REFLEXUM	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
75 BRACHYTHECIUM SALEBROSUM	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	5.9	+.0	+-+
76 CAMPYLIUM HISPIDULUM	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
77 CLADINA ARBUSCULA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	5.9	+.0	+-+
78 CLADINA RANGIFERINA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.0	+-+
79 CLADONIA GRACILIS	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
80 DREPANOCLADUS UNCINATUS	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
81 JAMESONIELLA AUTUMNALIS	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
82 MARCHANTIA POLYMORPHA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
83 MNIUM BLYTTII	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	5.9	+.C	+-+
84 PELTIGERA HORIZONTALIS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	5.9	+.0	+-+
85 PELTIGERA MALACEA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
86 POHLIA NUTANS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	5.9	+.0	+-+
87 POLYTRICHUM COMMUNE	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	5.9	+.0	+-+
88 RHYTIDIADELPHUS TRIQUETRUS	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
89 TETRAPHIS PELLUCIDA	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	5.9	+.C	+-+
90 TORTULA MUCRONIFOLIA	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
DW																						
HYLOCOMIUM SPLENDENS	.	1.	+.	+.	8.	.	+.	3.	1.	1.	4.	4.	4.	5.	3.	2.	5.	.	.	88.2	4.5	+-8
PLEUROZIUM SCHREBERI	.	.	.	1.	1.	.	+.	1.	+.	1.	4.	4.	4.	+.	+.	4.	2.	.	.	76.5	2.6	+-4
PTILIUM CRISTA-CASTRENSIS	.	.	+.	+.	2.	.	+.	.	+.	.	4.	3.	4.	+.	2.	3.	1.	.	.	70.6	2.4	+-4
PELTIGERA CANINA	1.	1.	+.	.	+.	+.	+.	+.	+.	+.	+.	+.	.	.	1.	.	.	.	.	70.6	+.6	+-1
CAMPYLIUM HISPIDULUM	+.	.	+.	.	.	+.	+.	+.	+.	+.	+.	+.	.	.	.	+.	+.	.	.	64.7	+.1	+-+
BRACHYTHECIUM SALEBROSUM	+.	+.	+.	.	.	+.	+.	.	.	+.	+.	+.	.	.	.	+.	+.	.	.	58.8	+.C	+-+
DICRANUM FUSCESCENS	.	+.	+.	.	+.	.	.	.	+.	.	.	+.	+.	.	.	.	.	.	.	35.3	+.C	+-+
EURHYNCHIUM PULCHELLUM	.	.	+.	.	+.	+.	.	+.	.	.	.	+.	.	.	.	.	+.	.	.	35.3	+.0	+-+
91 PYLAISIA POLYANTHA	.	.	.	.	1.	+.	.	+.	.	.	.	.	.	.	.	+.	+.	.	.	29.4	+.C	+-+
JAMESONIELLA AUTUMNALIS	.	.	.	+.	.	.	.	.	.	.	.	+.	+.	.	.	+.	+.	.	.	29.4	+.0	+-+
92 MNIUM SPINULOSUM	+.	.	.	.	.	+.	.	.	.	.	+.	.	.	.	.	+.	+.	.	.	29.4	+.0	+-+
93 NEPHROMA RESUPINATUM	.	.	+.	.	.	.	.	.	.	.	.	+.	.	+.	+.	.	.	.	.	29.4	+.C	+-+
BRACHYTHECIUM ALBICANS	.	.	.	.	1.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	23.5	+.C	+-1
94 BLEPHAROSTOMA TRICHOPHYLLUM	.	.	.	+.	.	.	.	.	+.	.	.	.	.	.	.	+.	+.	.	.	23.5	+.C	+-+
DICRANUM ACUTIFOLIUM	.	.	.	.	+.	.	.	.	+.	.	+.	+.	.	.	.	.	.	.	.	23.5	+.C	+-+
95 HERZOGIELLA TURFACEA	.	.	+.	.	.	.	+.	.	.	+.	.	.	.	.	.	.	+.	.	.	23.5	+.0	+-+

Table 6 (continued)

PLOT NUMBER	002	003	004	008	013	014	020	037	040	007	015	016	019	026	032	033	038					
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																	P	MS	RS
56 CLADONIA OCHROCHLORA	.	.	.	.	+.	.	.	.	.	.	+.	.	.	.	.	+.	.	17.6	+.0	+-+
DREPANOCLADUS UNCINATUS	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	+.	+.	17.6	+.0	+-+
97 ONCOPHORUS WAHLENBERGII	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.	+.	+.	17.6	+.C	+-+
PELTIGERA APHTHOSA	.	.	.	.	.	.	.	.	+.	+.	+.	.	.	.	.	.	.	17.6	+.0	+-+
PELTIGERA POLYDACTYLA	.	.	.	+.	.	.	.	.	.	.	+.	.	.	.	.	.	.	17.6	+.C	+-+
POHLIA NUTANS	.	.	.	.	+.	.	.	.	.	+.	.	.	.	.	.	+.	.	17.6	+.0	+-+
98 PTILIDIUM PULCHERRIMUM	.	.	.	+.	.	.	.	.	.	.	.	.	+.	.	.	+.	.	17.6	+.0	+-+
99 CEPHALOZIELLA DIVARICATA	.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	11.8	+.C	+-+
100 CETRARIA JUNIPERINA	.	.	.	+.	.	.	.	.	.	.	+.	.	.	.	.	.	.	11.8	+.0	+-+
101 CLADONIA BOTRYTES	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	+.	.	11.8	+.C	+-+
102 CROSSOCALYX HELLERIANUS	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	+.	.	11.8	+.C	+-+
DICRANUM UNDULATUM	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	11.8	+.0	+-+
103 HOMALOTHECIUM AENEUM	.	+.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	11.8	+.C	+-+
104 LEPIDOZIA REPTANS	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	+.	.	11.8	+.0	+-+
105 LOPHOCOLEA HETEROPHYLLA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	11.8	+.C	+-+
106 LOPHOCOLEA MINOR	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	+.	.	11.8	+.C	+-+
107 LOPHOZIA VENTRICOSA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	+.	.	11.8	+.0	+-+
108 NEPHROMA HELVETICUM	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	+.	11.8	+.C	+-+
PELTIGERA HORIZONTALIS	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.	+.	11.8	+.C	+-+
PLAGIOMNIUM CUSPIDATUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	11.8	+.0	+-+
109 DICRANUM FRAGILIFOLIUM	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.C	1-1
BRACHYTHECIUM REFLEXUM	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.0	+-+
110 CLADONIA CONIOCRAEA	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	5.9	+.0	+-+
111 CLADONIA CORNUTA	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	5.9	+.C	+-+
CLADONIA GRACILIS	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
112 DICRANUM POLYSETUM	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	5.9	+.C	+-+
113 EURHYNCHIUM PRAELONGUM	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	5.9	+.C	+-+
114 HOMALOTHECIUM FULGESCENS	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	5.9	+.0	+-+
115 LEPTOGIUM SATURNINUM	.	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	5.9	+.C	+-+
116 PELTIGERA EVANSIANA	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	5.9	+.0	+-+
PELTIGERA MALACEA	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	5.9	+.0	+-+
117 PLAGIOMNIUM DRUMMONDII	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	5.9	+.0	+-+
118 PTILIDIUM CILIARE	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	5.9	+.0	+-+
RHYTIDIADELPHUS TRIQUETRUS	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	5.9	+.0	+-+
119 TIMMIA MEGAPOLITANA	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	5.9	+.0	+-+

Table 6 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 2 ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
2- 0	LFH	006-000																		
2- 1	AHE	000-016	5.8	4.6	2.67	0.26	10.3	5	11.50	3.22	0.06	1.56	20.30	80.5	10YR42	10YR33	12	45	41	SIC
2- 2	BT	016-080	5.6	2.7	1.59	0.26	6.1	002	9.62	2.81	0.05	0.72	14.40	91.7	10YR52	10YR43	9	54	36	SICL
2- 4	CKGJ	080- +	7.3	1.3	0.76	0.06	12.7	<1	19.12	0.76	0.10	0.26	6.30	100.0	10YR52	10YR42	14	72	13	SIL *

PLOT 3 ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
3- 0	LFH	009-000	6.3	52.1	53.40	2.08	25.7	126	65.00	10.87	0.0	3.62	88.00	90.5						
3- 1	AE	000-016	6.2	0.9	0.52	0.07	7.4	014	5.25	1.26	0.02	0.47	8.20	85.5	10YR73	10YR53	18	55	25	SIL
3- 2	BT	016-048	6.3	1.3	0.74	0.08	9.3	005	11.88	3.30	0.05	0.87	18.10	89.0	10YR63	10YR43	10	36	53	C
3- 4	CK	048- +	7.6	1.5	0.86	0.08	10.8	002	11.50	2.69	0.09	0.35	9.40	100.0	10YR62	10YR42	1	78	20	SIL *

PLOT 4 DEGRADED EUTRIC BRUNISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
4- 0	LFH	006-000	5.6	92.1	53.40	1.34	39.9	104	38.75	7.37	0.0	2.62	79.00	61.9						
4- 1	AEJ	000-013	5.1	1.6	0.93	0.13	7.2	023	3.50	1.29	0.04	0.55	10.00	53.9	10YR62	10YR51	32	49	18	SIL
4- 2	BTGJ	013-052	4.9	1.1	0.65	0.13	5.0	005	5.00	2.64	0.05	0.46	12.10	67.4	10YR52	10YR42	16	51	32	SICL
4- 3	CG	052- +	4.7	1.9	1.10	0.11	10.0	005	4.87	2.78	0.07	0.41	13.50	60.3	10YR41	10YR32	26	39	34	CL

PLOT 8 ORTHIC GRAY LUVISOL — BUCKINGHORSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
8- 1	AE	000-005	4.6	1.2	0.69	0.05	13.8	013	2.50	0.60	0.02	0.10	8.40	38.4	10YR72	10YR62	20	57	22	SIL
8- 2	BT	005-045	4.7	0.8	0.44	0.04	11.0	004	6.62	2.51	0.07	0.27	16.70	56.8	10YR62	10YR43	6	35	58	C
9- 3	CK	045- +	7.4	1.3	0.78	0.08	9.8	005	12.37	2.83	0.06	0.24	15.30	100.0	10YR52	10YR31	25	64	9	SIL *

Table 7

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 13 GLEYED ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
13- 1	LFH	009-000	5.8	87.1	50.50	1.46	34.6	92	58.75	11.50	0.0	1.87	85.00	84.9						
13- 3	AE1	000-009	5.4	3.1	1.80	0.10	18.0	043	5.63	2.17	0.02	0.30	11.60	70.0	10YR62	10YR43	15	52	32	CL
13- 5	AE2	009-017	5.4	1.9	1.10	0.16	6.9	057	8.00	3.21	0.04	0.66	17.40	68.4	10YR42	10YR32	42	23	34	CL
13- 7	BT	017-043	5.5	1.0	0.57	0.08	7.1	009	9.00	4.44	0.05	0.51	17.60	79.6	10YR72	10YR53	28	24	46	C
13-11	2CG	043-081	5.3	0.9	0.55	0.11	5.0	004	8.75	4.19	0.09	0.26	17.80	74.7	10YR41	10YR32	15	46	38	SICL

PLOT 14 ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
14- 0	LFH	010-000	5.7	91.0	52.80	1.25	42.2	90	52.50	15.62	0.0	2.37	64.00	100.0						
14- 1	AE1	000-005	5.0	1.2	0.72	0.07	10.3	008	3.50	1.12	0.02	0.17	7.20	67.0	10YR72	10YR43	15	60	24	SIL
14- 2	AE2	005-020	4.8	0.8	0.44	0.06	7.3	005	3.00	1.07	0.04	0.12	7.00	60.4	10YR72	10YR43	29	52	18	SIL
14- 3	BT	020-033	4.6	0.6	0.36	0.05	7.2	006	3.62	2.07	0.09	0.20	11.90	50.3	10YR62	10YR53	8	51	41	SIC
14- 5	BTG	033-061	4.8	0.9	0.53	0.05	10.6	011	12.37	8.44	0.24	0.64	14.50	100.0	10YR52	10YR41	4	32	67	HC

PLOT 20 ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
20- 1	LFH	005-000	5.2	92.1	53.40	2.02	26.4	168	47.50	10.00	0.0	5.62	116.00	54.5						
20- 2	AE	000-009	5.0	1.9	1.08	0.05	21.6	008	3.62	0.96	0.0	0.19	7.10	67.5	10YR72	10YR62				
20- 3	AU	009-019																		
20- 4	BT	019-054	4.8	1.1	0.62	0.07	8.9	004	9.62	4.94	0.0	0.37	19.10	78.5	10YR62	10YR42				
20- 6	CK	054- +	7.1	1.8	1.02	0.09	11.3	007	10.50	5.31	0.06	0.29	11.50	100.0	10YR52	10YR32	34	51	14	SIL *

PLOT 37 GLEYED ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
37- 1	LFH	010-000	4.9	91.0	52.80	1.39	38.0	188	38.75	7.37	0.0	3.25	127.00	39.0						
37- 2	AE	000-023	4.8	3.2	1.87	0.11	17.0	044	5.50	1.95	0.03	0.40	18.10	43.5	10YR62	10YR42	18	49	31	SICL
37- 5	BTGJ	023-050	4.9	1.7	0.97	0.10	9.7	088	4.00	1.80	0.03	0.30	18.10	33.8	10YR72	10YR52	27	46	26	L
37- 8	BTG	050- +	4.7	1.1	0.64	0.08	8.0	003	6.00	4.37	0.07	0.30	16.70	64.4	10YR62	10YR42	14	44	41	SIC

Table 7 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 40 GLEYED ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
40- 1	LFH	016-000	5.6	86.0	49.90	1.39	35.9	150	45.00	11.50	0.0	2.50	141.00	41.9						
40- 2	AHE	000-002	5.4	13.8	8.00	0.47	17.0	025	13.00	5.15	0.03	1.52	30.90	63.8	10YR32	10YR21	4	38	57	C
40- 3	AE	002-014	5.2	1.2	0.69	0.07	9.9	6	3.75	1.67	0.05	0.35	13.80	42.2	10YR72	10YR62	15	59	25	SIL
40- 4	AB	014-020	5.0	1.1	0.66	0.07	9.4	003	8.25	4.50	0.05	0.47	10.50	100.0	10YR62	10YR43	22	32	45	C
40- 5	BT	020-033																		
40- 6	BTGJ	033-069	5.7	1.5	0.89	0.08	11.1	005	11.00	6.07	0.07	0.42	8.00	100.0	10YR52	10YR32	17	28	54	C
40- 7	CKGJ	069- +																		

PLOT 7 ORTHIC GRAY LUVISOL — BUCKINGHORSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
7- 0	LFH	010-000	4.5	87.9	51.00	1.86	27.4	138	35.00	6.62	0.0	3.50	119.00	37.9						
7- 1	AE	000-011	4.7	1.6	0.94	0.07	13.4	022	3.13	0.22	0.02	0.17	17.80	19.9	10YR71	10YR52	40	49	10	L
7- 2	AB	011-020	5.0	1.2	0.70	0.05	14.0	014	2.87	0.68	0.02	0.16	6.20	60.4	10YR62	10YR53	40	44	14	L
7- 3	BT	020-063	5.2	0.4	0.22	0.03	7.3	003	2.62	0.63	0.02	0.09	10.50	32.0	10YR63	10YR54	78	5	15	SL
7- 4	CK	063- +	7.6	0.8	0.48	0.05	9.6	001	12.12	2.47	0.09	0.05	8.50	100.0	10YR52	10YR42	45	41	12	L *

PLOT 15 ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
15- 1	LFH	010-000	5.0	90.0	52.20	1.37	38.1	110	47.50	7.87	0.0	2.87	129.00	45.3						
15- 2	AE	000-011	4.9	1.6	0.90	0.06	15.0	011	3.25	1.00	0.02	0.14	8.09	55.2	10YR72	10YR62	33	40	26	L
15- 4	BT	011-075	4.8	1.1	0.62	0.03	20.7	003	9.12	3.94	0.07	0.35	21.30	63.4	10YR62	10YR42	24	32	43	C
15- 6	CK	075- +	6.9	1.5	0.86	0.07	12.3	<1	11.50	4.28	0.07	0.29	17.50	92.2	10YR52	10YR32	12	40	47	SIC *

PLOT 16 ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
16- 1	LFH	008-000	5.0	92.1	53.40	1.44	37.1	162	43.75	7.25	0.0	3.62	135.00	40.6						
16- 2	AE	000-017	5.3	1.6	0.91	0.07	13.0	024	3.37	0.87	0.02	0.17	16.30	27.3	10YR72	10YR53	13	56	30	SICL
16- 4	BTGJ	017-052	5.3	1.6	0.91	0.10	9.1	006	10.00	4.60	0.06	0.46	17.20	87.9	10YR62	10YR42	12	29	57	C
16- 6	CKG	052- +	7.5	1.8	1.07	0.06	17.8	<1	15.25	7.37	0.10	0.47	14.10	100.0	10YR51	10YR32	21	41	37	CL *

Table 7 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

TERRAIN SYSTEM AFTER VALENTINE (1971)

BOREAL WHITE & BLACK SPRUCE ZONE

PLOT 19 DEGRADED DYSTRIC BRUNISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
19- 1	LFH	004-000	5.3	54.0	31.30	1.08	29.0	200	25.00	3.50	0.0	2.37	93.00	33.3						
19- 2	AHE	000-005	4.9	4.5	2.61	0.12	21.8	026	0.63	0.77	0.0	0.14	8.00	19.5	10YR52	10YR31				
19- 3	BM1	005-009	4.6	0.6	0.37	0.03	12.3	007	0.63	0.22	0.0	0.06	4.60	20.2	7.5YR53	7.5YR43				
19- 4	BM2	009-072	4.7	0.3	0.16	0.02	8.0	057	0.75	0.33	0.0	0.11	3.60	33.9	7.5YR53	7.5YR43				
19- 7	CK	072-100	7.5	0.3	0.19	0.02	9.5	008	4.00	0.68	0.02	0.04	2.00	100.0	7.5YR53	7.5YR42	96	2	1	S *
19- 8	CK	100- +	8.0	0.2	0.13	0.01	13.0	10	4.62	0.52	0.02	0.02	0.90	100.0	7.5YR52	7.5YR42	94	4	0	S *

PLOT 26 ORTHIC GRAY LUVISOL — BUCKINGHORSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
26- 1	LFH	009-000	6.0	91.0	52.80	1.25	42.2	114	50.00	15.25	0.0	3.00	73.00	93.7						
26- 2	AE	000-009	5.0	2.7	1.54	0.12	12.8	017	6.00	1.90	0.0	0.45	21.70	38.6	10YR63	10YR53				
26- 3	AB	009-019	6.0	1.2	0.69	0.07	9.9	007	5.50	3.55	0.0	0.35	18.00	52.5	10YR73	10YR53				
26- 4	BT	019-039	5.0	1.2	0.68	0.06	11.3	009	9.50	6.50	0.05	0.50	19.30	85.8	10YR63	10YR53	15	29	54	C
26- 5	BC	039-050																		
26- 6	CK	050- +	7.7	1.7	0.97	0.10	9.7	006	14.50	5.35	0.10	0.35	12.60	100.0	10YR51	10YR41	5	79	14	SIL *

PLOT 32 DEGRADED EUTRIC BRUNISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
32- 1	LFH	010-000	4.3	92.1	53.40	1.35	39.6	140	32.50	6.50	0.0	2.75	130.00	32.1						
32- 2	AHE	000-005	4.6	3.8	2.20	0.20	11.0	012	5.50	2.37	0.02	0.47	57.00	14.7	10YR43	10YR32	13	56	29	SICL
32- 3	BM1	005-016	5.5	2.3	1.34	0.10	13.4	004	7.25	3.42	0.0	0.35	8.40	100.0	10YR53	10YR43				
32- 4	BM2	016-032																		
32- 7	CK	032- +	7.5	1.2	0.72	0.04	18.0	009	11.00	3.65	0.05	0.27	10.60	100.0	10YR42	10YR32	16	47	36	SICL*

PLOT 33 GLEYED DEGRADED EUTRIC BRUNISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
33- 0	LFH	014-000	4.9	92.1	53.40	0.99	53.9	212	31.25	8.75	0.0	2.62	111.00	38.6						
33- 1	AHE	000-005	4.6	4.6	2.64	0.27	9.8	005	8.00	5.12	0.20	0.20	19.80	68.3			4	43	52	SIC
33- 2	BM	005-010	5.4	2.3	1.33	0.08	16.6	003	6.75	4.57	0.17	0.17	13.50	86.5	10YR53	10YR43	12	62	25	SIL
33- 3	BMGJ	010-025																		
33- 4	BMKG	025-031	7.1	1.1	0.62	0.05	12.4	003	7.25	4.45	0.0	0.17	8.10	100.0	10YR63	10YR43				
33- 6	CKG	031- +	7.9	1.3	0.73	0.05	14.6	010	11.50	4.35	0.25	0.15	14.60	100.0	10YR62	10YR42	14	65	19	SIL *

Table 7 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 38 EUTRIC BRUNISOL MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE XS	TEXTURE XSI	TEXTURE XC
38- 1	LFH	011-000	5.9	90.0	52.20	1.09	47.9	184	56.25	11.25	0.0	3.75	175.00	40.8					
38- 2	AHE	000-006	4.6	7.3	4.23	0.15	28.2	004	9.75	3.77	0.05	0.40	28.50	49.0	10YR42	10YR22	31	30	38 CL
38- 3	BM	006-016	6.0	3.0	1.74	0.11	15.8	004	11.25	3.10	0.03	0.25	17.00	86.0	10YR53	10YR43	39	39	21 L
38- 6	BMK	016-039	7.7	0.8	0.48	0.04	12.0	002	7.00	1.22	0.0	0.15	10.30	81.3	10YR43	10YR33			
38- 9	CK	039- +	7.7	2.1	1.19	0.08	14.9	003	12.00	3.52	0.0	0.40	15.10	100.0	2.5Y52	10YR22			

Table 7 (continued)

Aspen - White Spruce



Fig. 10 Populus tremuloides, along the Alaska Highway near Fort Nelson, growing on a moderately well drained Orthic Gray Luvisol.



Fig. 11 Characteristic shrub development dominated by Viburnum edule, Rosa acicularis and to a lesser extent by Shepherdia canadensis. The trembling aspen in this photo reached a height of 32m at 105 yrs with a 38cm dbh.

Aspen - White Spruce

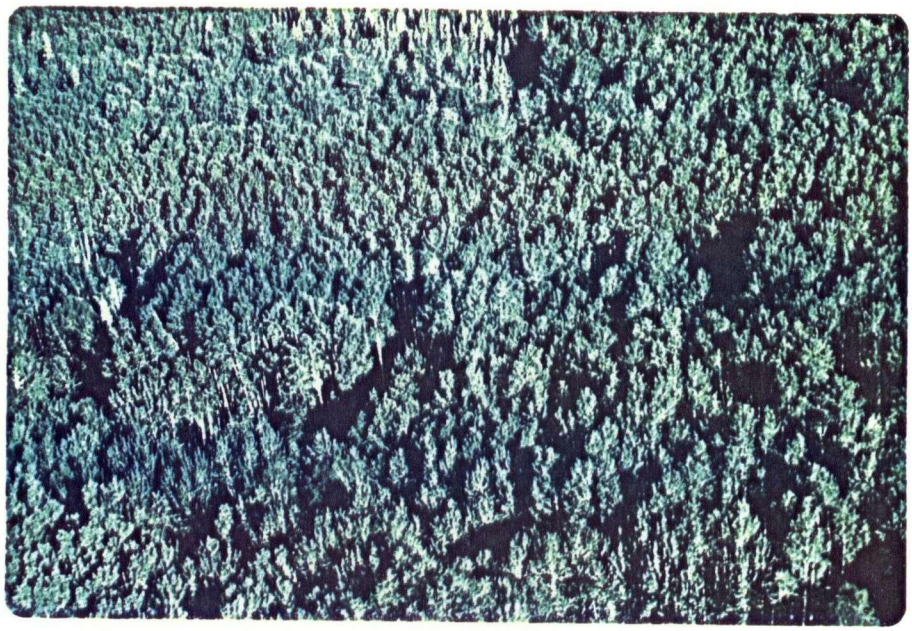
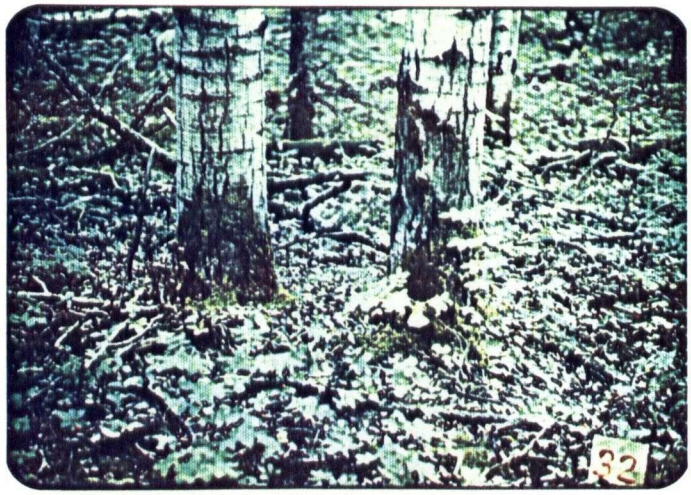


Fig. 12 Almost pure Populus tremuloides forest north of Fort Nelson. These forests are characteristic of moderately well drained sites.



Fig. 13 Populus tremuloides with Picea glauca in the understory. Poplar Hills west of Fort Nelson.

Aspen - White Spruce



Figs. 14 & 15 The spruce variant of the Aspen - White Spruce association which has developed on Degraded Eutric Brunisols. Note the poorly developed herb and shrub layers.



Aspen - White Spruce



Figs. 16 & 17
Orthic Gray Luvisol, (plots) typical of the aspen variant. This is considered the mesic soil of the study. Below is a Degraded Dystric Brunisol developed from fluvial parent materials of the Chuatse Terrain System. This soil supports the spruce variant.



Plant Association 1

Aspen - White Spruce

Hylocomio (splendentis) - Linnaeo (borealis) -
Aralio (nudicaulis) - Viburno (edulis) -
Populo (tremuloidis) - Piceetum glaucae

The Aspen - White Spruce ecosystems occur on moderately well drained sites in the uplands around Fort Nelson and occupy submesic to mesic (to slightly subhygric) sites in the study area (Fig. 9). All the stands studied originated after fire. This association can thus be considered as a "pulsating" climatic fire climax which, in the clementsian sense, is a sub-climax. Without fire, there are strong indications that the structure and composition of this association would change to one dominated by spruce, where the soil would develop a more acidic humus and more highly impoverished mineral horizons during natural succession. Soils of the Aspen - White Spruce ecosystem are primarily Orthic Gray Luvisols along with some Degraded Eutric and Dystric Brunisols.

Vegetation

Generally this association is characterized by well developed tree, shrub, and herb layers. The moss layer varies

considerably in development, being governed by the composition of the tree layer; ie. whether deciduous or coniferous.

The A_1 sublayer is generally dominated by Populus tremuloides and Picea glauca with the occasional Pinus contorta (preferably in sandy and impoverished soils) and Populus balsamifera (prevailingly in rich soils). A similar pattern follows in the A_2 layer, in which the effect of shade on shade intolerant trees is not yet very strong. In the A_3 layer, Picea glauca is often still the dominant tree as it is in the upper shrub layer. Betula papyrifera, Populus tremuloides, and Picea mariana are often present in the A_3 layer. However, Pinus contorta and Populus balsamifera are mostly absent. Alnus crispa and Salix bebbiana are two common shrubs, along with Picea glauca in the upper shrub layer. In the B_2 layer Viburnum edule and Rosa acicularis were present in 100% of the 17 plots, both with high species significance values (5.1). Shepherdia canadensis (in drier sites), Ribes oxyacanthoides, and Cornus stolonifera (in wetter sites) are present in more than half the stands examined. Alnus crispa, Populus tremuloides, Lonicera dioica, and Amelanchier alnifolia are other shrubs frequently present in the B_2 layer (more than 40% of the time).

Although Populus tremuloides is present from the low shrub layer to the A_3 layer in many stands, all stems

examined arose from suckers from the roots of aspen trees. These suckers are not ever vigorous enough to replace the present cover of aspen trees even after the stand opens up. Difficulty was experienced in locating aspen stands which are breaking up from old age and therefore the ultimate fate of these suckers was not determined. Populus tremuloides is well known as a shade intolerant pioneer species and is generally considered as a very transient species in the absence of fire (Raup, 1946; Moss, 1953; Horton, 1965; Maini, 1968; Hansen and Kurmis, 1972 and many others). On the other hand, the Picea glauca growing under the main canopy appeared relatively vigorous and therefore could replace the initial Populus tremuloides in succeeding stands. Picea glauca is considered as the dominant hypothetical climax species on mesic sites in this study. The presence of Picea mariana in many of the stands indicates that it will probably share a position in the climatic climax stand. In some spruce trees there is evidence of morphological characteristics, intermediate between white and black spruce, that indicate hybrids are present.

Young tree seedlings were generally not found in the herb layer of the sample plots from any of the tree species of the area. This absence of seedlings indicates that none of the species are adapted to take over as climax species

of the community. Therefore, it is normally fire which opens the forest for the establishment of new spruce and aspen stands. Many of the spruce trees in the understory of this association which appeared to be young were, when aged, within 20-30 years of the dominant overstory. This tends to agree with the findings of Dix and Swan (1971) for the Candle Lake area of Saskatchewan who report that Picea glauca and P. mariana are able to reproduce beneath a canopy for about 20 years after initial forest establishment. When the trees in the canopy are tall after 20 years of growth, evidently the light conditions at the ground level are worsened. This environment impedes new establishment of these trees, which are little shade tolerant.

The herb layer is dominated by Linnaea borealis, Cornus canadensis, Rubus pubescens, Aralia nudicaulis, Pyrola secunda, Mertensiana paniculata, and Mitella nuda. Linnaea borealis and Cornus canadensis were present in 100% of the communities examined and had high species significance values of 4.8 and 4.5 respectively. Hylocomium splendens and Ptilium crista-castrensis dominate the moss layer with respective significance values of 5.7 and 3.3. Pleurozium schreberi and Eurhynchium pulchellum are two other mosses frequently present. Commonly occurring lichens are Peltigera aphthosa, P. canina, and P. polydactyla, generally with low significance

values. It is quite understandable that this moss (ground) layer may well develop in time (at least 100 years after fire) and especially under a spruce canopy.

Three variations of the Aspen - White Spruce association which can be recognized are:

a) var. populosum tremuloidis (aspen variant)

b) var. betulosum papyriferae (birch variant)

c) var. piceosum glaucae (white spruce variant)

In table 6 the first 9 plots belong to the aspen variant, plot no. 7 belongs to the birch variant and the last 7 plots belong to the white spruce variant. The basic differences between the variants occur in the proportionate development of the vegetation layers. For example, the aspen and birch variants have a poorly developed moss layer on humus (average coverage of 4.4%) as compared to the white spruce variant with an average cover value of 60%. Conversely, with an average cover value of 37%, the herb layer of the aspen and birch variants is better developed than that of the white spruce variant with an average cover value of only 17%. Likewise the aspen and birch variants have a much better developed shrub layer (average coverage of B layer is 73%) than does the white spruce variant (average of 21%). The birch variant, represented by only one plot was separated from the aspen variant mainly on the lack of Populus tremuloides and small amount of Picea glauca which was found only in the B_2 layer. Additionally, the birch variant lacked

several other species which are common in the other variants, however, one plot does not allow for any truly meaningful comparison. It becomes evident that litter developed from densely deposited spruce needles keeps moisture required for establishment of mosses. This is not the case where litter is formed by deciduous angiosperms.

The presence and abundance of certain species can be used as differentials to distinguish between the aspen and white spruce variants. The following species are more characteristic of the aspen variant; Salix bebbiana, Cornus stolonifera, and Amelanchier alnifolia. Additionally, species such as Rubus pubescens and Aralia nudicaulis have a relatively high species significance in the aspen but generally not the spruce variant. Species more characteristic of the white spruce variant are Picea mariana, Ledum groenlandicum, Pleurozium schreberi, and Ptilium crista-castrensis. These species are favoured by decaying wood, especially from coniferous trees, remaining on the ground after fire, or eliminated by natural thinning processes. Hylocomium splendens also has a much higher species significance value in the spruce variant than it does in the aspen variant.

On the terraces above the Liard River in the North West Territories, Jeffrey (1964) described similar plant

communities. The vegetation from five of Jeffrey's "Terrace ecosystem types" can be described as one plant association which can be considered equivalent to the Fort Nelson Aspen - White Spruce association. The aspen variant is equivalent to the following of Jeffrey's units:

C6. Trembling aspen - white birch forest, terrace, on sandy loam.

C7. Trembling aspen forest, terrace, on clay loam.

C10. Trembling aspen forest, high terrace.

The spruce variant is equivalent to Jeffrey's units:

C2. Mixedwood forest, terrace, on neutral loam.

C3. Mixedwood forest, terrace, on slightly acid sand.

There is no equivalent plant association described by Jeffrey for low elevation forests of the Mackenzie Mountains in the North West Territories. The association most closely resembling the Aspen - White Spruce is Jeffrey's "low elevation mixed coniferous forest", however, tree growth is much poorer in the Mackenzie Mountains where $S.I._{100}$ generally does not exceed 20 meters. Additionally, this northern plant association is much poorer in species in the herb and shrub layers.

Soils

Most soils of the Aspen - White Spruce association are Orthic Gray Luvisols, many of which

correspond directly to the Sikanni Series of the Sikanni Terrain System described by Valentine (1971). Apart from organic soils, the Sikanni series are the most common soils of the Fort Nelson area covering 8.8% of the area mapped by Valentine. The Orthic Gray Luvisols of the Aspen - White Spruce association, which occur on the Buckinghorse Terrain System, correspond to Valentine's Fort Nelson Series. Apart from one Degraded Dystric Brunisol which occurred on an alluvial fan, all soils of the aspen variant were Orthic Gray Luvisols. The spruce variant was found on Degraded Eutric and Degraded Dystric Brunisols as well as on Orthic Gray Luvisols. The Degraded Dystric Brunisols mentioned above are moister versions of Valentine's Trail Series of the Chuatse Terrain System. Valentine has not described any Degraded Eutric Brunisols developed from silty loams deposited over the Buckinghorse shales in the Chuatse Terrain System.

The soil of plot 33 is a Degraded Eutric Brunisol developed from a silty loam alluvial deposit which had remnants of buried IFH horizons in the profile. This soil indicates that on fine textured materials, Cumulic Regosols eventually evolve into Degraded Eutric Brunisols while on coarser textured alluvial deposits such as the sand in plot 19, Degraded Dystric Brunisols eventually develop. Since most of the Orthic Gray Luvisols developed from silty loams,

it is reasonable to expect that the above mentioned Degraded Eutric Brunisols will eventually develop into Orthic Gray Luvisols. Jeffrey (1964) reported Gray Luvisols developed from alluvial sands on terraces above the Liard River and Valentine (1971) reported that numerous thin Bt horizons sometimes developed in lower sand horizons making Brunisolic Gray Luvisol profiles in some soils which were normally Degraded Dystric Brunisols. However, in this study, no Gray Luvisols were found developing from sands. For the area around Fort Nelson, the soil best characterizing mesic conditions is considered to be a moderately well-drained Orthic Gray Luvisol developing from silty loams, even though, as mentioned above, other soils can occupy this position.

The pH of LFH horizons of Orthic Gray Luvisols averages 5.4 and although the cation exchange capacity is high (avg. of 108 meq/100 gms) base saturation is also relatively high (averaging 63%) mainly due to high amounts of Ca and Mg in this horizon. The amount of available phosphorus is also high in the humus averaging 134 ppm. Beneath the humus layer, the pH decreases sharply in the Ae horizon (avg. 5.0) and then increases with depth (avg. of 5.2 in the Bt) until it becomes neutral, averaging 7.1 in the Ck horizon. The cation exchange capacity is lowest in the Ae of the mineral horizons even though it has a slightly

higher average organic matter content than the Bt. This low cation exchange capacity (C.E.C.) is probably due to removal of the clays which contribute highly to the exchange complex. The deposition of clays in the Bt is reflected through textural analysis which indicates the highest amount in Bt horizons.

The base saturation of the Ae (49.7%) is also lowest for all horizons in the profile which is due to the leaching of exchangeable cations to the lower horizons. The average base saturation of the Bt is 70.7%, while the Ck is generally 100% due mainly to high amounts of Ca and Mg.

It is interesting to note that the humus often has a higher pH than that of not only the Ae but also the underlying Bt horizon. Populus tremuloides is a species which cycles large amounts of Ca and through litterfall, is thought responsible for the high pH of the humus. Populus tremuloides, in these ecosystems, can be considered as a species which counteracts acid leaching of mineral soils (podzolization) and therefore would help keep the Orthic Gray Luvisols in dynamic equilibrium with the environment. The favouring of Populus tremuloides by periodic fires supports the contention that the present Orthic Gray Luvisols are the zonal soils of the area under a fire climax.

There are indications that under an environment free of fire, the zonal soils would be the result of podzolization processes. This aspect is discussed later in the description of the Black Spruce - Moss association. The different roles played in ecosystem development by Picea mariana, P. glauca, and Populus tremuloides should be considered in forestry practices on these sites, especially in selection of tree species.

The Brunisolic soils characteristic of the spruce variant have similar properties to the Orthic Gray Luvisols except that the pH of the humus tends to be slightly lower and the Ck horizon has a higher pH. The sandy soils, however, have lower cation exchange capacities and lower base saturations and therefore, can be subjected to podzolization, especially through spruce litterfall.

PLANT ASSOCIATION 2

FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE

Hylocomio (splendentis) - Mitello
(nudae) - Equiseto (pratensis) -
Viburno (edulis) - Piceetum glaucae

Characteristic Combination of Species

Layer	Constants (presence > 60%) * characteristic	Characteristic non - constants > II
Tree	Picea glauca	
	Betula papyrifera	
Shrub	Alnus tenuifolia	Ribes lacustre
	Rosa acicularis	Salix monticola
	Viburnum edule	
	Ribes oxyacanthoides	
	Cornus stolonifera	
	Ribes triste	
Herb	Cornus canadensis	Circaea alpina
	Mitella nuda*	Matteuccia struthiopteris
	Goodyera repens*	Cinna latifolia
	Equisetum pratense*	Carex deweyana
	Rubus pubescens	Thalictrum sparsiflorum
	Pyrola asarifolia	Fragaria virginiana
	Linnaea borealis	Aconitum delphinifolium
	Mertensia paniculata	Delphinium glaucum
	Equisetum scirpoides	Cymnocarpium dryopteris
	Viola renifolia	
	Galium triflorum*	
	Calamagrostis canadensis	
Moss	Hylocomium splendens	Brachythecium reflexum
	Ptilium crista-castrensis	

Table 8

FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE

Hylocomio (splendentis) - Mitello (nudae.) - Equiseto

(pratensis) - Viburno (edulis) - Piceetum glaucae

Plot No.	80	75	39	25	22	21	72	71
Elevation in M	300	305	345	720	720	720	305	305
Latitude	58° 44'	58° 39'	58° 49'	58° 39'	58° 39'	58° 39'	58° 39'	58° 39'
Longitude	122° 45'	122° 34'	123° 29'	124° 11'	124° 13'	124° 14'	122° 32'	122° 32'
Exposure	S	SW	Flat	Flat	E	Flat	Flat	Flat
Slope Gradient %	1	2	1	1	1	1	1	1
Percent coverage								
Total A	40	37	69	65	30	40	35	38
A_1	15	26	30	20	20	12	20	22
A_2	20	7	30	38	14	25	0	5
A_3	20	10	20	18	8	10	15	15
Total B	75	35	25	30	25	30	25	33
B_1	22	14	0	5	15	12	9	17
B_2	60	28	25	26	18	23	20	18
C	78	67	78	75	55	75	77	75
Dh	59	3	52	63	76	50	20	6
Dw	7	10	40	20	10	20	8	7
Plot Coverage %								
Litter	81	5	82	70	89	70	20	+
Decaying Wood	11	15	10	22	13	24	12	10
Mineral Soil	—	73	—	—	—	—	64	85
Rock	—	—	—	—	—	—	—	—
Hygrotope			Subhygric		Hygric			
Trophotope			Subeutrophic		eutrophic			
Parent Material				Alluvium				

Table 9

FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE

ST NO.	SPECIES	PLOT NUMBER 080	075	039	025	022	021	072	071	P	MS	RS
A1												
1	PICEA GLAUCA	5.2	6.3	6.2	5.2	5.2	5.2	5.3	5.3	100.0	5.6	5-6
2	POPULUS TREMULOIDES	.	.	.	3.2	.	.	.	.	12.5	1.1	3-3
3	POPULUS BALSAMIFERA	.	.	.	.	.	1.2	.	.	12.5	+.0	1-1
A2												
	PICEA GLAUCA	5.2	4.3	5.2	7.2	5.2	5.2	.	4.2	87.5	5.3	4-7
	POPULUS TREMULOIDES	.	.	4.2	.	.	1.2	.	.	25.0	2.0	1-4
	POPULUS BALSAMIFERA	.	.	.	.	.	1.2	.	.	12.5	+.0	1-1
A3												
	PICEA GLAUCA	4.2	4.2	5.2	5.2	4.2	4.2	5.2	5.2	100.0	5.1	4-5
4	BETULA PAPYRIFERA	4.2	4.2	4.2	.	.	3.2	.	2.3	62.5	3.4	2-4
5	ABIES LASIOCARPA	.	.	.	.	1.2	.	.	.	12.5	+.0	1-1
B1												
6	ALNUS TENUIFOLIA	4.2	5.2	.	3.2	5.2	4.2	4.2	5.2	87.5	4.9	3-6
	PICEA GLAUCA	4.2	.	.	1.1	1.2	1.2	.	2.2	62.5	2.3	1-4
	BETULA PAPYRIFERA	3.2	3.2	.	.	.	.	.	2.2	37.5	2.0	2-3
7	SALIX BEBBIANA	.	.	.	.	1.2	1.2	.	.	25.0	+.2	1-1
	ABIES LASIOCARPA	.	.	.	.	1.2	.	.	.	12.5	+.0	1-1
	POPULUS BALSAMIFERA	.	.	.	.	.	1.2	.	.	12.5	+.0	1-1
8	SALIX MONTICOLA	.	.	.	.	1.2	.	.	.	12.5	+.0	1-1
B2												
9	ROSA ACICULARIS	5.3	4.2	4.2	4.2	5.2	4.2	4.2	5.3	100.0	5.0	4-5
10	VIBURNUM EDULE	4.3	5.2	5.2	5.2	1.2	4.2	2.2	4.2	100.0	4.9	1-5
11	RIBES OXYACANTHOIDES	3.2	2.2	1.2	.	1.2	.	2.2	4.2	75.0	2.7	1-4
12	CORNUS STOLONIFERA	5.3	4.2	4.2	.	.	.	4.2	3.2	62.5	4.0	3-5
13	RIBES TRISTE	2.2	.	+.2	3.2	1.2	3.2	.	.	62.5	2.1	+-3
	PICEA GLAUCA	.	3.2	.	.	.	+.2	2.2	2.2	50.0	1.7	+-3
	SALIX BEBBIANA	3.	1.2	.	+.2	+.1	.	.	.	50.0	1.3	+-3
14	RIBES LACUSTRE	.	.	.	1.2	.	3.2	1.2	.	37.5	1.4	1-3
	ABIES LASIOCARPA	.	.	.	.	2.2	1.2	.	.	25.0	+.8	1-2
	ALNUS TENUIFOLIA	.	.	.	1.2	.	.	.	2.2	25.0	+.8	1-2
15	SHEPHERDIA CANADENSIS	.	.	1.2	.	.	2.2	.	.	25.0	+.8	1-2
	POPULUS BALSAMIFERA	2.1	.	.	.	.	+.1	.	.	25.0	+.5	+-2
16	RUBUS IDAEUS	+.	.	.	.	.	.	.	1.2	25.0	+.0	+-1
17	BETULA RESINIFERA	.	.	.	.	.	.	.	1.2	12.5	+.0	1-1
18	LONICERA DIOICA	1.2	.	.	.	.	.	.	.	12.5	+.0	1-1
	POPULUS TREMULOIDES	.	.	.	.	.	1.2	.	.	12.5	+.0	1-1
19	AMELANCHIER ALNIFOLIA	+.	.	.	.	.	.	.	.	12.5	+.0	+-+
	BETULA PAPYRIFERA	.	.	.	.	.	+.2	.	.	12.5	+.0	+-+
20	RIBES GLANDULOSUM	.	.	.	.	.	.	.	+.2	12.5	+.0	+-+
21	RIBES HUDSONIANUM	.	+.	.	.	.	.	.	.	12.5	+.0	+-+
C												
22	CORNUS CANADENSIS	4.2	1.2	5.2	4.2	5.2	5.2	1.2	3.2	100.0	4.8	1-5
23	MITELLA NUDA	4.3	3.2	4.2	5.2	3.2	4.2	+.2	4.2	100.0	4.3	+-5

Table 10

FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE

PLOT NUMBER	080	075	039	025	022	021	072	071														P	MS	RS
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																							
24 GOODYERA REPENS	+.2	+.2	+.2	2.	3.2	1.2	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.		100.0	1.7	+-3
25 EQUISETUM PRATENSE	8.3	8.2	.	6.2	3.2	2.2	4.2	8.2	.	.	.	.	.	.	.	.	.	.	.	.		87.5	6.4	2-8
26 RUBUS PUBESCENS	4.2	4.2	5.2	4.2	3.2	4.2	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.		87.5	4.4	3-5
27 PYROLA ASARIFOLIA	1.2	+.2	5.2	+.	+.2	4.3	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.		87.5	3.3	+-5
28 LINNAEA BOREALIS	2.2	2.2	6.2	4.2	4.2	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.		75.0	5.0	2-7
29 MERTENSIA PANICULATA	1.2	1.2	3.2	4.2	4.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.		75.0	3.1	1-4
30 EQUISETUM SCIRPOIDES	1.3	.	+.2	3.	2.2	2.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.		75.0	2.0	+-3
31 VIOLA RENIFOLIA	2.3	.	4.2	2.2	.	.	2.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.		62.5	2.7	2-4
32 GALIUM TRIFLORUM	2.3	2.3	+.2	.	.	.	+.2	3.3	.	.	.	.	.	.	.	.	.	.	.	.		62.5	1.8	-3
33 CALAMAGROSTIS CANADENSIS	.	.	1.1	1.	2.2	2.2	.	+.	.	.	.	.	.	.	.	.	.	.	.	.		62.5	1.3	+-2
34 CIRCAEA ALPINA	2.3	4.3	.	.	.	.	1.3	5.3	.	.	.	.	.	.	.	.	.	.	.	.		50.0	3.4	1-5
35 PYROLA SECUNDA	.	.	+.2	1.	3.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.		50.0	1.9	+-3
36 PYROLA CHLORANTHA	1.2	.	+.	.	+.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.		50.0	1.3	+-3
37 MATTEUCCIA STRUTHIOPTERIS	.	1.2	.	.	.	.	8.3	1.2	.	.	.	.	.	.	.	.	.	.	.	.		37.5	4.5	1-8
38 CINNA LATIFOLIA	.	4.2	.	.	.	.	1.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.		37.5	2.3	1-4
39 VACCINIUM VITIS-IDAEA	.	.	.	1.2	4.2	+.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.		37.5	2.0	+-4
40 CAREX DEWEYANA	.	+.2	.	.	.	.	3.2	+.	.	.	.	.	.	.	.	.	.	.	.	.		37.5	1.2	+-3
41 ARALIA NUDICAULIS	1.2	2.2	.	.	.	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.		37.5	1.2	1-2
42 EQUISETUM ARVENSE	2.3	.	.	.	.	2.2	.	+.	.	.	.	.	.	.	.	.	.	.	.	.		37.5	1.1	+-2
43 ACTAEA RUBRA	+.2	.	+.2	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.		37.5	+.1	+-1
44 FRAGARIA VIRGINIANA	.	+.2	1.2	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.		37.5	+.1	+-1
45 THALICTRUM SPARSIFLORUM	.	+.2	.	.	.	.	1.2	+.	.	.	.	.	.	.	.	.	.	.	.	.		37.5	+.1	+-1
46 ACONITUM DELPHINIFOLIUM	.	.	.	1.2	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.		25.0	+.8	-2
47 EPILOBIUM ANGUSTIFOLIUM	.	.	.	1.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.		25.0	+.8	1-2
48 MAIANTHEMUM CANADENSE	+.2	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		25.0	+.5	+-1
49 DELPHINIUM GLAUCUM	.	+.2	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		25.0	+.0	+-1
50 GYMNOCARPIUM DRYOPTERIS	.	.	.	.	.	.	1.2	+.	.	.	.	.	.	.	.	.	.	.	.	.		25.0	+.0	+-1
51 RUBUS ACAULIS	.	.	.	.	.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.		12.5	1.1	1-3
52 CAREX DISPERMA	.	.	.	.	.	.	2.3	.	.	.	.	.	.	.	.	.	.	.	.	.		12.5	+.4	2-2
53 PETASITES PALMATUS	.	.	.	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		12.5	+.0	1-1
54 ASTER CILIOLATUS	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		12.5	+.0	+-+
55 CAREX CONCINNA	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		12.5	+.0	+-+
56 GALIUM BOREALE	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		12.5	+.0	+-+
57 GEUM MACROPHYLLUM	.	.	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.		12.5	+.0	+-+
58 HABENARIA OBTUSATA	.	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.		12.5	+.0	+-+
59 LYCOPODIUM ANNOTINUM	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		12.5	+.0	+-+
60 MONESES UNIFLORA	.	.	.	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.		12.5	+.0	+-+
61 POLEMONIUM ACUTIFLORUM	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		12.5	+.0	+-+
62 SMILACINA TRIFOLIA	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		12.5	+.0	+-+
63 VICIA AMERICANA	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		12.5	+.0	+-+
DH																								
64 HYLOCOMIUM SPLENDENS	8.	3.	5.	7.	8.	8.	.	4.	.	.	.	.	.	.	.	.	.	.	.	.		87.5	6.8	3-8
65 PTILIUM CRISTA-CASTRENSIS	3.	.	5.	4.	5.	.	+.	3.	.	.	.	.	.	.	.	.	.	.	.	.		75.0	4.2	+-5
66 PLEUROZIUM SCHREBERI	1.	.	5.	.	.	.	.	3.	.	.	.	.	.	.	.	.	.	.	.	.		37.5	3.1	1-5
67 RHYTIDIADELPHUS TRIQUETRUS	.	.	.	.	.	.	5.	2.	.	.	.	.	.	.	.	.	.	.	.	.		25.0	3.0	2-5
68 PLAGIOMNIUM RUGICUM	.	.	.	.	.	.	+.	3.	.	.	.	.	.	.	.	.	.	.	.	.		25.0	1.2	+-3
69 BRACHYTHECIUM REFLEXUM	+.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.		25.0	+.0	+-+
70 CAMPYLIUM HISPIDULUM	.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		25.0	+.0	+-+
71 POHLIA NUTANS	.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.		25.0	+.0	+-+

Table 10 (continued)

FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE

ST NO.	SPECIES	PLOT NUMBER 080	075	039	025	022	021	072	071	P	MS	RS
		SPECIES SIGNIFICANCE AND VIGOR										
72	CINCLIDIUM STYGIUM	.	.	.	.	.	.	3.	.	12.5	1.1	3-3
73	PELTIGERA CANINA	.	.	2.	.	.	.	.	.	12.5	+.4	2-2
74	PELTIGERA APHTHOSA	.	.	1.	.	.	.	.	.	12.5	+.C	1-1
75	BLEPHAROSTOMA TRICHOPHYLLUM	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
76	BRACHYTHECIUM CURTUM	.	.	.	.	.	.	+.	.	12.5	+.0	+-+
77	CAMPYLIUM CHRYSOPHYLLUM	.	.	.	+.	.	.	.	.	12.5	+.0	+-+
78	CLACONIA FIMBRIATA	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
79	DISTICHIUM CAPILLACEUM	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
80	DITRICHUM HETEROMALLUM	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
81	EURHYNCHIUM PULCHELLUM	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
82	HYPNUM LINDBERGII	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
83	LEPIDOZIA REPTANS	.	.	.	.	.	.	+.	.	12.5	+.0	+-+
84	MNIUM MARGINATUM	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
85	MNIUM SPINULOSUM	.	.	.	+.	.	.	.	.	12.5	+.0	+-+
86	NEPHROMA HELVETICUM	.	.	+.	.	.	.	.	.	12.5	+.0	+-+
87	PLAGIOCHILA ASPLENIODES	.	.	.	.	.	.	+.	.	12.5	+.0	+-+
88	PLAGIOMNIUM CILIARE	.	.	.	+.	.	.	.	.	12.5	+.0	+-+
89	PLAGIOMNIUM CUSPIDATUM	+.	.	.	.	.	.	.	.	12.5	+.0	+-+
90	PLAGIOMNIUM DRUMMONDII	.	.	.	.	.	.	.	+.	12.5	+.0	+-+
91	PLAGIOMNIUM MEDIUM	.	.	.	.	.	.	.	+.	12.5	+.0	+-+
92	PLAGIOMNIUM ROSTRATUM	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
93	PLATYDICTYA JUNGERMANNIOIDES	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
94	THUIDIUM RECOGNITUM	+.	.	.	.	.	.	.	.	12.5	+.0	+-+
DW												
	HYLOCOMIUM SPLENDENS	2.	3.	4.	7.	4.	4.	1.	2.	100.0	4.7	1-7
	PTILIUM CRISTA-CASTRENSIS	3.	4.	4.	4.	4.	1.	4.	3.	100.0	4.1	1-4
	PLEUROZIUM SCHREBERI	.	2.	5.	.	+.	.	.	4.	50.0	3.4	+-5
	PELTIGERA CANINA	.	+.	+.	+.	.	.	.	.	37.5	+.0	+-+
	PELTIGERA APHTHOSA	.	1.	.	1.	.	.	.	.	25.0	+.2	1-1
95	NEPHROMA RESUPINATUM	.	.	+.	+.	.	.	.	.	25.0	+.0	+-+
	POHLIA NUTANS	.	+.	.	.	+.	.	.	.	25.0	+.0	+-+
	RHYTIDIADELPHUS TRIQUETRUS	.	.	.	.	1.	.	.	.	12.5	+.C	1-1
	BRACHYTHECIUM REFLEXUM	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
	CINCLIDIUM STYGIUM	.	.	.	.	+.	.	.	.	12.5	+.C	+-+
96	DREPANOCLADUS UNCINATUS	.	.	.	.	+.	.	.	.	12.5	+.C	+-+
	EURHYNCHIUM PULCHELLUM	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
97	HERZOGIELLA TURFACEA	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
98	LEPTOBRYUM PYRIFORME	.	.	.	.	+.	.	.	.	12.5	+.C	+-+
99	LEPTOBIUM SATURNINUM	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
	MNIUM MARGINATUM	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
	MNIUM SPINULOSUM	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
	NEPHROMA HELVETICUM	.	.	+.	.	.	.	.	.	12.5	+.0	+-+
100	ORTHOTRICHUM SPECIOSUM	.	.	.	.	+.	.	.	.	12.5	+.0	+-+
101	PELTIGERA HORIZONTALIS	.	.	+.	.	.	.	.	.	12.5	+.C	+-+
102	PELTIGERA MALACEA	.	.	.	.	.	+.	.	.	12.5	+.0	+-+
103	PYLAISIA POLYANTHA	.	.	.	.	+.	.	.	.	12.5	+.C	+-+
104	TETRAPHIS PELLUCIDA	.	+.	.	.	.	.	.	.	12.5	+.0	+-+

Table 10 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

TERRAIN SYSTEM AFTER VALENTINE (1971)

BOREAL WHITE & BLACK SPRUCE ZONE

PLOT 80 REGO GLEYSOL — MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
80- 1	LFH	006-000	6.1	84.0	48.70	0.57	85.4	032	72.50	13.00	0.0	1.12	77.00	100.0						
80- 2	AHG	000-012	7.0	16.8	6.26	0.61	10.3	004	29.00	4.67	0.0	0.30	25.50	100.0	10YR42	10YR21				
80- 3	CKG1	012-018	7.6	0.9	0.55	0.04	13.7	002	4.00	0.65	0.0	0.07	4.00	100.0	10YR42	10YR32	80	7	11	SL *
80- 4	CKG2	018- +	7.5	3.6	2.11	0.11	19.2	003	9.25	1.62	0.02	0.17	7.40	100.0	10YR52	10YR32	49	28	21	L *

PLOT 75 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
75- 1	CK1	000-005	7.4	3.0	1.73	0.09	19.2	007	9.00	1.40	0.05	0.27	14.70	73.0	10YR52	10YR32	29	55	15	SIL
75- 2	CK2	005-022	7.3	3.6	2.11	0.15	14.1	007	7.00	3.55	0.0	0.30	12.30	88.4	10YR52	10YR32				
75- 3	CK3	022- +	6.8	5.6	3.26	0.23	14.2	005	10.00	3.87	0.0	0.25	16.40	86.4	10YR52	10YR32				

PLOT 39 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
39- 1	LFH	004-000	6.2	92.1	53.40	1.46	36.6	104	52.50	7.25	0.0	1.87	106.00	58.4						
39- 2	AHK	000-010	7.3	11.2	6.50	0.13	50.0	005	17.50	3.00	0.0	0.25	28.50	72.9	10YR51	10YR21				
39- 4	CK1	010-026	7.3	6.8	3.94	0.07	56.3	006	18.50	2.85	0.0	0.22	21.20	100.0	10YR41	10YR21	6	62	31	SICL*
39- 8	CK2	026- +	7.4	1.1	0.61	0.12	5.1	004	6.25	0.97	0.0	0.05	4.40	100.0	2.5Y41	2.5Y31	80	12	6	LS *

PLOT 71 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
71- 1	CK1	000-005	6.9	2.3	1.33	0.21	6.3	009	10.25	2.02	0.05	0.37	16.80	75.6	10YR52	10YR32	10	69	20	SIL
71- 2	CK2	005-020	7.1	1.0	0.58	0.14	4.1	005	6.75	4.25	0.02	0.22	12.70	88.6	10YR42	10YR32	19	62	18	SIL
71- 3	CK3	020- +	7.5	0.6	0.37	0.12	3.1	7	10.50	2.32	0.02	0.30	12.20	100.0	10YR52	10YR32	15	67	16	SIL

PLOT 25 CUMULIC REGOSOL

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
25- 1	LFH	030-000	6.1	91.0	52.80	1.53	34.5	088	65.00	12.75	0.0	1.37	156.00	50.8						
25- 3	AH	000-020	5.1	8.3	4.81	0.33	14.6	007	10.75	3.72	0.0	0.10	14.60	99.8	10YR41	10YR21	17	49	33	SICL
25- 4	AHK	020-034	6.2	6.1	3.54	0.13	27.2	007	7.25	2.45	0.0	0.07	16.10	60.7	10YR32	10YR31				
25- 6	CK	034- +	7.9	1.7	0.99	0.07	14.1	003	8.75	2.25	0.0	0.05	13.90	79.5	10YR41	10YR21	37	51	11	SIL *

Table 11

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 21 CUMULIC REGOSOL

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
21- 1	LFH	006-000	6.0	94.0	54.50	1.32	41.3	46	57.50	15.37	0.0	1.37	83.00	89.6						
21- 2	CK1	000-007	7.2	11.6	6.72	0.33	20.4	006	11.00	1.35	0.02	0.05	11.80	100.0	10YR41	10YR21	16	68	15	SIL *
21- 4	CK2	007-050	7.3	16.4	6.03	0.32	18.8	010	9.62	2.07	0.0	0.04	18.30	64.3	10YR41	10YR21				
21- 6	CK3	050- +	7.7	0.4	0.26	0.04	6.5	012	6.25	0.65	0.02	0.02	1.20	100.0	10YR5	10YR31	70	15	14	SL *

PLOT 22 CUMULIC REGOSOL

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
22- 1	LF	016-010																		
22- 2	H	010-000	3.7	89.0	51.60	1.25	41.3	040	20.00	5.75	0.0	0.63	73.00	36.3						
22- 3	CK1	000-018	7.1	8.6	4.99	0.19	26.3	6	6.62	1.16	0.02	0.02	6.00	100.0	10YR41	10YR21	45	38	15	L *
22- 4	CK2	018-048	7.3	9.3	5.39	0.24	22.5	21	9.25	0.98	0.0	0.04	6.80	100.0	10YR41	10YR21				
22- 7	CK3	048- +	7.6	1.0	0.60	0.05	12.0	6	7.87	0.64	0.02	0.02	1.90	100.0	10YR41	10YR31	64	21	14	SL *

PLOT 72 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
72- 1	C1	000-019	6.3	8.7	5.07	0.24	21.1	005	11.00	5.15	0.02	0.40	18.70	88.6	10YR52	10YR32	1	60	38	SICL
72- 2	C2	019- +	6.8	5.7	3.32	0.22	15.1	003	10.75	3.95	0.02	0.37	14.30	100.0	10YR52	10YR32	6	56	36	SICL

Table 11 (continued)

Floodplain (Young Terrace) White Spruce

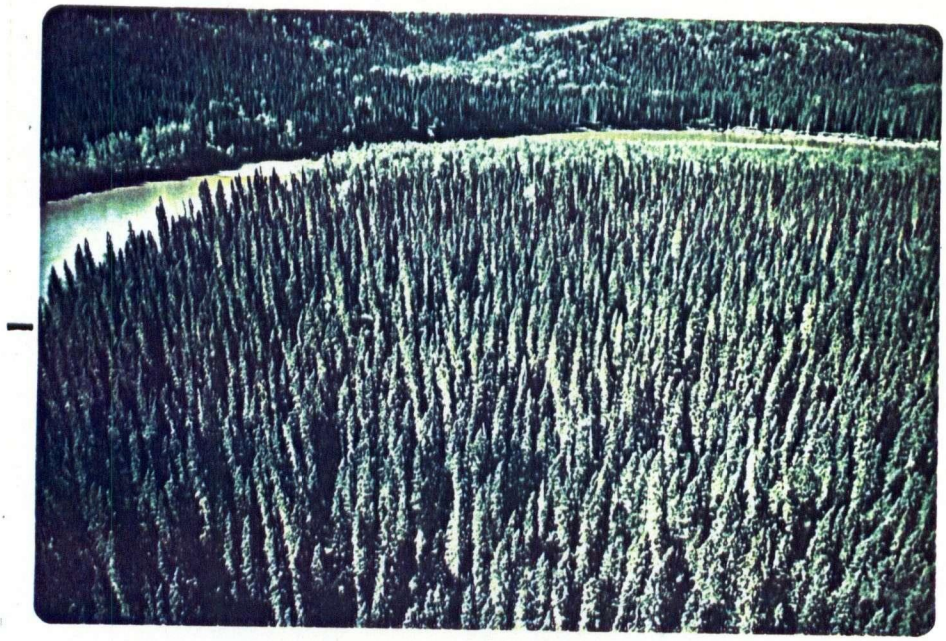


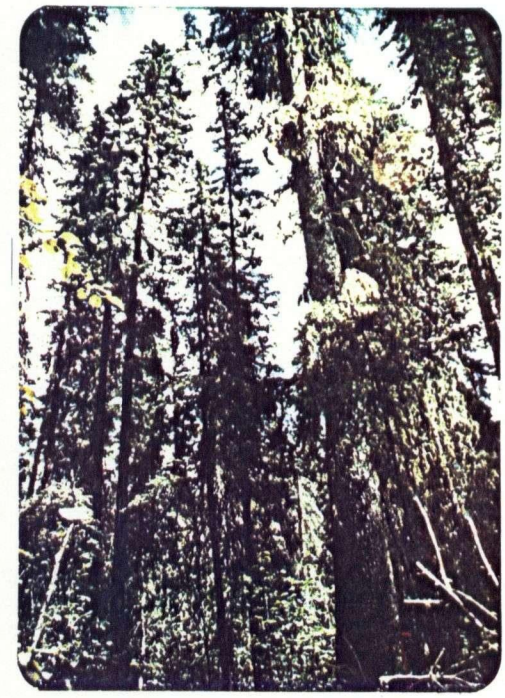
Fig. 18 Picea glauca forest on a floodplain of the Fort Nelson River.



Fig. 19 Photograph shows the relative heights above the river of a Floodplain Balsam Poplar ecosystem on the left and a Floodplain White Spruce ecosystem on the right. Soils are Cumulic Regosols.

Floodplain (Young Terrace) White Spruce





Figs. 20 & 21 Alluvial white spruce forests. Note the high water mark on the spruce in plot 75 from the 1971 flood. The dominant vegetation in the herb layer is Equisetum pratense. Plot 75 contained one Picea glauca 46m tall with a dbh of 61cm at age 180 years. This produces a site index of approximately 39.6m at 100 years which is the highest found in the entire study. The oldest spruce found in the entire study occurred in the plot shown on the right which was 40.2m tall at an age of 314 years.

Floodplain (Young Terrace) White Spruce



Fig. 22 In the foreground a few remnant Populus balsamifera trees are present in the white spruce stand. Meander in river (center of picture) shows the successional development from a point-bar deposit to a mature stand of white spruce.

Plant Association 2

Floodplain (Young Terrace) White Spruce

Hylocomio (splendentis) - Mitello (nudae) - Equiseto (pratensis) - Viburno (edulis) - Piceetum glaucae

Floodplain (Young Terrace) White Spruce ecosystems occur on older portions of recent alluvial terraces along the Fort Nelson, Prophet, Muskwa, and Tetsa Rivers. Along with the Floodplain Balsam Poplar, these sites support the most productive forest stands and are comparable in productivity with the richest stands examined by Revel (1972) in the Sub-Boreal Biogeoclimatic Zone. The most productive forests described by Revel occurred in the Gymnocarpio (dryopteridis) - Oplopanaco (horridi) - Abieto (lasiocarpae) - Piceetum glaucae association (Oak fern - Devil's club association) where the average site index, at 100 years for Picea glauca, is 32m. On alluvial sites in this study, white spruce averages 29.9m at 100 years. It should be noted, however, that the average S.I. measured on alluvial plots along the Muskwa and Fort Nelson Rivers was 32.3m at age 100 while the alluvial sites adjacent to the Spruce - Willow - Birch Biogeoclimatic Zone at higher elevations along the Tetsa River (Mile 376 of the Alaska Highway) had a $S.I._{100}$ of only 25.6m which lowers the

general average considerably. This last figure is comparable to a $S.I._{100}$ of 24.4m for white spruce given by Blyth (1965) for alluvial lowland forests along the lower Peace River in Alberta.

Most of the alluvial sites studied are characterized by immature soils which are periodically innundated by floodwaters which have maintained these ecosystems at a rich or eutrophic nutritional level. This, along with subhygric to hygric moisture regimes, are the major factors contributing to the high productivity of these sites. This subhygric to hygric moisture regime is estimated for the entire year. In reality it becomes hydric when the soils are flooded. At the end of the vegetative season, soils may become mesic when the water in the river is low.

Vegetation

The floodplain white spruce communities characteristically have well developed tree, shrub, herb, and moss layers, however, after severe flooding, the moss layer may be greatly reduced as is indicated by plots 71 and 75. The entire tree layer is dominated by Picea glauca with Betula papyrifera being common in the A_3 layer. The upper shrub layer is usually dominated by small white spruce and Alnus

tenuifolia. Rosa acicularis, Viburnum edule, Ribes oxyacanthoides Cornus stolonifera, and Ribes triste dominate the B_2 layer. After logging, these species expand to dominate the alluvial sites producing severe regeneration problems for white spruce.

The herb layer is characterized by Cornus canadensis, Mitella nuda, Goodyera repens, Equisetum pratense, Rubus pubescens, Pyrola asarifolia, and Linnaea borealis. The first three species were present in all plots studied, however, it should be noted that even though Equisetum pratense was absent in one plot, it had the highest average coverage value for herbs. Hylocomium splendens and Ptilium crista-castrensis are the most characteristic mosses of this association, occasionally with Pleurozium schreberi and Rhytidiadelphus triquetrus accompanying them. Pleurozium schreberi was generally absent on mineral soil in this association and was present generally only on decaying wood. Although plot 71 appears to be an exception, the severe flood of 1971 covered most of the area with fresh silt which is indicated by the high percentage of mineral soil covering the surface of the plots. Pleurozium schreberi is, however, common on decaying wood. Rhytidiadelphus triquetrus, which was additionally present only in the Aspen - White Spruce association, reached its best development in alluvial white spruce communities when it was present.

The above plant association is comparable to part of the "Floodplain White Spruce Forests" described for the Slave, Athabasca and lower Peace Rivers by Raup (1946). Horton (1965) described a very similar plant association for the lower Peace River in Wood Buffalo National Park which he termed the "Alluvial Lowland Spruce Forest". This type occupied low terraces along the major rivers in a fashion similar to the Fort Nelson area. Notable differences are that such species as Ribes oxyacanthoides, Goodyera repens, and Galium triflorum, which had high presence and significance values in the Fort Nelson area were not reported by Horten, otherwise the dominant species were similar.

Jeffrey (1964) terms this association, on the Liard River in the Northwest Territories, a "White spruce - white birch forest" which for all practical purposes is identical to the Floodplain (Young Terrace) White Spruce association of the Fort Nelson area. Growth of Picea glauca is, however, poorer in the Northwest Territories where height growth averages about 24.4m at an age of 120 years. Jeffrey (1964) reported that soil frost was common in the alluvial regosols of the low terraces along the Liard which probably is a major factor contributing to the poorer growth. Soil frost was also encountered on one of the Tetsa River plots (no. 22) at a depth of 39-45 cm and here too, tree growth is poor.

Valentine (1971) reports that in certain places the subsoil is frozen below 64 cm in some alluvial sites in the Fort Nelson area, however, in this study, no frozen soils were encountered, even under dense spruce forests.

The most similar plant association to the Floodplain (Young Terrace) White Spruce in the Sub-Boreal Biogeoclimatic Zone is the previously mentioned Oak fern - Devil's club [Gymnocarpio (dryopteridis) - Oplopanaco (horridi) - Abieto (lasiocarpae) - Piceetum glaucae] described by Revel (1972) and Wali and Krajina (1973). Oplopanax horridus, the most dominant shrub and Gymnocarpium dryopteris, the most dominant herb in the above association, although present, are rarely found in the boreal forest around Fort Nelson and neither is reported by either Horton (1965) for the lower Peace or by Jeffrey (1964) for the lower Liard. Common dominant plants in the shrub layer for the two respective associations are Viburnum edule, Cornus stolonifera, and Ribes lacustre with Cornus canadensis and Rubus pubescens common in the herb layer. The moss layers of the two associations are similar being characterized by the three feather mosses, Hylocomium, Ptilium, and to a lesser extent Pleurozium. However, the rest of the two associations, in general, bear little resemblance in terms of species abundance and composition. Additionally, the Oak fern - Devil's club association occurred

on more mature soils (Brunisols and Podzols) and therefore is not environmentally homologous in respect to the biogeoclimatic zones to the Floodplain White Spruce of the Fort Nelson area.

Soils

All soils examined, except for one Rego Gleysol, were Cumulic Regosols which correspond to the Prophet Series of the Muskwa Terrain System described by Valentine (1971). The texture of the parent material varies considerably from silty clay loams to loamy sands with silty loams being the most common. Generally the coarser materials are at greater depths in the profile. Buried organic horizons are also characteristic throughout the profiles.

The pH of the L-H horizons varied from 6.0 - 6.2 on the samples measured except in plot 22 (pH of 3.7) which had an unusually large organic matter accumulation (possibly from decaying wood) which was probably deposited by the flooding Tetsa River. The pH of the mineral soils are circumneutral varying from 6.2 to 7.9, except for one Ah horizon with a pH of 5.1. The average pH above 20 cm in the profile was 6.8 and for the first horizon below 20 cm, it was 7.3. The base saturation is generally high in the mineral soils, often reach-

ing 100%, especially in horizons with little organic matter. More than half of the mineral soils have a base saturation of 100% at depths greater than 20 cm. Calcium is the dominant cation in the soil, often in quantities exceeding the total C.E.C. Mg and K follow as the next most dominant cations. The quantities of sodium are very low, often not being detected, however, this should not affect vegetation growth since sodium is not known as an essential element.

Chemical analysis of cations and available phosphorus of the mineral soils of alluvial Cumulic Regosols has indicated that they are not strikingly richer nutritionally than the Orthic Gray Luvisols of the uplands in Aspen - White Spruce ecosystems. A major exception to this statement is that the regosols lack a strongly leached, nutrient impoverished, Ae horizon which is characteristic of luvisols. If the exchangeable cations are compared between the luvisolic Bt, which usually begins at a depth of 15 cm, and the Ck of the regosols below a depth of 20 cm, there are no notable differences except that the luvisols contain more exchangeable K. The pH of the regosols is, however, consistently much higher (7.3 vs 5.2 for the luvisols) as is the base saturation. Probably the largest factor contributing to the richness of the alluvial sites as reflected by tree growth, is the high water table which could contain a more or less continuous

supply of nutrients. This continuity of nutrient supply, even though not in high amounts, would reflect in vegetative growth even though it is not reflected in normal chemical analysis.

It should be noted that no LFH horizons were sampled along the Fort Nelson River due to the floods which obliterated this horizon in 1971 and that the Tetsa and Muskwa River samples may not be representative of the Fort Nelson LFH horizons. However, the samples taken are comparable to the one described by Valentine (1971).

PLANT ASSOCIATION 3

LODGEPOLE PINE - CLUBMOSS

Pleurozio (schreberi) - Hylocomio (splendentis) -
Lycopodio (annotini) - Ledo (groenlandici) -
Piceo (glaucae-marianae) - Pinetum contortae

Characteristic Combination of Species

Layer	Constants (presence > 60%) * characteristic	Characteristic non - constants > II
Tree	Pinus contorta	
	Populus tremuloides	
	Betula resinifera	
	Picea glauca	
	Picea mariana	
Shrub	Salix bebbiana*	
	Salix scouleriana*	
	Ledum groenlandicum	
	Viburnum edule	
	Rosa acicularis	
	Shepherdia canadensis	
Herb	Cornus canadensis	
	Vaccinium vitis-idaea	
	Epilobium angustifolium	
	Lycopodium annotinum*	
	Elymus innovatus*	
	Linnaea borealis	
	Lathyrus ochroleucus*	
	Pyrola secunda	
	Maianthemum canadense*	
	Equisetum sylvaticum	
	Viola renifolia	
	Lycopodium complanatum*	
	Pyrola asarifolia	
	Equisetum arvense	
	Galium boreale	
	Equisetum pratense	
	Geocaulon lividum	
Moss	Hylocomium splendens	
	Pleurozium schreberi	
	Peltigera aphthosa	

Table 12

LODGEPOLE PINE - CLUBMOSS

Hylocomio (splendentis) - Pleurozio (schreberi) - Lycopodio (annotini) - Vaccinio (vitis-idaea) - Ledo (groenlandici) - Pinetum contortae

Plot No.	35	55	41	42	43
Elevation M	580	500	530	520	530
Latitude	58°53'	58°41'	58°21'	58°20'	58°21'
Longitude	123°	122°41'	122°49'	122°49'	122°49'
Exposure	N	N	-	N.E.	S
Slope Gradient %	5	1	0	5	5
Percent coverage					
Total A	62	39	23	27	50
A_1	22	20	15	20	16
A_2	28	15	8	5	26
A_3	21	10	4	10	10
Total B	48	58	23	90	30
B_1	33	25	7	20	18
B_2	24	39	20	85	25
C	78	60	55	32	75
Dh	40	70	78	84	89
Dw	5	5	12	8	5
Plot Coverage %					
Litter	82	85	80	85	85
Decaying Wood	10	7	16	11	10
Mineral Soil	-	-	-	-	-
Rock	-	-	-	-	-
Hygrotope	Mesic - Subhygric				
Trophotope	Submesotrophic - Mesotrophic				
Parent material	Morainal Aeolian (?)				

Table 13

LODGEPOLE PINE - CLUBMOSS

BOREAL WHITE & BLACK SPRUCE ZONE

ST NO.	SPECIES	SPECIES SIGNIFICANCE AND VIGOR																				P	MS	RS
	PLOT NUMBER	035	055	041	042	043																		
A1																								
1	PINUS CONTORTA	5.2	3.2	5.2	4.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.0	3-5
2	POPULUS TREMULOIDES	2.2	5.2	.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	3.8	2-5
3	PICEA GLAUCA	.	.	.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.5	3-3
A2																								
	PINUS CONTORTA	5.2	5.2	4.2	5.2	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.2	4-5
4	BETULA RESINIFERA	1.2	.	.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.7	1-3
	POPULUS TREMULOIDES	1.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.7	1-3
5	POPULUS BALSAMIFERA	.	.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.5	3-3
A3																								
	PINUS CONTORTA	5.2	4.2	3.1	4.1	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.7	3-5
	PICEA GLAUCA	.	.	3.2	.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	3.0	3-4
	BETULA RESINIFERA	4.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.5	1-4
	POPULUS TREMULOIDES	1.+	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.8	1-1
6	PICEA MARIANA	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
B1																								
7	SALIX BEBBIANA	.	5.2	3.2	3.2	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	4.2	3-5
8	SALIX SCOULERIANA	+.2	.	4.2	3.2	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	3.5	+-4
	PICEA MARIANA	1.2	5.2	.	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	4.4	1-5
	PICEA GLAUCA	1.2	.	3.2	.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	2.4	1-3
	BETULA RESINIFERA	1.2	+.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.8	+-3
9	ALNUS CRISPA	6.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	4.2	3-6
	POPULUS TREMULOIDES	.	.	.	2.2	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.6	2-4
B2																								
10	LEDUM GROENLANDICUM	5.2	4.2	5.2	9.2	5.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	6.5	4-9
	POPULUS TREMULOIDES	3.2	1.2	4.2	1.2	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.3	1-4
11	VIBURNUM EDULE	4.2	1.2	3.1	2.1	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.2	1-4
12	ROSA ACICULARIS	3.2	1.2	3.1	+.1	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.0	+-3
	PICEA MARIANA	1.2	6.2	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	4.4	1-6
13	SHEPHERDIA CANADENSIS	.	1.2	.	1.2	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.9	1-3
	ALNUS CRISPA	3.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.3	3-3
	PICEA GLAUCA	.	.	3.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.6	+-3
	SALIX BEBBIANA	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	2.4	4-4
14	SALIX NOVAE-ANGLIAE	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
15	VACCINIUM MYRTILLOIDES	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
16	ABIES LASIOCARPA	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
17	BETULA GLANDULOSA	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
	BETULA RESINIFERA	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
18	RIBES TRISTE	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	SALIX SCOULERIANA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
C																								
19	CORNUS CANADENSIS	6.2	6.2	4.3	5.2	6.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.8	4-6
20	VACCINIUM VITIS-IDAEA	6.2	4.2	5.2	5.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.3	4-6
21	EPILOBIUM ANGUSTIFOLIUM	4.2	2.2	4.2	3.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.7	2-4

Table 14

PLOT NUMBER		035	055	041	042	043																							
ST	NO.	SPECIES	SPECIES SIGNIFICANCE AND VIGOR																								P	MS	RS
	22	LYCOPODIUM ANNOTINUM	4.2	4.2	3.2	2.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.7	2-4
	23	ELYMUS INNOVATUS	.	2.1	5.1	3.1	7.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	5.1	2-7
	24	LINNAEA BOREALIS	5.2	3.2	1.1	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	3.8	1-5
	25	LATHYRUS OCHROLEUCUS	.	3.2	3.2	2.1	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	3.0	2-3
	26	PYROLA SECUNDA	1.2	3.2	+.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	1.8	+-3
	27	MAIANTHEMUM CANADENSE	1.2	1.2	+.2	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	1.2	+-1
	28	EQUISETUM SYLVATICUM	+.2	+.1	1.1	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.7	+-1
	29	VIOLA RENIFOLIA	+.2	+.2	+.2	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
	30	LYCOPODIUM COMPLANATUM	4.2	.	1.2	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	3.0	1-4
	31	PYROLA ASARIFOLIA	2.2	3.2	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	2.0	+-3
	32	EQUISETUM ARVENSE	.	.	2.1	2.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.4	+-2
	33	GALIUM BOREALE	.	.	2.2	1.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.2	+-2
	34	EQUISETUM PRATENSE	.	.	+.2	2.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.1	+-2
	35	GEOCAULON LIVIDUM	+.	+.2	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
	36	PETASITES PALMATUS	3.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.3	3-3
	37	RUBUS PUBESCENS	3.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.7	1-3
	38	MITELLA NUDA	1.2	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
	39	VICIA AMERICANA	.	.	.	+.1	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
	40	HABENARIA ORBICULATA	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
	41	GOODYERA REPENS	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
	42	LYCOPODIUM OBSCURUM	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
	43	CALAMAGROSTIS CANADENSIS	+.+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	44	EQUISETUM SCIRPOIDES	.	.	.	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	45	FRAGARIA VIRGINIANA	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	46	HABENARIA OBTUSATA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	47	LISTERA CORDATA	.	+.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	48	MERTENSIA PANICULATA	.	.	.	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	49	PYROLA CHLORANTHA	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
DH																													
	50	HYLOCOMIUM SPLENDENS	5.	8.	5.	9.	8.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	7.5	5-9
	51	PLEUROZIUM SCHREBERI	5.	3.	8.	2.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.5	2-8
	52	PELTIGERA APHTHOSA	.	3.	3.	4.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	3.7	3-4
	53	PTILIUM CRISTA-CASTRENSIS	4.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	3.2	4-4
	54	PELTIGERA CANINA	.	.	.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	2.4	4-4
	55	PELTIGERA MALACEA	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
	56	CERATODON PURPUREUS	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	57	CLADONIA MULTIFORMIS	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	58	LEPTOBRYUM PYRIFORME	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	59	POHLIA NUTANS	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	60	POLYTRICHUM JUNIPERINUM	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
DW																													
		HYLOCOMIUM SPLENDENS	3.	3.	3.	4.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.7	3-4
		PLEUROZIUM SCHREBERI	3.	2.	4.	2.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.4	2-4
		PTILIUM CRISTA-CASTRENSIS	2.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.2	1-2
		PELTIGERA CANINA	.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
	61	CLADONIA OCHROCHLORA	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+

Table 14 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 35 GLEYED ORTHIC GRAY LUVISOL — BUCKINGHORSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
35- 1	LFH	007-000	4.5	87.9	51.00	0.81	63.0	116	26.25	5.75	0.0	3.37	134.00	26.5						
35- 2	AE	000-005	4.4	1.2	0.72	0.06	12.0	006	2.00	0.15	0.0	0.15	12.60	18.3	10YR72	10YR62				
35- 3	AEGJ	005-029	4.5	1.3	0.77	0.08	9.6	004	2.75	0.97	0.02	0.22	9.10	43.7	10YR72	10YR54	36	38	25	L
35- 5	BTGJ	029-061	4.2	1.0	0.56	0.07	8.0	009	3.50	1.60	0.05	0.25	9.80	55.1	10YR61	10YR42	28	32	39	CL
35- 7	BCG	061-068	4.3	1.1	0.63	0.07	9.0	006	7.00	3.42	0.07	0.30	12.60	85.7	10YR52	10YR32	19	37	42	C

PLOT 55 ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
55- 1	LFH	007-000	5.3	89.0	51.60	1.25	41.3	134	32.50	7.87	0.0	4.00	94.00	47.3						
55- 2	AE	000-020	4.8	0.9	0.51	0.05	10.2	018	2.00	0.50	0.0	0.10	12.60	20.6	10YR71	10YR61	47	45	7	L
55- 3	BT	020-070	4.8	0.9	0.50	0.06	8.3	004	6.00	2.85	0.03	0.27	13.40	68.3	10YR73	10YR54	22	43	34	CL
55- 4	CG	070- +	4.9	0.9	0.53	0.05	10.6	021	8.25	5.42	0.10	0.32	15.70	89.8	10YR63	10YR42	10	42	47	SIC

PLOT 41 GLEYED ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
41- 1	LFH	007-000	4.8	91.0	52.80	0.74	71.4	50	23.75	5.50	0.0	3.37	66.00	49.6						
41- 2	AE	000-011	4.8	3.5	2.05	0.13	15.8	021	6.75	2.02	0.03	0.45	13.60	68.0	10YR61	10YR42	12	55	32	SICL
41- 3	BTGJ	011-052	4.6	0.9	0.54	0.06	9.0	006	8.50	3.85	0.07	0.52	14.70	88.1	10YR62	10YR53	3	29	67	HC
41- 4	CG	052- +	4.5	0.9	0.50	0.05	10.0	018	10.00	4.50	0.10	0.45	14.20	100.0	10YR62	10YR42	8	29	62	HC

PLOT 42 GLEYED ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

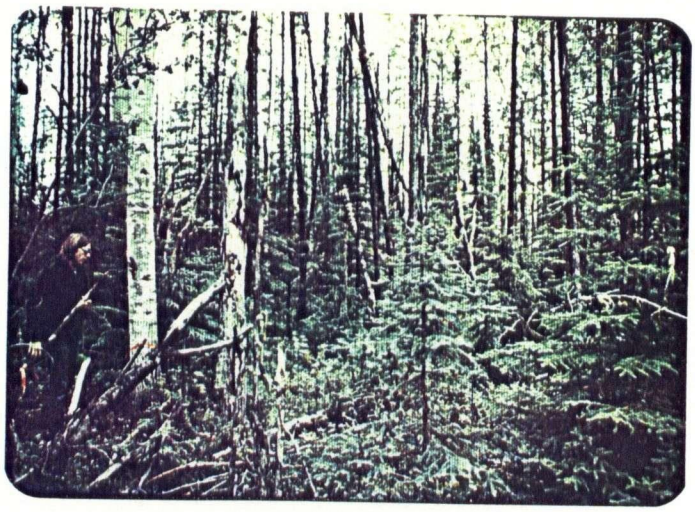
SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
42- 1	LFH	007-000	5.3	90.0	52.20	0.99	52.7	068	31.25	11.75	0.0	2.75	93.00	49.5						
42- 2	AHE	000-009	4.2	3.3	1.93	0.12	16.1	022	4.25	2.07	0.03	0.40	14.00	48.2	10YR72	10YR53	10	55	33	SICL
42- 3	BT	009-061	4.8	1.1	0.63	0.05	12.6	051	8.00	3.12	0.03	0.47	14.20	81.9	10YR63	10YR53	0	36	63	HC
42- 4	CGJ	061- +	5.0	1.3	0.74	0.08	9.3	021	12.50	4.55	0.07	0.45	12.60	100.0	10YR53	10YR42	3	35	62	HC

PLOT 43 GLEYED ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
43- 1	LFH	018-000	5.6	92.1	53.40	1.26	42.4	070	32.50	8.25	0.0	3.75	117.00	38.1						
43- 2	AHE	000-018	4.8	4.1	2.39	0.13	18.4	010	7.75	2.75	0.03	0.67	13.50	83.0	10YR62	10YR42	4	44	51	SIC
43- 3	BT	018-038	4.7	1.1	0.62	0.10	6.2	007	11.00	4.27	0.07	0.50	13.80	100.0	10YR62	10YR43	1	23	75	HC
43- 5	BTGJ	038-073																		
43- 4	CKGJ	073- +	7.7	1.4	0.81	0.08	10.1	021	16.25	3.40	0.07	0.30	15.50	100.0	10YR62	10YR32	18	44	37	SICL*

Table 15

Lodgepole Pine - Clubmoss



Figs. 23 & 24 Black spruce in the understory. Plot 42 has an exceptionally heavy cover of Ledum groenlandicum.



Lodgepole Pine - Clubmoss



Fig. 25 Photograph shows a variation of the Lodgepole Pine - Clubmoss association which bears a resemblance to the Aspen - White Spruce association.

Plant Association 3

Lodgepole Pine - Clubmoss

Pleurozio (schreberi) - Hylocomio (splendentis) - Lycopodio (annotini) - Ledo (groenlandici) - Piceo (glaucae - marianae) - Pinetum contortae

The Lodgepole Pine - Clubmoss association is found on very fine textured or heavy soils which show mottling at depth (mesic to subhygric hygrotopes). This indicates high water table conditions for parts of the year and poor drainage even though these ecosystems are generally found in neutral to shedding positions on the landscape. This association is rather uncommon in the area and appears to develop only where soils are very fine textured, usually non-calcareous (derived mostly from shales) and strongly acid (moderately acid up to very strongly acid). However, they are rated still as luvisols, even if they are acid, judging by the latest edition of the SSCC (The System of Soil Classification for Canada, 1976).

This ecosystem shows characteristics of both the order Piceetalia glaucae and the order Piceetalia marianae. It is in this association that Pinus contorta has the highest

wood volumes per hectare of naturally occurring stands of the study area.

Vegetation

All vegetation layers are fairly well developed in the Lodgepole Pine - Clubmoss association. The tree layer is characterized by Pinus contorta in the A_1 layer with a mean significance of 5.0 often with Populus tremuloides and the occasional Picea glauca sharing a dominant position. Pinus contorta is the dominant tree in the A_2 and A_3 layers in all communities sampled. It is interesting to note that Betula resinifera, which is commonly found in the A_2, A_3 and B_1 layers of this association, is rarely present in the Alluvial White Spruce or Aspen - White Spruce associations where Betula papyrifera is the common birch. This indicates that these two species are ecologically very distinct. Salix bebbiana and Salix scouleriana are dominant shrubs in the B_1 layer with mean species significances of 4.2 and 3.5 respectively. Additionally, Picea mariana becomes a dominant species in the upper shrub layer (plots 35, 55, 42) and this fact, along with its presence in the lower shrub layer, indicates that it will become part of the climax stand. In two other plots (41, 43), characterized by the higher species significance of Elymus innovatus, it appears that white spruce may become

a sub-climax tree.

The lower shrub layer is dominated by Ledum groenlandicum with a mean species significance of 6.5 in the communities studied. Ledum groenlandicum is frequently established on the decaying wood of conifers which remains after fire. This species is undoubtedly characteristic of the order Piceetalia marianae. Many species in the lower shrub layer such as Populus tremuloides and Viburnum edule, which were present in all plots, are characteristic of the Piceetalia glaucae. All of the Populus tremuloides present in the lower shrub layer arose as suckers from the roots of aspen in the overstory and showed poor form and vigor. One such aspen sucker was 20 meters from the nearest aspen tree which indicates the possible length of the roots of Populus tremuloides. In addition to the above species, Rosa acicularis was present in all plots of this plant association with an average species significance of 3.0. Rosa acicularis is characteristic of the boreal white and black spruce zone.

Cornus canadensis, Vaccinium vitis-idaea, Epilobium angustifolium, and Lycopodium annotinum, which were present in all stands studied, dominated the herb layer, with the first two species having high significance values of 5.8 and

5.3 respectively. Elymus innovatus was present in four of the five communities studied. This species is usually characteristic of dry upland woods (Raup, 1935) or dry sandy areas (Moss, 1953). According to this study, Elymus innovatus requires sandy loams to silty loams. However, Moss does mention that Elymus innovatus was a leading species under lodgepole pine growing on "fairly heavy soil" which would resemble Fort Nelson conditions. Linnaea borealis, Lathyrus ochroleucus, Pyrola secunda, Maianthemum canadense, Equisetum sylvaticum, and Viola renifolia are all present on 80% of the stands sampled. However, only Linnaea borealis, established on mor humus, and Lathyrus ochroleucus, characteristic for loams, had high species significance values (3.8 and 3.0 respectively). Although Lycopodium complanatum was only present in 3 of the 5 plots, it sometimes occupies a considerable part of the herb layer. Hylocomium splendens, with a significance value of 7.9 and Pleurozium schreberi, with a value of 5.5, were the only two mosses present 100% of the time. Peltigera aphthosa, which was present in 80% of the sample plots, was the only lichen with a high mean significance value (3.7).

The analyses indicate that the Lodgepole Pine - Clubmoss plant association belongs in the Piceetalia glaucae, however, its relationship to the Piceetalia Marianae, even if

more remote, is still recognizable.

Soils

Soils examined in this association were mostly Gleyed Orthic Gray Luvisols which develop mainly from clay parent materials and only exceptionally from a silty clay loam (plot 43). These soils had the finest textures of the entire study with "heavy clays" being common in the profile. The average clay content of the B_t and C_g horizons are 56 and 50% respectively. Valentine (1971) has not described this particular soil type in his report. However, the Fort Nelson series, which is an Orthic Gray Wooded, is somewhat similar but this series is not as fine textured and supports Aspen - White Spruce communities. Valentine mentions that clay accumulation restricts drainage and that the upper part of the B_t is mottled in the Fort Nelson series. This mottling was present in the B_t horizons of the soils examined in this association with one plot having mottling even in the A_e horizon. All the soils examined occurred in neutral to shedding positions which indicate that the poor internal drainage of the soils is due mostly to the fine texture of the clays, which keeps the soil saturated for a good part of the year. Later in the summer, the upper parts of these soils dry out considerably which could account for the high presence of such

species as Elymus innovatus and Shepherdia canadensis which are well adapted for dry soils. It could be expected, that some of these soils derived from aeolian deposits (mostly clay and silt).

These Gleyed Orthic Gray Luvisols generally had a much lower pH throughout the solum than the Orthic Gray Luvisols of the Aspen - White Spruce association. Amounts of exchangeable Ca and Mg were very similar in the mineral soils. However, the LFH of the Aspen - White Spruce luvisols contained much more exchangeable Ca than did the LFH of the Lodgepole Pine - Clubmoss. Evidently, parent materials of the latter community are mostly from non-calcareous shales. The large amount of Pinus contorta in the tree layer is promoted by non-calcareous soils, especially when they dry out in the uppermost layer. Lodgepole pine also produces litter characteristically acid and low in calcium.

ORDER II

Piceetalia marianae Annas et Krajina (Piceetalia glaucae-marianae Krajina 1969 p.p.)

The order Piceetalia marianae has the most widespread occurrence of any order in the study area. When the Piceetalia marianae are projected on the edatopic grid, they occupy hygrotopes from xeric to subhydric and trophotopes mostly from oligotrophic to mesotrophic. Soils of the Piceetalia marianae are generally poor, due either to low nutrient status of the parent material, or to poor drainage. Mineral soils of the order are mostly Degraded Dystric Brunisols and Luvisols (generally from non-calcareous parent materials) and their gleyed versions. Organic soils are generally Fibrisols and Mesisols. The order consists of four alliances and five associations. Two alliances, the Cladino (mitis) - Pinion contortae (- banksianae) and the Pleurozio (schreberi) - Piceion marianae, occupy mineral soils, with the remaining two alliances occurring mostly on organic soils.

Vegetation of the Piceetalia marianae is characterized by the following order character species:

Picea mariana	Empetrum nigrum
Pinus contorta	Carex loliacea
Ledum groenlandicum	Pleurozium schreberi
Vaccinium vitis-idaea	Barbilophozia barbata
Geocaulon lividum	Peltigera aphthosa
Oxycoccus microcarpus	Peltigera malacea

Alliance 2 Cladino (mitis) - Pinion contortae (- banksianae) Annas et Krajina is closely related to a similar alliance characteristic of the Sub-Boreal Zone. This similar (but distinct) Sub-Boreal alliance was first termed as the Cladonio (gracilis) - Pinion contortae Revel et Krajina 1972, and as the Pinion contortae Wali et Krajina 1973 but should rather be termed as the Cladonio (gracilis) - Vaccinio (myrtilloidis) - Pinion contortae.

This alliance contains only one plant association, which develops on xeric to subxeric sites. Therefore, its vegetation and environment characteristics are identical with those of the plant association which follows.

PLANT ASSOCIATION 4

LODGEPOLE PINE - KINNIKINNICK - LICHEN

Cladino (mitis) - Peltigero (aphthosae) -
Pleurozio (schreberi) - Arctostaphylo
(uvae-ursi) - Pinetum contortae

Characteristic Combination of Species

Layer	Constants (presence > 60%) * characteristic	Characteristic non - constants > II
Tree	Pinus contorta	
	Populus tremuloides	
	Pinus banksiana *	
	Picea mariana	
	Picea glauca	
Shrub	Alnus crispa	
	Rosa acicularis	
	Ledum groenlandicum	
	Shepherdia canadensis	
	Viburnum edule	
	Vaccinium myrtilloides *	
Herb	Vaccinium vitis-idaea *	Lycopodium obscurum
	Arctostaphylos uva-ursi *	
	Linnaea borealis	
	Cornus canadensis	
	Geocaulon lividum	
	Epilobium angustifolium	
	Pyrola asarifolia	
	Equisetum arvense	
	Pyrola secunda	
	Maianthemum canadense	
	Pyrola chlorantha	
Moss	Cladina mitis *	Ceratodon purpureus
	Pleurozium schreberi	Cladonia fimbriata
	Hylocomium splendens	
	Cladina alpestris *	
	Cladonia gracilis *	
	Cladonia uncialis	
	Cladina rangiferina *	
	Peltigera aphthosa	
	Peltigera canina *	
	Polytrichum juniperinum *	
	Cladina arbuscula	
	Cephaloziella divaricata *	
	Cetraria nivalis *	
	Dicranum polysetum *	
	Pohlia nutans	
	Ptilidium pulcherrimum *	

Table 16

LODGEPOLE PINE - KINNIKINNICK - LICHEN

Cladino (mitis) - Peltigero (aphthosae) -

Pleurozio (schreberi) - Arctostaphylo

(uvae-ursi) - Pinetum contortae

Plot No.	12	59	81	82	92
Elevation in M	420	425	435	440	440
Latitude	59 53'	58 40'	58 40'	58 40'	58 39'
Longitude	122 00'	122 42'	122 43'	122 42'	122 42'
Exposure	-	-	-	-	-
Slope Gradient %	0	0	0	0	0
Percent coverage					
Total A	65	27	37	42	28
A_1	35	11	30	16	15
A_2	20	15	10	15	10
A_3	35	10	12	15	8
Total B	65	9	50	13	12
B_1	35	6	20	5	10
B_2	40	6	35	9	7
C	85	39	64	20	40
Dh	3	55	11	80	86
Dw	15	5	-	-	-
Plot Coverage %					
Litter	80	80	82	93	96
Decaying Wood	15	7	3	2	-
Mineral Soil	-	-	-	-	-
Rock	-	-	-	-	-
Hygrotope	Xeric		-	Subxeric	
Trophotope	Oligotrophic		-	Submesotrophic	
Parent Material	Fluvial			aeolian ?	

Table 17

LODGEPOLE PINE - KINNIKINNICK - LICHEN

BOREAL WHITE & BLACK SPRUCE ZONE

ST NO.	SPECIES	PLOT NUMBER 012	059	081	082	092	P	MS	RS
A1									
1	PINUS CONTORTA	.	5.2	4.2	5.2	5.2	80.0	5.1	4-5
2	PINUS BANKSIANA	6.2	.	.	.	.	20.0	4.1	6-6
3	POPULUS TREMULOIDES	.	.	5.2	.	.	20.0	3.4	5-5
A2									
	PINUS CONTORTA	3.2	5.2	4.2	5.2	4.2	100.0	5.0	3-5
	POPULUS TREMULOIDES	3.2	.	4.2	2.2	4.2	80.0	3.6	2-4
	PINUS BANKSIANA	.	.	.	1.2	1.2	40.0	+.8	1-1
4	PICEA GLAUCA	2.2	.	.	.	.	20.0	1.0	2-2
5	PICEA MARIANA	1.2	.	.	.	.	20.0	+.2	1-1
A3									
	PICEA MARIANA	1.1	3.2	4.2	4.2	2.2	100.0	3.6	1-4
	PINUS CONTORTA	.	4.2	1.1	4.2	2.2	80.0	3.4	1-4
	POPULUS TREMULOIDES	4.1	.	2.1	.	2.2	60.0	2.5	2-4
	PICEA GLAUCA	2.2	.	+.2	.	4.2	60.0	2.6	+-4
B1									
	PICEA MARIANA	+.1	3.2	4.2	4.2	2.2	100.0	3.6	+-4
	PICEA GLAUCA	2.2	.	3.2	.	2.2	60.0	2.2	2-3
6	ALNUS CRISPA	1.2	2.2	.	.	3.2	60.0	2.1	1-3
7	SALIX BEBBIANA	.	.	4.2	.	.	20.0	2.4	4-4
8	BETULA RESINIFERA	.	.	1.2	.	.	20.0	+.2	1-1
	PINUS CONTORTA	.	.	.	.	1.2	20.0	+.2	1-1
9	SALIX SCOULERIANA	.	.	1.2	.	.	20.0	+.2	1-1
	POPULUS TREMULOIDES	+.1	.	.	.	.	20.0	+.0	+-+
10	SALIX GLAUCA	+.1	.	.	.	.	20.0	+.0	+-+
B2									
11	ROSA ACICULARIS	4.1	4.1	4.1	3.2	3.2	100.0	4.1	3-4
12	LEDUM GROENLANDICUM	2.2	1.2	3.2	4.2	1.2	100.0	3.2	1-4
	PICEA MARIANA	3.1	3.2	2.2	4.2	.	80.0	3.3	2-4
13	SHEPHERDIA CANADENSIS	5.2	.	5.2	.	1.2	60.0	4.4	1-5
	PICEA GLAUCA	.	.	2.2	+.2	2.2	60.0	1.4	+-2
14	VIBURNUM EDULE	1.1	.	.	2.2	1.1	60.0	1.4	1-2
15	VACCINIUM MYRTILLOIDES	.	2.2	+.2	+.2	.	60.0	1.1	+-2
	POPULUS TREMULOIDES	.	.	1.1	+.2	1.1	60.0	1.0	+-1
	PINUS CONTORTA	.	.	2.2	.	2.1	40.0	1.4	2-2
	ALNUS CRISPA	4.2	.	.	.	.	20.0	2.4	4-4
16	AMELANCHIER ALNIFOLIA	.	1.2	.	.	.	20.0	+.2	1-1
	SALIX SCOULERIANA	.	.	1.2	.	.	20.0	+.2	1-1
17	POTENTILLA FRUTICOSA	+.1	.	.	.	.	20.0	+.0	+-+
	SALIX BEBBIANA	.	.	+.2	.	.	20.0	+.0	+-+
18	SALIX PYRIFOLIA	+.1	.	.	.	.	20.0	+.0	+-+
C									
19	VACCINIUM VITIS-IDAEA	4.2	5.2	7.2	4.2	3.2	100.0	5.3	3-7
20	ARCTOSTAPHYLOS UVA-URSI	3.2	4.2	4.2	4.2	6.2	100.0	5.0	3-6

Table 18

LODGEPOLE PINE - KINNIKINNICK - LICHEN

BOREAL WHITE & BLACK SPRUCE ZONE
PAGE 2

ST NO.	SPECIES	012	059	081	082	092															P	MS	RS
	PLOT NUMBER / SPECIES SIGNIFICANCE AND VIGOR																						
21	LINNAEA BOREALIS	6.2	1.2	2.2	3.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.4	1-6
22	CORNUS CANADENSIS	2.1	+.2	5.2	4.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.2	+-5
23	GEOCAULON LIVIDUM	3.2	+.2	3.2	1.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.7	+-3
24	EPILOBIUM ANGUSTIFOLIUM	+.1	1.1	3.2	2.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.1	+-3
25	PYROLA ASARIFOLIA	.	4.2	+.	+.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	2.5	+-4
26	EQUISETUM ARVENSE	.	+.2	4.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	2.4	+-4
27	PYROLA SECUNDA	2.2	.	+.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.2	+-2
28	MAIANTHEMUM CANADENSE	.	1.2	1.2	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.1	1-1
29	PYROLA CHLORANTHA	.	1.2	.	1.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.0	+-1
30	LYCOPODIUM OBSCURUM	.	4.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	3.2	4-4
31	LYCOPODIUM COMPLANATUM	.	.	.	2.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.6	2-4
32	PEDICULARIS LABRADORICA	.	.	3.2	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.6	+-3
33	EQUISETUM SCIRPOIDES	.	+.2	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
34	LATHYRUS OCHROLEUCUS	+.1	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
35	ELYMUS INNOVATUS	5.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	3.4	5-5
36	PYROLA GRANDIFLORA	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	2.4	4-4
37	CALAMAGROSTIS CANADENSIS	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
38	MERTENSIA PANICULATA	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
39	ORYZOPSIS PUNGENS	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
DH																							
40	CLADINA MITIS	2.	5.	4.	6.	5.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.3	2-6
41	PLEUROZIUM SCHREBERI	+.	5.	3.	6.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.0	+-6
42	HYLOCOMIUM SPLENDENS	+.	4.	4.	4.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.0	+-4
43	CLADINA ALPESTRIS	+.	4.	+.	3.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.2	+-4
44	CLADONIA GRACILIS	1.	+.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	+.9	+-1
45	CLADONIA UNCIALIS	.	.	+.	+.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	4.3	+-3
46	CLADINA RANGIFERINA	+.	5.	.	4.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	4.3	+-5
47	PELTIGERA APHTHOSA	3.	3.	.	4.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	3.7	3-4
48	PELTIGERA CANINA	+.	+.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
49	CLADINA ARBUSCULA	+.	.	.	+.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.6	+-3
50	CEPHALOZIELLA DIVARICATA	+.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
51	CETRARIA NIVALIS	.	+.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
52	DICRANUM POLYSETUM	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
53	POHLIA NUTANS	+.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
54	POLYTRICHUM JUNIPERINUM	.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
55	PTILIDIUM PULCHERRIMUM	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
56	CERATODON PURPUREUS	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
57	CLADONIA FIMBRIATA	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
58	DICRANUM UNDULATUM	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
59	DREPANOCLADUS UNCINATUS	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
60	PELTIGERA POLYDACTYLA	.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
61	BARBILOPHOZIA BARBATA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
62	BRACHYTHECIUM ALBICANS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
63	CAMPYLIUM HISPIDULUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
64	CETRARIA CUCULLATA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
65	CETRARIA ERICETORUM	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
66	CETRARIA ISLANDICA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
67	CLADONIA AMAUROCRAEA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
68	CLADONIA BACILLARIS	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+

Table 18 (continued)

PLOT NUMBER	012	059	081	082	092																P	MS	RS
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																						
69 CLADONIA CHLOROPHAEA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
70 CLADONIA COCCIFERA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
71 CLADONIA CORNUTA	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
72 CLADONIA CRISPATA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
73 CLADONIA MULTIFORMIS	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
74 CLADONIA PLEUROTA	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
75 DICRANUM ACUTIFOLIUM	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
76 DICRANUM FUSCESCENS	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
77 PELTIGERA MALACEA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
78 POLYTRICHUM STRICTUM	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
79 PTILIDIUM CILIARE	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
80 STEREOCAULON TOMENTOSUM	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
DW																							
PELTIGERA APHTHOSA	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.C	+-+
PLEUROZIUM SCHREBERI	+.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.E	+-3
HYLOCOMIUM SPLENDENS	1.	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.2	1-2
DICRANUM FUSCESCENS	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.E	1-1
CLADINA MITIS	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
CLADONIA GRACILIS	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
BRACHYTHECIUM ALBICANS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
81 CETRARIA JUNIPERINA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
CETRARIA NIVALIS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
CLADONIA COCCIFERA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
CLADONIA MULTIFORMIS	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
82 CLADONIA NEMOXYNA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
DICRANUM ACUTIFOLIUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
DICRANUM UNDULATUM	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
83 PELTIGERA HORIZONTALIS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
PTILIDIUM PULCHERRIMUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+

Table 18 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 59 DEGRADED DYSTRIC BRUNISOL — CHUATSE TERRAIN SYSTEM — TRAIL — SOIL SERIES

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
59- 1	LFH	001-000	5.0	92.1	53.40	0.79	67.6	84	22.50	4.62	0.0	1.25	68.00	41.9						
59- 2	AE	000-011	4.8	2.0	1.16	0.02	58.0	009	0.50	0.20	0.12	0.05	8.30	8.7	5YR71	5YR51	64	13	22	SCL
59- 3	BM	011-060	5.4	0.2	0.14	0.02	7.0	036	0.50	0.15	0.0	0.07	5.60	12.9	10YR64	7.5YR43	89	3	6	S
59- 4	BC	060-105	6.7	0.1	0.07	0.02	3.5	023	2.00	0.70	0.0	0.07	5.50	50.5	7.5YR54	7.5YR43	88	2	8	S

PLOT 81 DEGRADED DYSTRIC BRUNISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
81- 1	LFH	002-000																		
81-22	AE	000-014	6.0	0.3	0.20	0.02	10.0	015	1.00	0.32	0.0	0.05	3.60	38.2	7.5YR72	7.5YR62	79	14	6	LS
81- 3	BM	014-078	5.5	0.2	0.13	0.02	6.5	035	0.25	0.05	0.0	0.07	4.10	9.1	7.5YR56	7.5YR44				
81- 4	C	078- +	6.3	0.1	0.05	0.01	5.0	014	1.00	0.27	0.0	0.07	5.00	27.0	10YR54	10YR44	21	53	24	SL

PLOT 82 DEGRADED DYSTRIC BRUNISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
82- 1	LFH	002-000																		
82- 2	AE	000-010	4.2	1.5	0.87	0.02	43.5	006	0.75	0.10	0.0	0.02	4.30	20.3	10YR71	10YR51	63	6	29	SCL
82- 3	BM	010-071	6.0			0.01		023	0.75	0.22	0.0	0.10	4.90	21.9	7.5YR58	10YR44				
82- 4	BC	071- +	5.5			0.02		006	1.50	0.65	0.0	0.10	4.80	46.9	10YR64	10YR44	87	2	10	LS

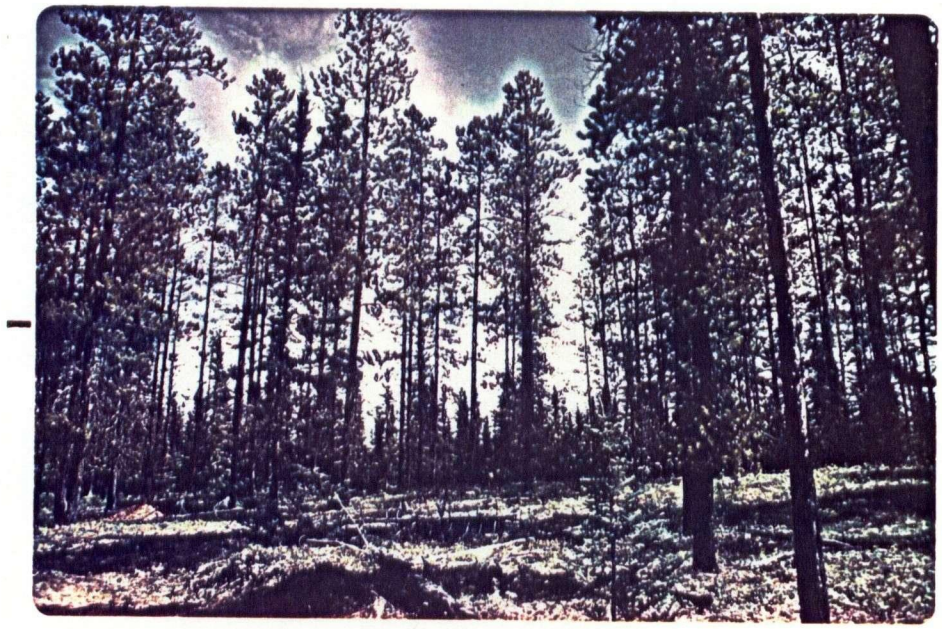
PLOT 92 DEGRADED DYSTRIC BRUNISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
92- 1	LFH	003-000	3.9	87.1	50.50	0.90	56.1	160	11.25	3.12	0.0	2.50	82.00	20.9						
92- 2	AE	000-009	4.4	2.0	1.16	0.01	116.0	006	0.25	0.10	0.03	0.12	8.40	6.0	7.5YR72	7.5YR62	79	9	10	SL
92- 3	BM	009-065	5.4	0.4	0.22	0.03	7.3	043	0.25	0.10	0.03	0.10	6.60	7.2	7.5YR58	7.5YR44	92	3	3	S
92- 5	C	065- +	5.9	0.2	0.09	0.05	1.8	014	4.50	1.62	0.03	0.27	13.90	46.2	10YR54	10YR43	80	1	18	SL

Table 19

Lodgepole Pine - Kinnikinnick Lichen





Figs. 26 & 27 Lodgepole pine growing on dunes south of Fort Nelson between the Fort Nelson and Prophet Rivers. The distinct boundaries between lodgepole pine and black spruce communities can be attributed directly to drainage patterns of the soil.

Lodgepole Pine - Kinnikinnick - Lichen

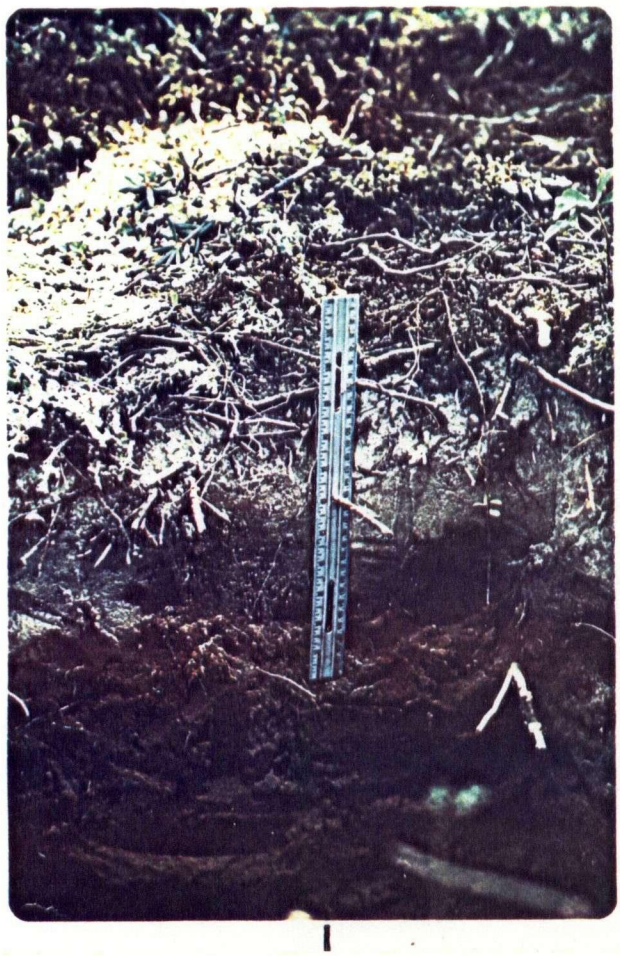


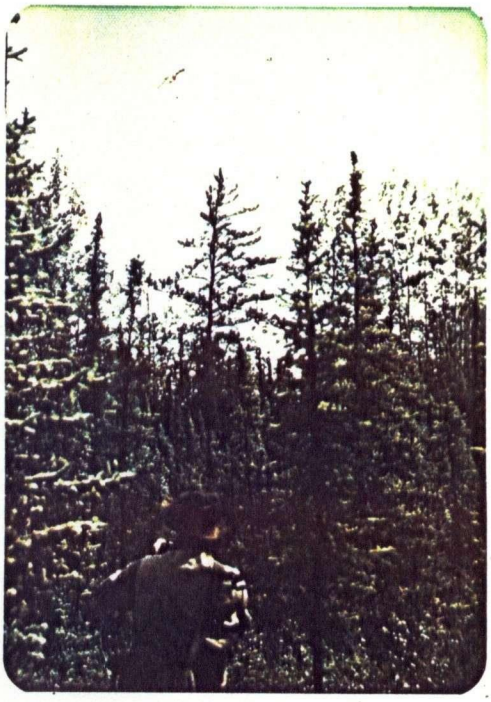
Fig. 28 Arctostaphylos uva-ursi (with red berries) is generally only found in this association. Vaccinium vitis-idaea and Cornus canadensis, both visible above, were also present in all stands sampled.



Fig. 29 Typical vegetation showing scattered Ledum groenlandicum, and Rosa acicularis in the shrub layer. Picea mariana is the most characteristic spruce in the understory, however, P. glauca is frequently present.

Lodgepole Pine - Kinnikinnick - Lichen





Figs. 30 & 31 A degraded Dystric Brunisol typical of sand dunes near Fort Nelson with a very prominent white Ae horizon and reddish Bm horizon. These soils have very thin LH horizons, generally less than 2cm thick. The tree in the centre of the photo on the right shows the characteristic sweeping branches of Pinus banksiana. These trees are on a fluvial deposit near the Petitot River.

Plant Association 4

Lodgepole Pine - Kinnikinnick - Lichen

Cladino (mitis) - Peltigero (aphthosae) - Pleurozio (schreberi) - Arctostaphylo (uvae-ursi) - Pinetum contortae

The Lodgepole Pine - Kinnikinnick - Lichen association, when projected on the edatopic grid, occurs on subxeric to xeric hygrotopes and oligotrophic to submesotrophic trophotopes.

Vegetation

Occasionally Pinus banksiana (jack pine) or a hybrid between Pinus banksiana and Pinus contorta (lodgepole pine) can be found on these sites, however, it generally grows more poorly than lodgepole pine. Moss (1953) reports that Pinus banksiana is the predominant pine east of the study area, along the Mackenzie Highway in Alberta, but that hybrids between lodgepole and jack pine are frequent. Jeffrey (1961a) reported that pure stands of Pinus banksiana occurred on south-facing slopes of Nahanni Butte north of the study area and that occasional occurrences of this species were found

on older floodplains and terraces of the Liard River in the Northwest Territories. In British Columbia, Pinus banksiana is a relatively rare tree, however, its occurrence is fairly common on dry sites on coarse parent material along the Petitot River in N.E. British Columbia (Lat. 59° 50', Long. 122°). It occurs together with Pinus contorta with which it hybridizes. Occasional individual trees were found on sand dunes between the Prophet and Fort Nelson Rivers 15 miles south of Fort Nelson at mile 285 of the Alaska Highway. The hybrids of both species are found here as well. This location is the extreme south western edge of the presently known distribution of Pinus banksiana in British Columbia.

The Lodgepole Pine - Kinnikinnick - Lichen ecosystems are dominated by lodgepole pine in the upper tree layers (A_1 and A_2) generally with poorly growing Populus tremuloides in the A_2 layer. Picea mariana is one of the dominant tree species in the A_3 layer and is characteristically found in the B_1 and B_2 layers. In addition, Picea glauca plays a similar role to Picea mariana, except that its role is usually subordinate to black spruce. This indicates that in the absence of fire the main climax tree species would be Picea mariana, probably along with some Picea glauca. Apart from the spruces, Alnus crispa is the only other

frequent shrub in the upper B layer. Rosa acicularis and Ledum groenlandicum (mainly on decaying wood) are the main species in the low shrub layer, present in all communities sampled. The shrub and tree layers of this association remain open due to the dryness of the site.

Vaccinium vitis-idaea, Arctostaphylos uva-ursi, Linnaea borealis, Cornus canadensis, Geocaulon lividum, and Epilobium angustifolium were present in all communities examined and generally dominated the herb layer. Arctostaphylos uva-ursi (kinnikinnick), which was found only sporadically in one other association (no. 7), was highly developed in the Lodgepole Pine - Kinnikinnick - Lichen association with an average species significance of 5.0.

The best growth of lichens of the entire study occurred in this association, both in terms of dominance and species diversity. Twenty-four species of lichens were found occurring on the humus with Cladina mitis, C. alpestris, C. rangiferina, C. arbuscula, Cladonia gracilis, C. uncialis, and Peltigera aphthosa being dominants. In addition to the lichens, Pleurozium schreberi and Hylocomium splendens are constant dominant mosses. It is noticeable that Ptilium crista-castrensis does not occur here, as the humus is generally too dry.

Raup (1935) has described a similar pine-lichen association from Wood Buffalo Park where Pinus banksiana communities develop on well drained sands. Revel (1972) and Wali and Krajina (1973) have described a lodgepole pine - lichen association [Cladonio (gracilis) - Arctostaphylos (uvae-ursi) - Vaccinio (myrtilloidis) - Pinetum contortae)] for the Sub-Boreal Biogeoclimatic zone which has many similarities to the Lodgepole Pine - Kinnikinnick - Lichen association of the boreal zone. One notable difference between the two respective xeric associations is that in the Sub-Boreal Biogeoclimatic zone, Vaccinium caespitosum and Vaccinium myrtilloides are dominant species while in the Fort Nelson area, Vaccinium vitis-idaea is the dominant Vaccinium with V. myrtilloides playing only a minor role and V. caespitosum being absent. Wali and Krajina (1973) found that lodgepole pine-lichen sites had the highest summer air, and surface soil temperatures of any plant association with forest stands in the sub-boreal zone. Similar relative temperatures can be expected on the xeric sites in the boreal zone as indicated by the vegetation.

Soils

The soils of the Lodgepole Pine - Kinnikinnick - Lichen association are Degraded Dystric Brunisols which

correspond directly to Valentine's Trail Series of the Chuatse Terrain System. These soils have developed on sand deposits which overlie tills or shale bedrock and generally are found near the rim of the plateau where it has been down-cut by the major rivers. Due to limited access, all of the communities sampled were south of Fort Nelson between the Prophet and Fort Nelson Rivers except for plot 12 which was located between the junction of the Petitot River and Fort Simpson Winter Tractor Trail near the North West Territories boundary.

The Degraded Dystric Brunisols of the Lodgepole Pine - Kinnikinnick - Lichen association are the most highly leached soils of the study since they are composed of coarse parent materials in shedding topographic positions which allows for easy movement and loss of water and ions from the soil. These soils are characterized by low cation exchange capacities (C.E.C.) due mainly to the high percentage of sand throughout the profile. Additionally, these soils have very low base saturation which indicate that they are highly leached. To illustrate this point, the average C.E.C. of the Bm horizon was 5.30 milliequivalent per 100 grams of soil (meq/100g) with only a base saturation of 12.8% which indicates an impoverished soil. Equivalent average figures for Bt horizons of Orthic Gray Luvisols of the Aspen - White Spruce association

are a C.E.C. of 16.0 meq/100g and a base saturation of 70.7%. Exchangeable cations in the Bm are therefore, very low when compared to the Bt. Average values of exchangeable cations in meq/100g of the Degraded Dystric Brunisol's Bm are: Ca, .44; Mg, .13; k, .08 which represent only 5.9%, 3.8%, and 19.0% of the respective average values of the Bt of Orthic Gray Luvisols of the mesic Aspen - White Spruce association. Similar trends, though not as visible, are apparent in the other horizons.

Alliance 3 Pleurozio (schreberi) - Piceion marianae Annas et Krajina [this alliance is comparable with the alliance, named Dicrano (polyseti) - Pino (contortae) - Piceion marianae Revel et Krajina 1972, which is still distinct and occurring in the Sub-Boreal Spruce Zone].

Soils of the Pleurozio (schreberi) - Piceion marianae range from Orthic Gray Luvisols (from acid parent materials) to Brunisols, Gleysols and Fibrisols. Vegetation of the alliance is characterized by the following species:

Betula glandulosa	Pleurozium schreberi
Vaccinium membranaceum	Ptilium crista-castrensis
Vaccinium caespitosum	Herzogiella turfacea

Two plant associations belong to the alliance pleurozio (schreberi) - Piceion marianae (plant associations 5 and 6).

PLANT ASSOCIATION 5

BLACK SPRUCE - MOSS

Ptilio (cristae-castrensis) -
Hylocomio (splendentis) - Pleurozio
(schreberi) - Piceetum marianae

Characteristic Combination of Species

Layer	Constants (presence > 60%) * characteristic	Characteristic non - constants > II
Tree	Picea mariana Pinus contorta	
Shrub	Ledum groenlandicum	
Herb	Cornus canadensis Vaccinium vitis-idaea	
Moss	Pleurozium schreberi Hylocomium splendens Ptilium crista-castrensis Peltigera aphthosa	

Table 20

BLACK SPRUCE - MOSS

Ptilio (crista - castrensis) -

Hylocomio (splendentis) - Pleurozio

(schreberi) - Piceetum marianae

Plot No.	1	5	6	9	17	23	36	54	10	18	24	49	79
Elevation in M	660	370	630	400	390	1070	580	500	430	390	1060	480	
Latitude	58° 51'	58° 45'	58° 51'	58° 38'	58° 47'	58° 39'	58° 53'	58° 32'	58° 38'	58° 47'	58° 39'	58° 37'	
Longitude	122° 49'	122° 32'	122° 50'	122° 30'	122° 43'	124° 11'	123° 0 '	122° 41'	122° 40'	122° 42'	124° 11'	122° 40'	
Exposure	NW	W	SW	S	-	S	N	-	N	N	S	-	NE
Slope Gradient %	12	1	2	1	0	8	4	0	1	2	10	0	8
Percent coverage													
Total A	55	65	75	60	60	50	68	80	72	36	60	75	75
A_1	20	60	45	20	11	15	20	20	15	18	12	10	25
A_2	28	20	20	45	40	30	40	50	60	15	40	35	30
A_3	18	3	18	5	20	15	20	20	2	10	25	40	35
Total B	4	-	12	7	8	6	4	13	2	18	6	6	17
B_1	4	-	10	1	5	5	3	11	1	6	5	5	11
B_2	4	-	5	7	5	3	2	3	2	14	2	2	12
C	2	1	20	5	3	13	2	3	14	24	60	2	64
Dh	56	80	85	73	75	78	55	89	89	64	65	76	80
Dw	30	14	8	20	12	10	30	1	5	17	16	10	3
Plot Coverage %													
Litter	86	80	86	75	75	90	65	91	90	74	88	82	81
Decaying Wood	6	16	7	20	7	2	35	1	5	21	2	10	11
Mineral Soil	-	-	-	-	-	-	-	-	-	-	-	-	-
Rock	-	-	-	-	-	-	-	-	-	-	-	-	-
Hygrotope	(Xeric) - subhygric												
Trophotope	Oligotrophic - submesotrophic												
Parent Material	Morainal Lacustrine Fluvial												

Table 21

BLACK SPRUCE - MOSS (PLEUROZIUM-HYLOCOMIUM-PTILIUM)

ST NO.	SPECIES	SPECIES SIGNIFICANCE AND VIGOR																			P	MS	RS
PLOT NUMBER		001	005	006	009	017	023	036	054	010	018	024	049	079									
A1																							
1	PINUS CONTORTA	5.	3.	7.	.	.	3.2	4.2	.	.	5.2	4.2	4.2	5.2	.	.	.	.	.	.	69.2	4.9	3-7
2	PICEA MARIANA	1.	7.	.	4.	.	5.2	5.2	4.2	.	.	3.2	.	3.2	.	.	.	.	.	.	61.5	4.5	1-7
3	PICEA GLAUCA	.	.	.	4.	4.2	.	.	.	4.	2.2	.	3.2	.	.	.	.	.	.	.	38.5	2.9	2-4
4	POPULUS TREMULOIDES	.	4.	.	.	.	.	.	.	1.	1.2	.	3.2	.	.	.	.	.	.	.	30.8	1.9	1-4
5	LARIX LARICINA	.	.	.	.	1.2	.	.	5.2	.	.	.	.	.	.	.	.	.	.	.	15.4	2.2	1-5
6	ABIES LASICCARPA	.	.	.	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	2-2
7	POPULUS BALSAMIFERA	.	.	.	.	.	.	.	.	2.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	2-2
A2																							
	PICEA MARIANA	6.	4.	3.	7.	7.2	6.2	6.2	7.2	8.	5.2	5.2	5.2	.	.	.	.	.	.	.	92.3	6.1	3-8
	PINUS CONTORTA	.	.	5.	.	.	2.2	4.2	.	.	.	6.2	2.2	6.2	.	.	.	.	.	.	46.2	4.2	2-6
	POPULUS TREMULOIDES	.	+.	+.	.	.	.	.	.	.	2.2	.	4.2	.	.	.	.	.	.	.	30.8	1.6	+-4
8	BETULA PAPYRIFERA	.	+.	3.	.	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	23.1	1.0	+-3
	LARIX LARICINA	.	.	.	.	.	.	.	4.2	+.	.	.	.	.	.	.	.	.	.	.	15.4	1.4	+-4
	PICEA GLAUCA	.	.	.	.	2.2	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	15.4	+.3	1-2
	POPULUS BALSAMIFERA	.	+.	.	.	.	.	.	+.1	.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
9	BETULA RESINIFERA	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.8	3-3
	ABIES LASIOCARPA	.	.	.	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	2-2
A3																							
	PICEA MARIANA	4.	5.	5.	3.	5.2	5.2	5.2	5.2	1.	4.2	5.2	6.2	4.2	.	.	.	.	.	.	100.0	5.2	1-6
	PINUS CONTORTA	.	.	.	.	.	1.1	.	.	.	.	4.2	.	5.2	.	.	.	.	.	.	23.1	2.8	1-5
	BETULA PAPYRIFERA	.	.	+.	2.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	23.1	+.2	+-2
	ABIES LASIOCARPA	.	.	.	.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.8	3-3
	BETULA RESINIFERA	.	.	.	.	.	.	.	.	.	.	.	3.	.	.	.	.	.	.	.	7.7	+.8	3-3
	LARIX LARICINA	.	.	.	.	.	.	.	1.0	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	1-1
	PICEA GLAUCA	.	.	.	.	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	1-1
B1																							
	PICEA MARIANA	+.	+.	3.	.	1.2	3.2	3.2	4.1	+.	1.2	4.2	4.2	2.2	.	.	.	.	.	.	92.3	3.2	+-4
10	ALNUS CRISPA	1.	.	2.	+.	.	.	.	.	.	3.2	.	.	.	.	.	.	.	.	.	30.8	1.2	+-3
	ABIES LASIOCARPA	.	.	1.	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.2	1-2
11	SALIX SCOULERIANA	.	.	.	.	.	.	.	.	.	.	.	.	4.2	.	.	.	.	.	.	7.7	1.3	4-4
	PINUS CONTORTA	.	.	.	.	.	.	.	.	.	.	.	.	3.2	.	.	.	.	.	.	7.7	+.8	3-3
12	SALIX BEBBIANA	.	.	.	.	.	.	.	3.1	.	.	.	.	.	.	.	.	.	.	.	7.7	+.8	3-3
13	BETULA GLANDULOSA	.	.	.	.	.	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	2-2
	BETULA RESINIFERA	.	.	.	.	.	.	.	.	.	.	.	2.1	.	.	.	.	.	.	.	7.7	+.0	2-2
	POPULUS TREMULOIDES	.	.	.	.	.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	7.7	+.0	1-1
	PICEA GLAUCA	.	.	.	.	.	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
B2																							
14	LEDUM GROENLANDICUM	1.	.	2.	.	1.2	1.2	+.2	1.2	1.	5.2	1.2	.	4.2	.	.	.	.	.	.	76.9	3.0	+-5
15	ROSA ACICULARIS	.	+.	.	4.	3.2	.	+.1	2.2	1.	1.2	.	.	.	.	.	.	.	.	.	53.8	2.0	+-4
	ABIES LASIOCARPA	3.	.	4.	.	.	2.1	.	.	.	1.2	+.2	.	.	.	.	.	.	.	.	38.5	2.0	+-4
	PICEA MARIANA	.	.	.	.	.	1.1	.	1.1	.	1.2	1.2	.	1.2	.	.	.	.	.	.	38.5	+.8	1-1
16	VIBURNUM EDULE	.	+.	.	+.	1.1	.	.	.	1.	+.2	.	.	.	.	.	.	.	.	.	38.5	+.2	+-1
	ALNUS CRISPA	+.	.	2.	.	.	.	.	.	+.	.	.	.	4.2	.	.	.	.	.	.	30.8	1.0	+-4
	POPULUS TREMULOIDES	.	+.	.	.	.	.	.	.	+.	1.2	.	2.2	.	.	.	.	.	.	.	30.8	+.4	+-2

Table 22

PLOT NUMBER	001	005	006	009	017	023	036	054	010	018	024	049	079									
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																			P	MS	RS
17 VACCINIUM MEMBRANACEUM	.	.	.	.	.	4.2	.	.	.	.	1.2	.	.	.	.	.	.	.	.	15.4	1.4	1-4
18 VACCINIUM CAESPITOSUM	.	.	.	.	.	.	.	.	.	.	2.2	.	+.2	.	.	.	.	.	.	15.4	+.1	+-2
19 VACCINIUM ULIGINOSUM	.	.	.	.	.	.	.	.	.	.	.	.	5.2	.	.	.	.	.	.	7.7	2.2	5-5
SALIX SCOULERIANA	.	.	.	.	.	.	.	.	.	.	.	.	2.2	.	.	.	.	.	.	7.7	+.0	2-2
BETULA GLANDULOSA	.	.	.	.	.	.	.	.	.	.	.	.	1.2	.	.	.	.	.	.	7.7	+.0	1-1
BETULA RESINIFERA	.	.	.	.	.	.	.	.	.	.	.	1.2	.	.	.	.	.	.	.	7.7	+.0	1-1
20 RIBES LACUSTRE	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
21 SALIX NOVAE-ANGLIAE	.	.	.	.	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
22 SHEPHERDIA CANADENSIS	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
C																						
23 CORNUS CANADENSIS	3.	2.	4.2	3.	1.2	4.2	1.2	3.2	4.	4.2	4.2	2.2	4.2	.	.	.	.	.	.	100.0	3.8	1-4
24 VACCINIUM VITIS-IDAEA	2.	.	3.2	+.	1.2	3.2	1.2	2.2	1.	4.2	8.2	.	6.2	.	.	.	.	.	.	84.6	4.7	+-8
25 LINNAEA BOREALIS	.	.	3.2	.	1.2	.	.	.	3.	+.2	.	+.2	+.2	.	.	.	.	.	.	46.2	1.4	+-3
26 GEOCAULON LIVIDUM	.	.	+.	.	+.2	1.2	.	.	.	+.2	3.2	+.2	.	.	.	.	.	.	.	46.2	1.1	+-3
27 PYROLA SECUNDA	.	.	.	+.	.	1.2	.	+.2	.	+.2	.	+.2	1.2	.	.	.	.	.	.	46.2	+.3	+-1
28 EQUISETUM SCIRPOIDES	.	.	.	.	1.2	.	+.2	+.2	1.	+.2	.	.	.	.	.	.	.	.	.	38.5	+.2	+-1
29 LYCOPODIUM ANNOTINUM	.	.	3.	+.	.	1.2	.	.	.	.	.	.	2.2	.	.	.	.	.	.	30.8	1.2	+-3
30 EMPETRUM NIGRUM	.	.	.	.	.	+.2	+.2	.	.	.	1.2	.	1.2	.	.	.	.	.	.	30.8	+.1	+-1
31 HABENARIA ORBICULATA	.	.	.	+.	.	.	.	.	+.	1.2	.	+.2	.	.	.	.	.	.	.	30.8	+.0	+-1
32 EQUISETUM SYLVATICUM	.	+.1	.	+.	.	.	.	+.2	.	.	.	+.2	.	.	.	.	.	.	.	30.8	+.0	+-+
33 GOODYERA REPENS	.	.	.	.	.	.	.	.	+.2	.	+.2	+.2	.	.	.	.	.	.	.	23.1	+.0	+-+
34 PYROLA CHLORANTHA	.	.	.	.	.	.	.	.	+.	+.2	.	+.2	.	.	.	.	.	.	.	23.1	+.0	+-+
35 LYCOPODIUM COMPLANATUM	.	.	2.	.	.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	15.4	+.3	1-2
36 CALAMAGROSTIS CANADENSIS	.	.	.	+.	.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	15.4	+.0	+-1
37 MITELLA NUDA	.	.	.	+.	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-1
38 VIOLA RENIFOLIA	.	.	.	+.	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-1
39 EPILOBIUM ANGUSTIFOLIUM	.	.	.	.	.	.	+.2	.	.	+.2	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
40 LATHYRUS OCHROLEUCUS	.	.	.	.	.	.	+.2	.	+.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
41 MERTENSIA PANICULATA	.	.	.	+.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
42 EQUISETUM ARVENSE	.	.	.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	1-1
43 MAIANTHEMUM CANADENSE	.	.	.	.	.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	7.7	+.0	1-1
44 CORALLORHIZA TRIFIDA	.	.	.	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
45 FRAGARIA VIRGINIANA	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
46 MONESES UNIFLORA	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
47 PETASITES PALMATUS	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
48 PYROLA ASARIFOLIA	.	.	.	.	.	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
49 RUBUS PUBESCENS	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
DH																						
50 PLEUROZIUM SCHREBERI	6.	8.	6.	7.	7.	7.	6.	7.	5.	7.	7.	3.	8.	.	.	.	.	.	.	100.0	7.2	3-8
51 HYLOCOMIUM SPLENDENS	8.	4.	6.	6.	5.	6.	5.	6.	8.	5.	7.	8.	5.	.	.	.	.	.	.	100.0	6.9	4-8
52 PTILIUM CRISTA-CASTRENSIS	4.	5.	6.	7.	4.	4.	5.	5.	4.	4.	4.	3.	4.	.	.	.	.	.	.	100.0	5.2	3-7
53 PELTIGERA APHTHOSA	3.	1.	.	+.	4.	1.	3.	4.	1.	3.	4.	1.	4.	.	.	.	.	.	.	92.3	3.4	+-4
54 PELTIGERA CANINA	.	.	.	.	3.	.	+.	1.	.	.	.	+.	.	.	.	.	.	.	.	30.8	1.0	+-3
55 PELTIGERA MALACEA	.	.	.	.	+.	1.	.	1.	.	.	+.	.	.	.	.	.	.	.	.	30.8	+.1	+-1
56 PTILIDIUM PULCHERRIMUM	.	.	.	+.	.	.	.	.	+.	+.	.	+.	.	.	.	.	.	.	.	30.8	+.0	+-+
57 CLADINA MITIS	.	.	.	.	.	.	+.	.	.	.	+.	.	+.	.	.	.	.	.	.	23.1	+.0	+-+
58 CLADINA RANGIFERINA	+.	.	.	.	+.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	23.1	+.0	+-+
59 DREPANOCLADUS UNCINATUS	.	.	.	.	.	.	.	.	.	.	+.	.	+.	.	.	.	.	.	.	23.1	+.0	+-+

Table 22 (continued)

PLOT NUMBER	001	005	006	009	017	023	036	054	010	018	024	049	079									
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																				P	MS	RS
60 POHLIA NUTANS	.	.	.	.	.	.	.	.	+.	+.	.	.	+.	.	.	.	.	.	.	.	23.1	+.0	+-+
61 PELTIGERA POLYDACTYLA	.	.	.	.	1.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	1-1
62 AULACOMNIUM PALUSTRE	.	.	.	.	.	.	.	.	.	+.	.	.	+.	.	.	.	.	.	.	.	15.4	+.0	+-+
63 DICRANUM ACUTIFOLIUM	.	.	.	.	.	.	.	.	+.	.	.	.	+.	.	.	.	.	.	.	.	15.4	+.0	+-+
64 DICRANUM FUSCESCENS	.	.	.	.	.	.	.	.	+.	.	.	+.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
65 HERZOGIELLA TURFACEA	.	.	.	.	.	.	.	.	+.	.	.	.	+.	.	.	.	.	.	.	.	15.4	+.0	+-+
66 BARBILOPHOZIA HATCHERI	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	7.7	+.0	+-+
67 BARBILOPHOZIA LYCOPODIOIDES	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	7.7	+.0	+-+
68 BRACHYTHECIUM ALBICANS	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
69 BRACHYTHECIUM REFLEXUM	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
70 CAMPYLIUM HISPIDULUM	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
71 CERATODON PURPUREUS	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
72 CLADINA ABERRANS	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
73 CLADINA ARBUSCULA	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	7.7	+.0	+-+
74 CLADONIA BACILLARIS	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
75 CLADONIA CORNUTA	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
76 CLADONIA GRACILIS	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
77 CLADONIA MULTIFORMIS	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
78 DICRANUM UNDULATUM	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
79 JAMESONIELLA AUTUMNALIS	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
80 LOPHOZIA VENTRICOSA	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	7.7	+.0	+-+
81 NEPHROMA ARCTICUM	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	7.7	+.0	+-+
82 NEPHROMA RESUPINATUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
83 POHLIA CRUDA	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
84 POHLIA ELONGATA	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
85 POLYTRICHUM JUNIPERINUM	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
86 TRITOMARIA EXSECTIFORMIS	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	7.7	+.0	+-+
DW																							
PLEUROZIUM SCHREBERI	4.	5.	3.	4.	4.	4.	4.	3.	1.	5.	5.	3.	+.	.	.	.	.	.	.	.	100.0	4.5	+-5
PTILIUM CRISTA-CASTRENSIS	3.	3.	4.	4.	2.	3.	3.	+.	3.	3.	4.	1.	+.	.	.	.	.	.	.	.	100.0	3.4	+-4
HYLOCOMIUM SPLENDENS	4.	1.	3.	4.	3.	1.	3.	2.	1.	2.	4.	3.	+.	.	.	.	.	.	.	.	100.0	3.3	+-4
DICRANUM FUSCESCENS	+.	+.	+.	+.	.	.	+.	.	+.	.	.	+.	+.	.	.	.	.	.	.	.	61.5	+.1	+-+
PTILIDIUM PULCHERRIMUM	+.	.	+.	+.	+.	.	+.	.	.	.	.	+.	+.	.	.	.	.	.	.	.	53.8	+.0	+-+
POHLIA NUTANS	.	.	+.	+.	.	.	+.	.	.	.	.	+.	+.	.	.	.	.	.	.	.	38.5	+.0	+-+
DREPANOCLADUS UNCINATUS	+.	.	+.	+.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	30.8	+.0	+-+
JAMESONIELLA AUTUMNALIS	+.	+.	.	.	.	.	+.	.	.	.	.	+.	.	.	.	.	.	.	.	.	30.8	+.0	+-+
CLADONIA GRACILIS	.	.	.	+.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	23.1	+.0	+-+
PELTIGERA APHTHOSA	.	.	.	.	.	.	2.	.	.	1.	.	.	.	.	.	.	.	.	.	.	15.4	+.3	1-2
DICRANUM ACUTIFOLIUM	2.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.1	+-2
PELTIGERA MALACEA	.	.	.	.	+.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-1
87 BLEPHAROSTOMA TRICHOPHYLLUM	.	.	.	.	.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
BRACHYTHECIUM ALBICANS	.	.	.	.	.	.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
88 CEPHALOZIELLA DIVARICATA	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
CLADONIA BACILLARIS	.	.	.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
89 CLADONIA CONIOCRAEA	.	.	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
CLADONIA CORNUTA	+.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
90 CLADONIA SQUAMOSA	.	.	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
91 DICRANUM FRAGILIFOLIUM	.	+.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
92 DICRANUM TAURICUM	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+

Table 22 (continued)

ST NO.	SPECIES	001	005	006	009	017	023	036	054	010	018	024	049	079							P	MS	RS
	DICRANUM UNCULATUM	.	.	.	.	.	.	+.	.	.	.	.	+.	.	.	.	.	.	.	.	15.4	+.C	+-+
	HERZOGIELLA TURFACEA	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
93	LEPICOZIA REPTANS	.	.	.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.C	+-+
94	TETRAPHIS PELLUCIDA	.	.	.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	15.4	+.0	+-+
	PELTIGERA POLYDACTYLA	.	.	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.C	1-1
95	ALECTORIA SARMENTOSA	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.C	+-+
96	BARBILOPHOZIA BARBATA	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	7.7	+.0	+-+
97	BRACHYTHECIUM SALEBROSUM	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	7.7	+.C	+-+
	CAMPYLIUM HISPIDULUM	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	7.7	+.C	+-+
98	CEPHALOZIA AFFINIS	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
99	CETRARIA ISLANDICA	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.C	+-+
100	CETRARIA PINASTRI	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
101	CLADONIA DEFORMIS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
102	CLADONIA DIGITATA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
103	CLADONIA FIMBRIATA	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	7.7	+.0	+-+
104	CLADONIA OCHROCHLORA	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
105	DICRANUM MUEHLENBECKII	.	.	.	.	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	7.7	+.C	+-+
106	DICRANUM POLYSETUM	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
107	ICMADOPHILA ERICETORUM	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	7.7	+.C	+-+
108	LOPHOCOLEA HETEROPHYLLA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
109	LOPHOZIA LONGIDENS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
110	MNIUM SPINULOSUM	.	.	.	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+
	NEPHROMA RESUPINATUM	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	7.7	+.0	+-+

Table 22 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

TERRAIN SYSTEM AFTER VALENTINE (1971)

BOREAL WHITE & BLACK SPRUCE ZONE

PLOT 1 ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE XS	%SI	%C	
1- 1	LFH	005-000	4.4	87.9	51.00	0.60	85.0	056	10.00	1.75	0.0	1.62	104.00	13.0						
1- 2	AE	000-009	3.9	2.7	1.54	0.08	19.3	019	0.50	0.23	0.04	0.30	12.00	8.9	10YR71	10YR42	26	57	15	SIL
1- 3	AB	009-022	4.3	1.3	0.75	0.09	8.3	015	1.00	0.72	0.04	0.35	12.50	16.9	10YR63	10YR54	19	37	42	C
1- 4	BT	022-044	4.1	1.3	0.73	0.12	6.1	012	0.25	0.60	0.05	0.39	11.90	10.8	10YR63	10YR44	19	34	46	C

PLOT 5 GLEYED ORTHIC GRAY LUVISOL — BUCKINGHORSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE XS	%SI	%C	
5- 0	LFH	010-000	3.9	91.0	52.80	0.92	57.4	124	20.00	3.87	0.0	1.50	68.00	37.5						
5- 1	AE	000-012																		
5- 2	BTG	012-046	5.4	1.1	0.66	0.07	9.4	005	8.50	4.87	0.0	0.40	15.50	89.4	10YR63	10YR44				
5- 3	CKG	046- +	7.7	1.8	1.03	0.08	12.9	003	12.62	6.37	0.04	0.35	13.50	100.0	10YR51	10YR32	4	55	40	SIC *

PLOT 6 GLEYED ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE XS	%SI	%C	
6- 0	LFH	010-000	3.7	86.0	49.90	1.37	36.4	202	15.00	3.00	0.0	2.62	76.00	27.1						
6- 1	AE	000-014	4.1	2.2	1.25	0.07	17.9	052	1.00	0.39	0.04	0.31	13.00	13.4	10YR62	10YR42	18	60	20	SIL
6- 2	BT	014-050	4.1	1.6	0.94	0.17	5.5	011	0.25	0.29	0.05	0.35	16.70	5.6	10YR53	10YR56	26	19	53	C
6- 3	CGJ	063- +	3.8	3.1	1.80	0.15	12.0	023	0.12	0.33	0.05	0.34	15.80	5.3	10YR41	10YR31	6	39	54	C

PLOT 9 GLEYED ORTHIC GRAY LUVISOL — BUCKINGHORSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE XS	%SI	%C	
9- 1	AEJ	000-010	4.6	2.4	1.38	0.06	23.0	004	7.50	2.37	0.05	0.20	16.20	62.5	10YR53	10YR42	30	40	28	CL
9- 2	BTJG	010-037	7.0	1.7	1.00	0.09	11.1	007	12.50	3.66	0.06	0.25	19.70	83.6	10YR52	10YR42	34	27	38	CL
9- 3	CKG	037- +	7.7	1.6	0.94	0.06	15.7	004	12.25	2.47	0.07	0.19	15.20	98.6	10YR62	10YR42	22	46	31	CL *

PLOT 17 GLEYED EUTRIC BRUNISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE XS	%SI	%C	
17- 1	LF	013-006	3.5	89.0	51.60	0.95	54.3	58	18.75	2.25	0.0	1.75	117.00	19.6						
17- 2	H	006-000																		
17- 3	AH	000-007	7.6	17.9	10.40	0.45	23.1	58	56.25	8.62	0.0	0.0	66.00	98.3	10YR31	10YR11	58	18	23	SCL
17- 4	BMKGJ	007-048	7.7	0.7	0.38	0.03	12.7	3	4.87	1.19	0.02	0.05	4.40	100.0	10YR52	10YR33	78	10	10	SL *
17- 7	CKG1	048-060	8.0	0.7	0.40	0.04	10.0	<1	11.62	0.91	0.0	0.11	3.60	100.0	10YR64	10YR43				
17- 8	CKG2	060-089	7.9	2.2	1.29	0.09	14.3	003	12.37	1.24	0.02	0.11	7.20	100.0	10YR52	10YR32	52	27	19	SL *

PLOT 23 GLEYED DEGRADED DYSTRIC BRUNISOL

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE XS	%SI	%C	
23- 0	LFH	012-000	3.9	86.0	49.90	0.91	54.8	110	7.50	5.25	0.0	1.25	124.00	11.5						
23- 1	AHE	000-012	4.1	3.0	1.76	0.13	13.5	020	1.12	0.68	0.0	0.20	15.60	13.1	10YR52	10YR32				
23- 2	BMGJ	012-030	3.7	1.6	0.94	0.10	9.4	016	1.00	0.50	0.05	0.17	14.00	12.3	10YR63	10YR42	25	40	35	CL
23- 3	BMGJ	030-076	4.1	0.9	0.52	0.06	8.7	025	0.87	0.46	0.05	0.12	12.10	12.4	10YR63	10YR42	59	23	18	SL
23- 4	CG	076- +	3.8	1.3	0.74	0.10	7.4	037	1.12	0.54	0.05	0.16	10.00	18.8	10YR62	10YR41	39	34	25	L

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 36 GLEYED ORTHIC GRAY LUVISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
36- 1	LFH	010-000	3.7	86.0	49.90	0.90	55.4	156	15.00	2.75	0.0	1.87	146.00	13.5						
36- 2	AE	001-005	4.2	3.8	2.20	0.40	5.5	032	9.50	4.17	0.0	0.72	24.70	58.5	10YR32	10YR21				
36- 3	AEGJ	005-023	4.6	4.6	2.67	0.15	17.8	015	6.50	2.10	0.05	0.37	16.20	55.7	10YR62	10YR42	18	51	29	SICL
36- 5	BTG	023-048	5.2	0.9	0.52	0.06	8.7	004	8.50	3.30	0.03	0.27	15.70	77.1	10YR63	10YR53	33	32	33	CL
36- 7	CG	048- +	6.3	1.1	0.66	0.04	16.5	005	12.75	4.62	0.07	0.25	20.80	85.1	10YR52	10YR42	22	35	41	C

*PLOT 54 PEATY PHASE REGO HUMIC GLEYSOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
54- 0	OF1	021-016	3.7	94.0	54.50	1.25	43.6	78	26.25	10.75	0.0	2.00	87.00	45.1						
54- 1	OF2	016-010	5.1	92.1	53.40	1.16	46.0	54	8.75	6.50	0.0	0.75	106.00	15.3						
54- 2	OM	010-000	6.3	92.1	53.40	0.93	57.4	014	76.25	15.87	0.0	0.0	141.00	65.4						
54- 3	AH	000-015	7.2	2.6	1.51	0.08	18.9	005	12.50	3.62	0.05	0.20	19.70	83.1	10YR53	10YR32	9	68	22	SIL
54- 4	CKG	015- +	7.8	1.5	0.86	0.07	12.3	002	13.00	3.05	0.05	0.35	19.00	86.6	10YR63	10YR42	2	86	10	SI *

PLOT 10 HUMIC ELUVIATED GLEYSOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
10- 0	LFH	010-000	5.5	87.1	50.50	1.45	34.8	100	47.50	9.87	0.0	1.25	138.00	42.7						
10- 1	AHEG	000-026	5.8	10.7	6.21	0.40	15.5	084	8.37	1.89	0.22	0.29	36.00	29.9	10YR42	10YR21	16	47	35	SICL
10- 2	BTG	026-050	7.2	0.8	0.46	0.04	11.5	012	8.00	2.49	0.11	0.15	10.80	99.6	2.5Y53	2.5Y42	56	37	6	SL *
10- 3	CKG	050- +	7.4	1.2	0.71	0.08	8.9	004	11.25	3.80	0.20	0.25	16.40	94.5	2.5Y52	2.5Y32	21	48	29	CL *

PLOT 18 DEGRADED DYSTRIC BRUNISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
18- 1	LFH	007-000	3.7	92.9	53.90	0.74	72.8	102	15.00	3.62	0.0	2.37	158.00	13.3						
18- 2	AE	000-015	4.1	1.4	0.82	0.03	27.3	003	1.25	0.23	0.02	0.06	4.50	34.9	7.5YR62	10YR42	56	18	25	SCL
18- 3	BM	015-062	5.2	0.4	0.21	0.01	21.0	054	1.88	0.31	0.02	0.09	3.50	65.5	7.5YR53	7.5YR43	73	10	16	SL
18- 6	BMK	062-085	7.6	0.3	0.19	0.01	19.0	006	4.50	0.47	0.02	0.02	0.80	100.0	7.5YR53	7.5YR42	96	3	0	S *
18-10	CK	085-124	8.0	0.2	0.11	0.01	11.0	003	4.00	0.33	0.02	0.02	0.90	100.0	10YR62	10YR52	90	3	5	S *

Table 23 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 24 ORTHIC HUMO-FERRIC PODZOL (TENT.)

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
24- 1	LFH	013-000	3.5	91.0	52.80	1.09	48.4	096	10.00	3.87	0.0	1.37	110.00	14.1						
24- 2	AE	000-010	4.0	1.3	0.78	0.05	15.6	014	0.37	0.22	0.0	0.12	8.80	8.7	10YR71	10YR61				
24- 3	BF1	010-023	4.5	1.6	0.95	0.06	15.8	021	0.25	0.16	0.04	0.15	9.30	6.4	10YR64	10YR54	32	45	22	L *
24- 4	BF2	023-055	3.8	0.9	0.50	0.06	8.3	008	0.50	0.34	0.0	0.17	9.10	11.5	10YR63	10YR63				
24- 6	C	055- +	4.7	0.8	0.46	0.05	9.2	022	1.25	0.65	0.0	0.10	9.30	21.8	10YR52	10YR42				

PLOT 49 DEGRADED DYSTRIC BRUNISOL — CHUATSE TERRAIN SYSTEM

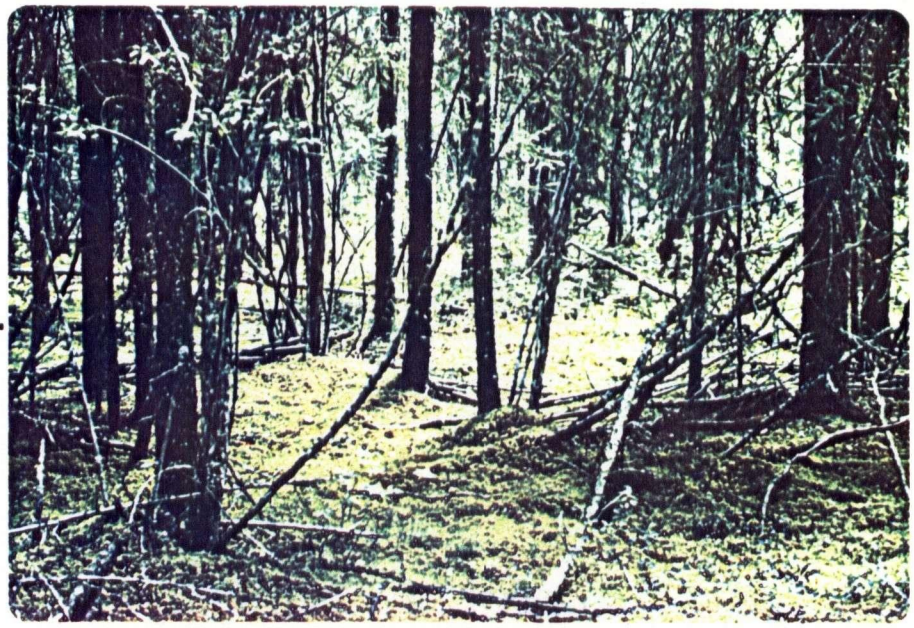
SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
49- C	LFH	005-000	4.8	87.9	51.00	1.09	46.8	120	30.00	5.50	0.0	2.37	82.00	46.3						
49- 1	AE	000-011	4.7	2.6	1.53	0.07	21.9	007	3.50	0.77	0.03	0.15	8.40	53.0	10YR71	10YR51	16	49	35	SICL
49- 2	BM	011-053	5.6	0.4	0.26	0.02	13.0	003	2.75	0.30	0.03	0.12	9.70	33.0	10YR64	10YR44	47	19	33	SCL
49- 3	C	053- +	7.0	0.8	0.45	0.05	9.0	006	3.50	0.75	0.0	0.05	14.20	30.3	10YR53	10YR33	50	37	12	L *

PLOT 79 DEGRADED DYSTRIC BRUNISOL

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
79- 1	LFH	010-000	3.9	87.1	50.50	1.28	39.5	098	12.50	3.00	0.0	2.12	92.00	19.3						
79- 2	AE	000-013	4.2	1.3	0.78	0.09	8.7	008	0.75	0.35	0.02	0.15	7.10	18.0	10YR71	10YR51	38	38	23	L
79- 3	BM	013-053	4.7	1.5	0.86	0.07	12.3	004	1.50	0.77	0.02	0.30	14.20	18.3	10YR63	10YR43	35	20	44	C
79- 4	C	053- +	4.9	1.1	0.61	0.08	7.6	008	2.25	1.62	0.05	0.22	9.60	43.2	10YR63	10YR54	44	21	34	CL

Table 23 (continued)

Black Spruce - Moss





Figs. 32 & 33 Above is a typical community. Below is Pleurozium schreberi, generally the most dominant moss.

Black Spruce - Moss



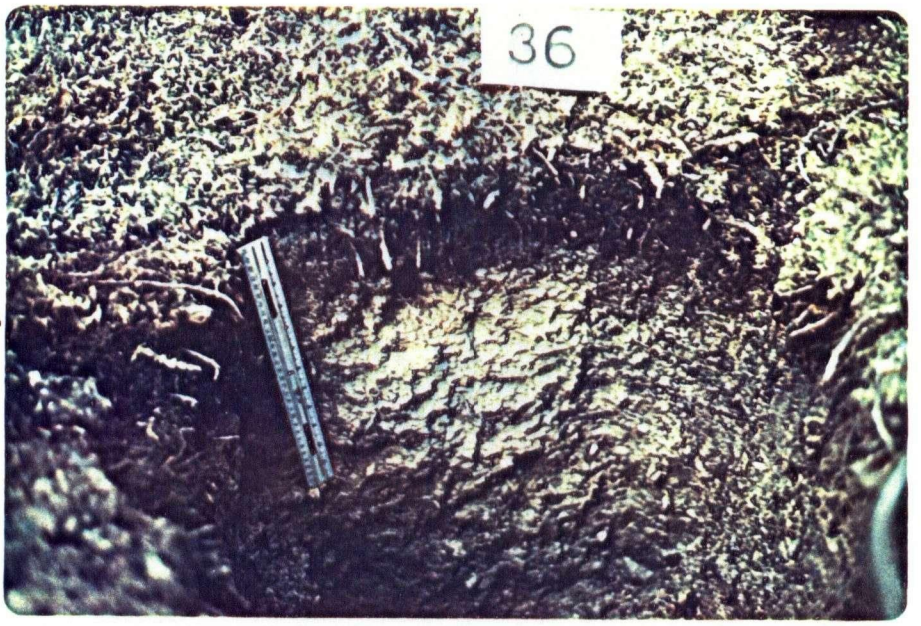
Figs. 34 & 35 Above is Hylocomium splendens, below is Ptilium crista-castrensis which along with Pleurozium schreberi, characterize the moss layer.



Black Spruce - Moss



Figs. 36 & 37 Above, a moderately well drained Degraded Dystric Brunisol. Below, a poorly drained Gleyed Orthic Gray Luvisol. Both soils support the Black Spruce - Moss association.



Plant Association 5

Black Spruce - Moss

Ptilio (crista-castrensis) - Hylocomio (splendentis) - Pleurozio (schreberi) - Piceetum marianae

Black Spruce - Moss ecosystems are most commonly found on soils of various textures that have impeded drainage, however, they can be found on moderately well drained sites provided the soils are poor in nutrients. On the edatopic grid, this association occurs on submesic to subhygric hygrotopes and on oligotrophic to mesotrophic trophotopes. These plant communities have only a few plant species, averaging only 7 species of herbs in the sample plots. This association is characterized as much by the absence of species, usually occurring on richer soils, as by the presence of plants, tolerating poor soils. In all cases this community has a very well developed moss layer which, along with dense black spruce in the tree layer, is the most conspicuous attribute of the association. Mor humus, characteristic of this site, developing especially from black spruce litter (and decaying wood), supports rapid establishment of the moss layer.

Vegetation

Generally a few tall Pinus contorta occur in the A_1 layer whereas the main canopy, the A_2, is dominated by Picea mariana which also dominates in the A_3. Scattered white spruce, when present, is characteristically in the A_1 and A_2 layers and does not seem to tolerate a suppressed position under a dense black spruce canopy (See Table 22).

The shrub layer is very poorly developed with an average cover value of the total B of only 8%. Apart from Picea mariana which is almost always present in the B_1 layer (showing greater shade tolerance than white spruce), only Alnus crispa and Abies lasiocarpa occurred in more than one plot. The B_2 layer is characterized by Ledum groenlandicum, generally with a low species significance value. Rosa acicularis which is present in half the communities examined grows very poorly, and generally with a low species significance. Abies lasiocarpa occurred more frequently in the B_2 layer than did Picea mariana. Abies lasiocarpa is a very shade tolerant species in the boreal zone. It is capable of germinating and growing under relatively dense shade. Its presence indicates that it could possibly become a component of the climax community, however, no stands of black spruce were found which were old enough to adequately determine successional development.

Cornus canadensis, with an average species significance value of 3.8, was the only species present in all plots. Vaccinium vitis-idaea which was present in 85% of the plots had a slightly higher average species significance (4.7). Linnaea borealis, Geocaulon lividum, Pyrola secunda and Equisetum scirpoides were present in 1/3 to 1/2 of the communities sampled. Of the above, Cornus canadensis, Linnaea borealis, and Pyrola secunda are companion species; Vaccinium vitis-idaea and Geocaulon lividum are order characteristic species for Piceetalia marianae and Equisetum scirpoides is more characteristic of the Black Spruce - Salix myrtillifolia - association. The Black Spruce - Moss lacks vascular species which are truly characteristic of the association.

The moss layer is very well developed with Pleurozium schreberi, Hylocomium splendens, and Ptilium crista-castrensis always being present with high average species significance values (7.2, 6.9, and 5.2 respectively). Peltigera aphthosa was present in 12 of the 13 plots with an average species significance of 3.4. It is the high constancy and high species significane of the above species, with a poorly developed herb and shrub layer, which identifies the Black Spruce - Moss association. In addition to the above species, Peltigera canina, P. malacea, and Ptilidium pulcherrimum are frequently found in the moss layer, usually with a low species significance.

This plant association is common throughout the boreal forest of Canada (Knapp, 1965) with similar associations being described from Alberta (Raup, 1935 and Moss, 1953) to Newfoundland (Damman, 1964).

Soils

The Black Spruce - Moss association occurs on a relatively wide variety of soils with Gleyed Orthic Gray Luvisols and Degraded Dystric Brunisols being the most common. Other soils include Gleyed Orthic Eutric Brunisols, Rego Humic Gleysols, Humic Eluviated Gleysols, and Orthic Gray Luvisols. The explanation of this wide variation of soils will follow.

All the soils examined had very acidic LFH horizons with the pH averaging 3.9 (3.5 - 5.5). The dense carpet of feather mosses (Pleurozium, Hylocomium, and Ptilium) contribute to the relatively thick mor humus characteristic of this association.

Generally where this association occurs on moderately well drained soils, soil analysis indicates the nutritional status is poor. An example would be the soil of plot 1 which is a moderately well drained Orthic Gray Luvisol which

has developed from a fine textured till. Morphologically, this soil strongly resembles a typical mesic Orthic Gray Luvisol of the Aspen - White Spruce association with the texture or sand, silt, and clay content being essentially identical. The C.E.C. of 11.9 of the Bt of plot 1 is well within the range of the C.E.C.'s of the mesic Orthic Gray Luvisols, however, the base saturation of 10.8% in plot 1 is only 15% of the average value of 70.7% for the Bt horizons of the mesic Aspen - White Spruce. This low base saturation indicates degradation of the soil through podzolization or the effect of acidic parent materials. Clark and Green (1964) have discussed similar Luvisolic soils developed from acid parent material in the Fort St. John area of northeastern British Columbia.

Likewise, the moderately well drained Degraded Dystric Brunisols (as in plots 18, 49, and 79) have relatively low base saturations and low amounts of Ca and Mg. This appears to indicate that leaching of soils is high under a Black Spruce - Moss association due to the effect of acid humus. Additionally, ash analysis shows that the moss association's humus has a very low Ca content.

The Black Spruce - Moss association is more common in receiving positions where it is subject to water movement

from upslopes. Due to the heavy texture of the soils in the Fort Nelson area, seepage waters move very slowly and behave more like stagnated water thereby resulting in slow growing trees. In contrast, in more mountainous areas than in the region of this study, these seepage waters effectively increase the nutrient content of the soils producing highly productive forest sites. Providing seepage water movement is slow and not excessive, the typical Black Spruce - Moss association develops, however, where more water is present, the Black Spruce - Equisetum sylvaticum association, which will be discussed next, develops. Plot 54 represents a community and soil which has some transitional characteristics toward this more poorly drained forest type. Valentine (1971) has not described any of the soils found under the Black Spruce - Moss association, however, plot 54, with a Rego Humic Gleysol, is similar to his Klowee Series.

The presence of different ecosystems, represented by different soil groups, occurring in this community, may be explained by the fact that these habitats tend to evolve toward the climatic climax forest of this zone, in which black spruce is becoming the most common final tree. Wherever thick mor humus is developed (frequently from accumulation of decayed coniferous wood, as probably is the case in plot 17) this development appears to take place.

If parent soil influence is diminished by overlain thick organic layers, from which mor humus developed, the moss and herb layer are dependent upon this type of mor humus. This dependency on mor humus conditions may effect even the shrub and tree layers providing that such organic humus horizons are thick (over 10 cm).

It should be clearly explained that such plots as 17, 54, and 10 belong here only by similarities in floristic structure, however, presence (and growth), either of Picea glauca or Larix laricina indicate that these plots should be considered as environmentally distinct. These plots do, however, point out successional trends.

The fact that acid mor humus can develop independently of the mineral substrate and the fact that it has developed on moderately well drained soils indicates that there is a potential for its development, even on mesic sites. Once it has developed on mesic sites, it appears to degrade the mineral soil through podzolization as is indicated by plot 1 (Table 23). Black spruce is well adapted for existing in moss humus with its shallow root system growing through this acid mor humus. Wheetman and Timmer (1967) have pointed out that the feather moss layer represents the major source of nitrogen to the trees and that feather mosses, through their accumulation of

nutrients, build up fertility, particularly on shallow and rocky soils. In the Fort Nelson area where the mineral soils are frequently rich and fine textured, the development of acid mor humus tends to degrade the soil. For this reason, factors such as fire which release nutrients tied up in organic layers, thereby increasing the potential for mineralization of organic matter, retard the development of acid mor humus. Historically, fire in the boreal forests around Fort Nelson is one of the major factors which have prevented more extensive development of acid mor humus and black spruce forests in upland sites.

It may be concluded that fire can be utilized as an ecologically sound tool on nutritionally rich, fine textured soils, to prevent degradation of forest sites in the Fort Nelson area, especially if tree species which cycle large amounts of bases are encouraged after burning. Other site treatments which favour mineralization of this mor humus can, however, be utilized in lieu of fire.

PLANT ASSOCIATION 6

BLACK SPRUCE - EQUISETUM SYLVATICUM

Hylocomio (splendentis) - Pleurozio (schreberi) -
Equiseto (sylvatici) - Piceetum marianae

Characteristic Combination of Species

Layer	Constants (presence > 60%) * characteristic	Characteristic non - constants > II
Tree	Picea mariana Larix laricina Betula resinifera	
Shrub	Rosa acicularis Ledum groenlandicum	Salix pyrifolia
Herb	Equisetum sylvaticum * Cornus canadensis Vaccinium vitis-idaea Rubus chamaemorus Pyrola secunda Petasites palmatus * Smilacina trifolia Equisetum arvense Listera cordata *	Ranunculus lapponicus
Moss	Pleurozium schreberi Hylocomium splendens Ptilium crista-castrensis Sphagnum girgensohnii * Aulacomnium palustre Philonotis fontana * Pohlia nutans	Sphagnum subnitens Campylium hispidulum Cephalozia pleniceps Cladonia nemoxyna

Table 24

BLACK SPRUCE - EQUISETUM SYLVATICUM

Hylocomio (splendentis) - Pleurozio (schreberi) -

Equiseto (sylvatici) - Piceetum marianae

Plot No.	52	29	30	47	51
Elevation in M	495	695	645	495	495
Latitude	58° 33'	58° 40'	58° 40'	58° 33'	58° 32'
Longitude	122° 40'	123° 38'	123° 37'	122° 41'	122° 40'
Exposure	-	NE	N	-	-
Slope Gradient %	0	4	12	0	0
Percent coverage					
Total A	75	63	65	27	29
A_1	10	15	15	6	4
A_2	35	40	48	14	8
A_3	40	15	12	7	20
Total B	17	7	10	78	65
B_1	15	5	3	+	45
B_2	3	3	8	78	12
C	27	31	50	28	65
Dh	86	90	75	95	90
Dw	1	2	12	+	+
Plot Coverage %					
Litter	89	90	76	95	96
Decaying Wood	3	2	5	+	+
Mineral Soil	-	-	-	-	-
Rock	-	-	-	-	-
Hygrotope	Subhygric - Hygric				
Trophotope	Mesotrophic - Sube trophic				
Parent Material	Morainal, Lacustrine				

Table 25

BLACK SPRUCE - EQUISETUM SYLVATICUM

PLOT NUMBER	052	029	030	047	051																	P	MS	RS
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																							
A1																								
1 PICEA MARIANA	3.2	5.2	5.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	4.8	3-5
2 LARIX LARICINA	4.2	.	.	1.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	3.2	1-4
A2																								
PICEA MARIANA	6.2	7.2	7.2	5.1	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	6.2	4-7
LARIX LARICINA	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	2.4	4-4
3 BETULA RESINIFERA	.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.5	3-3
4 PINUS CONTORTA	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
A3																								
PICEA MARIANA	7.2	5.2	5.2	4.1	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.6	4-7
LARIX LARICINA	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
B1																								
PICEA MARIANA	5.2	3.1	.	+.1	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	5.1	+-7
BETULA RESINIFERA	1.1	.	1.2	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.9	1-3
5 SALIX PYRIFOLIA	.	+.2	.	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.4	+-4
6 ALNUS CRISPA	.	3.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.2	3-3
7 ABIES LASIOCARPA	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
8 POPULUS TREMULOIDES	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
B2																								
9 ROSA ACICULARIS	2.1	1.1	4.2	1.1	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.0	1-4
10 LEDUM GROENLANDICUM	1.2	2.2	.	8.3	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	5.2	1-8
PICEA MARIANA	.	.	.	7.1	4.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	4.9	4-7
SALIX PYRIFOLIA	.	.	.	+.1	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.4	+-4
11 BETULA GLANDULOSA	.	.	.	3.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.6	+-3
12 VACCINIUM ULIGINOSUM	.	.	.	3.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.6	+-3
13 RIBES GLANDULOSUM	1.2	.	+.+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
BETULA RESINIFERA	+.1	.	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
ABIES LASIOCARPA	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
ALNUS CRISPA	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
14 RIBES TRISTE	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
15 SALIX ARBUSCULOIDES	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
16 SALIX NOVAE-ANGLIAE	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
17 VIBURNUM EDULE	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
LARIX LARICINA	.	.	.	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
18 SPIRAEA BETULIFOLIA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
19 VACCINIUM CAESPITOSUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
20 VACCINIUM MEMBRANACEUM	.	.	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
C																								
21 EQUISETUM SYLVATICUM	4.2	3.2	3.2	5.2	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.3	3-7
22 CORNUS CANADENSIS	3.2	5.2	5.2	+.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.8	+-5
23 VACCINIUM VITIS-IDAEA	2.2	4.2	4.2	3.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.1	2-4
24 RUBUS CHAMAEMORUS	4.2	4.2	.	3.3	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	4.4	3-5
25 PYROLA SECUNDA	1.2	.	1.2	+.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	1.0	+-1
26 PETASITES PALMATUS	3.2	.	3.2	.	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	2.4	1-3

Table 26

BLACK SPRUCE - EQUISETUM SYLVATICUM

ST NO.	SPECIES	052	029	030	047	051															P	MS	RS
27	SMILACINA TRIFOLIA	3.2	.	.	2.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	2.1	1-3
28	EQUISETUM ARVENSE	2.2	.	+.2	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.1	+-2
29	LISTERA CORDATA	+.2	.	+.2	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.1	+-2
30	CAREX DISPERMA	2.2	.	.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.0	2-3
31	RANUNCULUS LAPPONICUS	3.2	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.6	+-3
32	LYCOPODIUM ANNOTINUM	.	1.2	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.8	1-1
33	OXYCOCCUS MICROCARPUS	.	.	.	1.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.8	1-1
34	GOODYERA REPENS	.	+.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
35	EQUISETUM SCIRPOIDES	+.2	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
36	HABENARIA ORBICULATA	+.2	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
37	LINNAEA BOREALIS	.	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	2.4	4-4
38	CAREX AQUATILIS	.	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
39	CAREX LOLIACEA	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
40	EMPETRUM NIGRUM	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
41	MERTENSIA PANICULATA	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
42	MITELLA NUDA	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
43	MONESES UNIFLORA	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
44	PYROLA ASARIFOLIA	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
45	VIOLA RENIFOLIA	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
46	ANDROMEDA POLIFOLIA	.	.	.	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
47	EQUISETUM PRATENSE	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
48	ERIOPHORUM BRACHYANTHERUM	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
49	GALIUM BOREALE	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
50	GEOCAULON LIVIDUM	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
51	RUBUS PUBESCENS	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
DH																							
52	PLEUROZIUM SCHREBERI	5.	6.	5.	8.	5.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	6.4	5-8
53	HYLOCOMIUM SPLENDENS	6.	6.	5.	5.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.6	3-6
54	PTILIUM CRISTA-CASTRENSIS	7.	7.	7.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	5.9	7-7
55	SPHAGNUM GIRGENSOHNII	1.	+.	.	.	8.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	5.1	+-8
56	AULACOMNIUM PALUSTRE	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
57	PHILONOTIS FONTANA	+.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
58	POHLIA NUTANS	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
59	CLADONIA NEMOXYNA	4.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.4	+-4
60	PELTIGERA APHTHOSA	.	3.	.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.3	3-3
61	CLADONIA GRACILIS	.	.	.	3.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.6	+-3
62	SPHAGNUM SUBNITENS	.	1.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
63	CAMPYLIUM HISPIDULUM	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
64	CEPHALOZIA CONNIVENS	.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
65	CEPHALOZIA PLENICEPS	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
66	CLADONIA CORNUTA	.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
67	DICRANUM UNDULATUM	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
68	PELTIGERA CANINA	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
69	PELTIGERA POLYDACTYLA	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
70	TOMENTHYPNUM NITENS	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
71	CLADINA MITIS	.	.	.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	2.4	4-4
72	CLADINA RANGIFERINA	.	.	.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	2.4	4-4
73	POLYTRICHUM COMMUNE	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
74	SCAPANIA PALUDOSA	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1

Table 26 (continued)

PLOT NUMBER		052	029	030	047	051																				P	MS	RS
ST NO.	SPECIES	SPECIES SIGNIFICANCE AND VIGOR																										
75	BRACHYTHECIUM ALBICANS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
76	BRACHYTHECIUM REFLEXUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
77	CALLIERGON CORDIFOLIUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
78	CALLIERGON STRAMINEUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
79	CALYPOGEIA SPHAGNICOLA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
80	CEPHALOZIELLA SUBDENTATA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
81	CERATODON PURPUREUS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
82	CINCLIDIUM STYGIUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
83	CLADONIA GONECHA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
84	CLADONIA PLEUROTA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
85	CLADONIA UNCIALIS	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
86	DREPANOCLADUS CAPILLIFOLIUS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
87	DREPANOCLADUS REVOLVENS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
88	DREPANOCLADUS UNCINATUS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
89	DREPANOCLADUS VERNICOSUS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
90	EURHYNCHIUM PULCHELLUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
91	HERZOGIELLA TURFACEA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
92	LEPIDOZIA REPTANS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
93	LEPTOBRYUM PYRIFORME	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
94	LOPHOZIA ALPESTRIS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
95	LOPHOZIA ASCENDENS	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
96	LOPHOZIA OBTUSA	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
97	MNIUM SPINULOSUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
98	MYLIA ANOMALA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
99	PALUDELLA SQUARROSA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
100	PLAGIOMNIUM CUSPIDATUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
101	PLAGIOTHECIUM PILIFERUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
102	POLYTRICHUM STRICTUM	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
103	PTILIDIUM PULCHERRIMUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
DW																												
	PLEUROZIUM SCHREBERI	.	2.	3.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	2.C	+-3
104	DICRANUM FUSCESCENS	+.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.C	+-+
	PTILIUM CRISTA-CASTRENSIS	.	2.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.6	2-4
	HYLOCOMIUM SPLENDENS	.	1.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.7	1-3
	PELTIGERA APHTHOSA	+.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
	CEPHALOZIA CONNIVENS	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
	CLADONIA GRACILIS	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.C	+-+
105	CLADONIA OCHROCHLORA	.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
	DREPANOCLADUS UNCINATUS	.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.C	+-+
	HERZOGIELLA TURFACEA	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.C	+-+
106	JAMESONIELLA AUTUMNALIS	.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
	LEPIDOZIA REPTANS	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
	MNIUM SPINULOSUM	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.C	+-+
	PTILIDIUM PULCHERRIMUM	.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
	AULACOMNIUM PALUSTRE	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
107	BLEPHAROSTOMA TRICHOPHYLLUM	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
108	CEPHALOZIELLA DIVARICATA	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
109	CLADONIA FIMBRIATA	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
110	CROSSOCALYX HELLERIANUS	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+

Table 26 (continued)

BLACK SPRUCE - EQUISETUM SYLVATICUM

PLOT NUMBER		052	029	030	047	051																	
ST NO.	SPECIES	SPECIES SIGNIFICANCE AND VIGOR																			P	MS	RS
111	DICRANUM TAURICUM	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
	DICRANUM UNDULATUM	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
112	LEPTOGIUM SATURNINUM	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
113	LOPHOZIA ELONGATA	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
114	LOPHOZIA VENTRICOSA	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
115	NEPHROMA HELVETICUM	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	PELTIGERA CANINA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
116	PELTIGERA HORIZONTALIS	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
	PELTIGERA POLYDACTYLA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
117	SCAPANIA UMBROSA	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
118	TETRAPHIS PELLUCIDA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
119	TRITOMARIA EXSECTIFORMIS	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+

Table 26 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 52 PEATY PHASE REGO HUMIC GLEYSOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
52- 1	OF1	044-037	5.9	87.9	51.00	1.04	49.0	110	42.50	10.12	0.0	2.62	66.00	83.9					
52- 2	OF2	037-000																	
52- 3	CG	000- +	6.0	4.6	2.64	0.14	18.9	23	14.25	4.87	0.05	0.32	19.30	100.0	10YR53	10YR32	11	55	33 SICL

PLOT 29 GLEYED ORTHIC GRAY LUVISOL

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
29- 1	LFH	005-000	3.8	92.9	53.90	1.07	50.4	142	8.75	4.25	0.0	2.62	145.00	10.9					
29- 2	AHE	000-006	3.0	7.3	4.26	0.47	9.1	013	1.50	1.50	0.05	0.87	19.40	20.2	7.5YR40	7.5YR20	8	39	51 SIC
29- 3	AE1	006-010	3.9	3.8	2.19	0.09	24.3	045	0.75	0.55	0.02	0.17	11.00	13.6	10YR62	10YR32	27	52	20 SIL
29- 4	BT1	010-016	3.7	3.9	2.28	0.26	8.8	013	1.75	1.52	0.05	0.47	9.80	38.8	10YR51	10YR21	21	30	47 C
29- 5	BT2	016-057	3.9	5.4	3.11	0.19	16.4	018	1.25	0.97	0.02	0.35	8.20	31.7	10YR51	10YR32	21	42	36 CL
29- 8	2CG	057- +	4.8	1.2	0.69	0.06	11.5	13	5.00	3.05	0.0	0.27	10.40	81.0	10YR42	10YR32			

PLOT 30 GLEYED ORTHIC GRAY LUVISOL

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
30- 1	LFH	006-000	4.3	90.0	52.20	1.01	51.7	288	22.50	8.12	0.0	1.12	134.00	23.8					
30- 2	AHE	000-005	3.8	5.9	3.42	0.60	5.7	024	3.25	1.90	0.02	0.95	21.00	29.2	10YR41	10YR21	8	27	64 HC
30- 3	AE	005-019	4.6	1.9	1.09	0.08	13.6	007	3.50	2.62	0.02	0.22	8.90	71.6	10YR72	10YR52	5	47	47 SIC
30- 4	BT	019-033	4.7	1.6	0.91	0.08	11.4	006	4.00	3.15	0.02	0.27	12.80	58.2	10YR62	10YR42	13	33	66 HC
30- 5	BTGJ	033-053	4.9	1.7	0.99	0.07	14.1	009	4.75	3.05	0.0	0.25	11.30	71.5	10YR52	10YR42			
30- 7	CGJ	053- +	6.6	1.7	1.00	0.09	11.1	010	5.50	2.85	0.02	0.25	9.10	94.8	10YR52	10YR32	14	52	34 SICL

PLOT 47 TERRIC SPHAGNO-FIBRISOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
47- 1	OF1	000-014	3.9	84.0	48.70	0.81	60.1	38	16.25	5.00	0.0	0.63	63.00	35.1					
47- 2	OF2	014-066	4.8	82.1	47.60	1.09	43.7	8	41.25	8.50	0.0	0.0	128.00	39.2					
47- 3	CG	066-072	5.1	2.3	1.33	0.12	11.1	023	8.00	3.50	0.07	0.25	16.40	72.1	10YR52	10YR32	2	43	54 SIC

PLOT 51 PEATY PHASE REGO HUMIC GLEYSOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
51- 1	OF1	038-030																	
51- 2	OF2	030-000	4.6	92.1	53.40	0.86	62.1	058	36.25	8.25	0.0	1.25	98.00	46.9					
51- 3	AHG	000- +	5.3	6.5	3.78	0.21	18.0	021	13.25	4.22	0.03	0.25	20.20	87.9	10YR52	10YR22	9	60	29 SICL

Table 27

Black Spruce - Equisetum sylvaticum

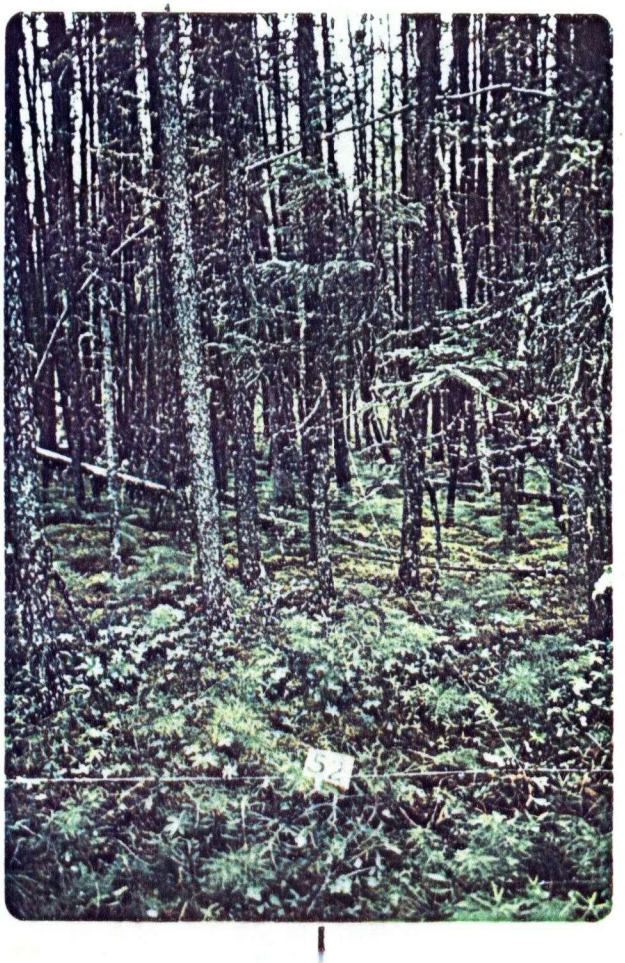


Fig. 38 A Black Spruce - Equisetum sylvaticum association on a Peaty Phase Rego Humic Gleysol.

Black Spruce - Equisetum sylvaticum



Fig. 39 Very dense development of Equisetum sylvaticum under a black spruce canopy with Sphagnum girgensohnii dominating the moss layer.

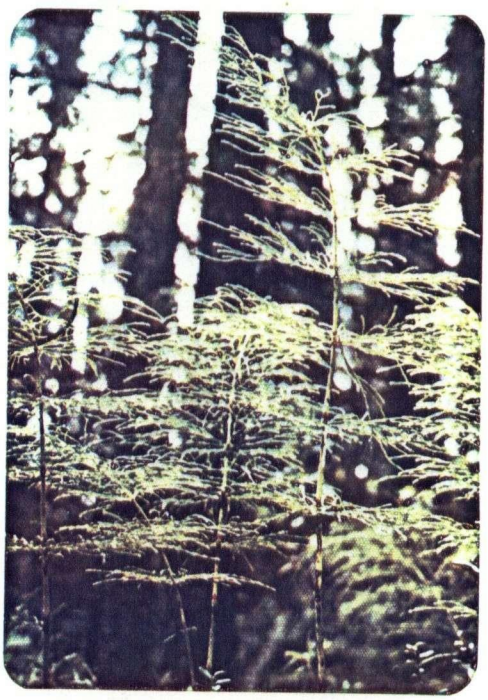


Fig. 40 Accompanying soil - Peaty Phase Rego Humic Gleysol

Black Spruce - Equisetum sylvaticum



Figs. 41 & 42 A Gleyed Orthic Gray Luvisol near the base of a slope. Below, Equisetum sylvaticum.



Plant Association 6

Black Spruce - Equisetum Sylvaticum

Hylocomio (splendentis) - Pleurozio (schreberi) - Equiseto (sylvatici) - Piceetum marianae

In areas of gentle topography around Fort Nelson, the Black Spruce - Equisetum sylvaticum association occurs under poorly drained conditions on almost level topography where there is considerable movement of water through the soil. Additionally in more mountainous areas west of Fort Nelson, this association can develop on Gleyed Orthic Gray Luvisols at the base of slopes where it shows some affinities to the Black Spruce - Moss association. This association occurs basically on hygric (rarely subhygric) trophotopes and has been judged to occur on submesotrophic to mesotrophic trophotopes.

Vegetation

The tree layer is dominated by black spruce and in areas where the soils are gleysolic or organic, Larix laricina is additionally present. Generally Picea mariana is the dominant species in the shrub layer which indicates

it is a climax species.

Rosa acicularis, with an average species significance of 3.0, is the only species present in the B_2 in all sample plots. Ledum groenlandicum, which is generally associated with poor sites, was the only other constant dominant in this layer.

In all cases Equisetum sylvaticum was a dominant in the herb layer with an average species significance of 5.3. Cornus canadensis, a companion species and Vaccinium vitis-idaea, a characteristic order species of Piceetalia marianae were both dominant constants. Rubus chamaemorus, which was present in four of the five communities sampled, indicates the affinities this association has towards the high moor Black Spruce - Sphagnum fuscum association. Petasites palmatus, a characteristic species, which is generally associated with seepage water was also frequently encountered in this association. Equisetum arvense and Listera cordata are generally associated with moist situations which are mesotrophic. Jeglum (1971) placed both Equisetum arvense and Petasites palmatus in a mesotrophic nutritional class for the Candle Lake area of Saskatchewan.

Pleurozium schreberi and Hylocomium splendens were the most frequent dominant mosses with average species significances of 6.4 and 5.6 respectively. Ptilium crista-castrensis was also often a dominant moss with high average species significances. Sphagnum girgensohnii was present in 3 of the 5 plots, once with a species significance of 8. This Sphagnum can withstand dense shade and in certain cases can expand under a black spruce canopy. Aulacommium palustre, although with a very low coverage value, was also present in 3 of the 5 plots. This species is again more characteristic of bog associations. The vegetation of the Black Spruce - Equisetum sylvaticum association shows affinities towards the Black Spruce - Moss association, especially through the moss layer as well as towards bog species. Some species, however, are present which indicate at least mildly minerotrophic waters.

Soils

The soils of the Black Spruce - Equisetum sylvaticum association range from imperfectly drained to very poorly drained. The very poorly drained soils were peaty phases of Rego Humic Gleysols, however, one soil had sufficiently thick peat to be classified as a Terric Sphagno-Fibrisol [a Terric Fibrisol according to the System of Soil Class-

ification For Canada (1970)]. Even though thick accumulations of peat were present on the mineral soil, sufficient water movement was present to give these soils a submesotrophic nutrient status.

The Gleyed Orthic Gray Luvisols which occur near the base of relatively steep slopes also are subject to seepage water which appears to have sufficient movement to prevent the development of Black Spruce - Moss associations. This latter association frequently develops in equivalent topographical positions in more gentle terrain where water movement is much slower. The two types of soils of the Black Spruce - Equisetum sylvaticum association (basically the Gleyed Orthic Gray Luvisols and the Gleysols) support similar species of vegetation but must be treated as different ecosystems types since the soils are different.

Alliance 4 Aulacomnio (palustris) - Salico (myrtillifoliae) - Piceion marianae Annas et Krajina

This alliance has only one plant association in the area of this study. Its vegetation and environmental characteristics are, therefore, identical with those of plant association no. 7. This alliance was not reported in the Sub-Boreal Spruce Zone by Revel (1972) or by Wali

and Krajina (1973) and has not been observed in the Sub-Boreal Zone (Krajina, pers. comm.).

PLANT ASSOCIATION 7

BLACK SPRUCE - SALIX MYRTILLIFOLIA - AULACOMNIUM

Aulacomnio (palustris) - Tomenthypno (nitentis) - Equiseto (scirpoidis) - Ledo (groenlandici) - Salico (myrtillifoliae) - Nano-Piceetum marianae

Characteristic Combination of Species

Layer	Constants (presence >60%) * characteristic	Characteristic non - constants > II
Tree	Picea mariana	
Shrub	Ledum groenlandicum	Vaccinium uliginosum
	Salix novae-angliae *	
	Salix arbusculoides *	
Herb	Salix myrtillifolia *	Carex vaginata
	Vaccinium vitis-idaea	Spiranthes romanzoffiana
	Equisetum scirpoides *	Polemonium acutiflorum
	Equisetum arvense	Carex concinna
	Pedicularis labradorica *	
	Epilobium angustifolium	
	Arctostaphylos rubra *	
	Rubus pubescens	
	Mertensia paniculata	
	Senecio lugens *	
	Cornus canadensis	
	Oxycoccus microcarpus	
	Carex dioica	
	Geocaulon lividum	
	Petasites palmatus	
	Parnassia palustris *	
	Achillea millefolium	
	Linnaea borealis	
	Smilacina trifolia	
Moss	Aulacomnium palustre *	Jamesoniella autumnalis
	Hylocomium splendens	Pohlia sphagnicola
	Tomenthypnum nitens *	Polytrichum strictum
	Peltigera aphthosa	Brachythecium salebrosum
	Cladina mitis	Lophozia obtusa
	Cladonia gracilis	
	Cladina arbuscula *	
	Dicranum undulatum *	
	Pleurozium schreberi	
	Cladonia cornuta	
	Pohlia nutans	
	Peltigera polydactyla *	
	Cephaloziella subdentata *	
	Cladina rangiferina	

Table 28

BLACK SPRUCE - SALIX MYRTILLIFOLIA - AULACOMNIUM

Aulacomnio (palustris) - Tomenthypno (nitentis) -

Equiseto (scirpoidis) - Ledo (groenlandici) - Salico

(myrtillifoliae) - Nano - Piceetum marianae

Plot No.	44	45	88	89	90	91
Elevation in M	440	440	425	425	425	425
Latitude	58° 38'	58° 38'	58° 40'	58° 40'	58° 39'	58° 40'
Longitude	122° 40'	122° 39'	122° 42'	122° 43'	122° 40'	122° 42'
Exposure	-	-	-	-	-	-
Slope Gradient %	0	0	0	0	0	0
Percent coverage						
Total A	-	-	-	-	-	-
A_1	-	-	-	-	-	-
A_2	-	-	-	-	-	-
A_3	-	-	-	-	-	-
Total B	75	80	70	79	67	75
B_1	50	50	45	13	20	10
B_2	56	60	40	68	55	68
C	60	65	72	70	65	63
Dh	85	92	92	96	95	95
Dw	5	1	1	-	-	+
Plot coverage %						
Litter	90	92	92	96	95	95
Decaying Wood	5	5	3	-	1	1
Mineral Soil	-	-	-	-	-	-
Rock	-	-	-	-	-	-
Hygrotope	Hygric					
Trophotope	Mesotrophic - Subeutrophic					
Parent Material	Organic over Fluvial					

Table 29

BLACK SPRUCE - SALIX MYRTILLIFOLIA - AULACOMNIUM

ST NO.	SPECIES	044	045	088	089	C90	091													P	MS	RS
	PLOT NUMBER	SPECIES SIGNIFICANCE AND VIGOR																				
B1																						
1	PICEA MARIANA	7.1	8.1	5.2	5.2	5.1	4.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	6.2	4-8
2	SALIX ARBUSCULOIDES	3.1	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	2.1	3-3
3	SALIX NOVAE-ANGLIAE	3.2	.	.	2.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	1.7	2-3
4	PICEA GLAUCA	.	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	2.2	4-4
5	POPULUS BALSAMIFERA	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.C	1-1
B2																						
6	LEDUM GROENLANDICUM	6.3	8.2	5.2	6.2	6.2	5.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	6.7	5-8
	SALIX NOVAE-ANGLIAE	4.2	3.2	4.2	1.2	2.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.5	1-4
	PICEA MARIANA	5.1	4.1	4.2	.	7.1	6.2	.	.	.	.	.	.	.	.	.	.	.	.	83.3	5.4	4-7
	SALIX ARBUSCULOIDES	.	2.2	1.2	.	2.2	+.	.	.	.	.	.	.	.	.	.	.	.	.	66.7	1.5	+-2
7	ROSA ACICULARIS	1.1	3.1	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.6	+-3
8	VACCINIUM ULIGINOSUM	3.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	2.1	3-3
9	SHEPHERDIA CANADENSIS	.	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.C	+-+
10	SALIX GLAUCA	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	1.4	3-3
11	ALNUS TENUIFOLIA	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.7	2-2
12	LARIX LARICINA	.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.C	1-1
13	RIBES GLANDULOSUM	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	1-1
14	SALIX ATHABASCENSIS	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.C	1-1
15	VIBURNUM EDULE	.	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	1-1
16	RIBES HUDSONIANUM	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.C	+-+
17	RIBES LACUSTRE	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
18	RIBES OXYACANTHOIDES	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.C	+-+
19	SALIX BEBBIANA	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
20	SALIX PEDICELLARIS	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.C	+-+
21	SALIX PLANIFOLIA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
22	VACCINIUM MYRTILLOIDES	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
C																						
23	SALIX MYRTILLIFOLIA	6.2	4.2	6.2	6.2	7.2	5.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	6.0	4-7
24	VACCINIUM VITIS-IDAEA	5.2	5.2	3.2	4.2	3.2	6.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.2	3-6
25	EQUISETUM SCIRPOIDES	3.2	3.2	3.2	4.2	3.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.7	3-4
26	EQUISETUM ARVENSE	2.2	1.2	3.2	3.2	2.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.6	+-3
27	PEDICULARIS LABRADORICA	1.2	1.2	2.2	1.2	+.0	2.0	.	.	.	.	.	.	.	.	.	.	.	.	100.0	1.8	+-2
28	EPILOBIUM ANGUSTIFOLIUM	1.2	2.2	+.2	1.2	1.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	1.5	+-2
29	ARCTOSTAPHYLOS RUBRA	.	4.2	4.2	4.3	5.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	83.3	4.5	4-5
30	RUBUS PUBESCENS	.	2.2	+.1	2.2	2.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	83.3	2.0	+-2
31	MERTENSIA PANICULATA	.	2.2	1.2	2.2	1.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	83.3	1.6	+-2
32	SENECIO LUGENS	.	.	4.2	3.2	2.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	66.7	3.0	2-4
33	CORNUS CANADENSIS	.	4.2	+.2	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	66.7	2.2	+-4
34	OXYCOCCUS MICROCARPUS	+.2	.	.	3.2	1.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	66.7	1.7	+-3
35	CAREX DIOICA	.	.	1.2	2.2	2.2	+.	.	.	.	.	.	.	.	.	.	.	.	.	66.7	1.5	+-2
36	GEOCAULON LIVIDUM	2.2	1.2	+.2	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	66.7	1.3	+-2
37	PETASITES PALMATUS	.	.	1.2	2.2	1.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	66.7	1.3	+-2
38	PARNASSIA PALUSTRIS	.	+.2	2.3	+.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	66.7	1.1	+-2
39	ACHILLEA MILLEFOLIUM	.	.	+.	1.2	1.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	66.7	+.9	+-1
40	LINNAEA BOREALIS	.	1.2	1.1	.	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	66.7	+.9	+-1
41	SMILACINA TRIFOLIA	+.1	.	.	+.	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	66.7	+.1	+-+

Table 30

PLOT NUMBER	044	045	088	089	090	091																	P	MS	RS
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																								
42 CAREX VAGINATA	.	4.2	.	4.2	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	3.1	+-4
43 MITELLA NUDA	.	.	1.1	2.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.2	1-2
44 VIOLA RENIFOLIA	1.2	1.2	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.8	+-1
45 SPIRANTHES ROMANZOFFIANA	.	.	+.2	+.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
46 ARCTOSTAPHYLOS UVA-URSI	4.3	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	2.2	+-4
47 CAREX AQUATILIS	.	.	3.2	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	1.7	2-3
48 PYROLA ASARIFOLIA	.	.	+.2	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.2	+-1
49 PYROLA CHLORANTHA	.	.	+.2	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.2	+-1
50 PYROLA SECUNDA	1.2	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.2	+-1
51 CAREX CONCINNA	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.0	+-+
52 POLEMONIUM ACUTIFLORUM	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.0	+-+
53 FRAGARIA VIRGINIANA	.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	1.4	3-3
54 CAREX LOLIACEA	.	.	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.7	2-2
55 EQUISETUM PALUSTRE	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	1-1
56 EQUISETUM PRATENSE	.	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	1-1
57 PETASITES FRIGIDUS	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	1-1
58 RUBUS CHAMAEMORUS	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	1-1
59 CALAMAGROSTIS CANADENSIS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
60 CAREX AUREA	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
61 CAREX DISPERMA	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
62 EQUISETUM SYLVATICUM	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
63 HABENARIA OBTUSATA	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
64 LISTERA CORDATA	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
DH																									
65 AULACOMNIUM PALUSTRE	1.	4.	8.	8.	8.	8.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	7.5	1-8
66 HYLOCOMIUM SPLENDENS	5.	8.	5.	2.	4.	5.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.7	2-8
67 TOMENTHYPNUM NITENS	8.	1.	5.	5.	5.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.7	1-8
68 PELTIGERA APHTHOSA	3.	+.	+.	+.	1.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.8	+-4
69 CLADINA MITIS	+.	1.	+.	+.	+.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	1.7	+-3
70 CLADONIA GRACILIS	1.	1.	.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	1.0	+-1
71 CLADINA ARBUSCULA	6.	5.	+.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	83.3	4.5	+-6
72 DICRANUM UNDULATUM	+.	.	+.	+.	4.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	83.3	3.1	+-4
73 PLEUROZIUM SCHREBERI	3.	2.	2.	3.	.	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	83.3	2.7	2-3
74 CLADONIA CORNUTA	1.	1.	.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	83.3	1.0	+-1
75 POHLIA NUTANS	+.	.	+.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	83.3	+.3	+-+
76 PELTIGERA POLYDACTYLA	1.	.	.	1.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	66.7	+.5	+-1
77 CEPHALOZIELLA SUBDENTATA	+.	+.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	66.7	+.1	+-+
78 CLADINA RANGIFERINA	+.	+.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	66.7	+.1	+-+
79 PELTIGERA CANINA	.	1.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.4	+-1
80 CEPHALOZIELLA DIVARICATA	.	.	.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
81 CLADONIA CHLOROPHAEA	+.	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
82 CLADONIA GONECHA	+.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
83 CLADONIA PLEUROTA	+.	.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
84 DICRANUM ACUTIFOLIUM	.	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
85 JAMESONIELLA AUTUMNALIS	+.	.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
86 POHLIA SPHAGNICOLA	+.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
87 POLYTRICHUM STRICTUM	+.	.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
88 SPHAGNUM FUSCUM	.	.	.	3.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	1.5	1-3
89 SPHAGNUM RUBELLUM	1.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.6	1-1

Table 30 (continued)

BLACK SPRUCE - SALIX MYRTILLIFOLIA - AULACOMNIUM

PLOT NUMBER	044	045	088	089	090	091																
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																			P	MS	RS
90 BRACHYTHECIUM SALEBROSUM	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.0	+-+
91 BRYUM PSEUDOTRICUETRUM	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.0	+-+
92 CALYPOGEIA SPHAGNICOLA	+.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.0	+-+
93 CAMPYLIUM HISPIDULUM	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.0	+-+
94 CLADONIA GRAYI	+.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.0	+-+
95 CLADONIA SUBULATA	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.0	+-+
96 LOPHOZIA OBTUSA	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.0	+-+
97 PHILONOTIS FONTANA	+.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.0	+-+
98 CLADINA ALPESTRIS	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	1-1
99 SPHAGNUM SUBFULVUM	.	.	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	1-1
100 BLEPHAROSTOMA TRICHOPHYLLUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
101 CALLIERGON RICHARDSONII	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
102 CEPHALOZIA CONNIVENS	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
103 CERATODON PURPUREUS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
104 CETRARIA CUCULLATA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
105 CLADONIA FIMBRIATA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
106 CLADONIA MULTIFORMIS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
107 DICRANUM BONJEANII	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
108 DICRANUM ELONGATUM	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
109 DICRANUM MUEHLENBECKII	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
110 DREPANOCLADUS REVOLVENS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
111 DREPANOCLADUS UNCINATUS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
112 HERZOGIELLA TURFACEA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
113 LOPHOCOLEA HETEROPHYLLA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
114 LOPHOZIA EXCISA	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
115 LOPHOZIA LONGIDENS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
116 MARCHANTIA POLYMORPHA	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
117 MYLIA ANOMALA	.	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
118 OBTUSIFOLIUM OBTUSUM	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
119 SPHAGNUM CAPILLACEUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
120 SPHAGNUM SUBNITENS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
121 SPHAGNUM WARNSTORFII	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
122 SPLACHNUM AMPULLACEUM	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
123 STEREOCAULON TOMENTOSUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
124 TRITOMARIA SCITULA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
DW																						
PELTIGERA POLYDACTYLA	.	.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	33.3	+.0	+-+
125 BRACHYTHECIUM ASPERRIMUM	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
PELTIGERA APHTHOSA	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
126 PELTIGERA SPURIA	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+
127 PTILIDIUM PULCHERRIMUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	16.7	+.0	+-+

Table 30 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 44 CRYIC MESISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
44- 1	OF	000-018	4.4	92.1	53.40	1.09	49.0	48	27.50	7.75	0.0	1.00	81.00	45.2					
44- 2	OM	018-042	5.8	89.0	51.60	1.20	43.0	012	73.75	11.87	0.0	0.0	113.00	76.0					
44- 3	OHZ	042- +	6.2	72.1	41.80	0.81	51.6	014	65.00	8.25	0.0	0.0	127.50	57.6					

PLOT 45 REGO GLEYSOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
45- 0	LFH	010-000	4.3	86.0	49.90	1.39	35.9	068	28.75	4.00	0.0	2.00	77.00	45.5						
45- 1	CKG1	000-011	6.9	1.2	0.67	0.06	11.2	001	12.00	3.05	0.0	0.20	8.60	100.0	10YR53	10YR44				
45- 2	CKG2	011-017	7.6	1.2	0.67	0.07	9.6	002	12.00	3.37	0.10	0.25	12.90	100.0	10YR53	10YR33	40	27	31	CL
45- 3	CKG3	017-023	7.3	0.6	0.35	0.05	7.0	017	13.50	2.52	0.07	0.25	9.10	100.0	10YR64	10YR43	27	38	33	CL
45- 5	CKG4	023- +	7.6	1.0	0.57	0.06	9.5	023	12.25	2.50	0.0	0.27	15.40	97.9	10YR52	10YR42				

PLOT 88 CRYIC MESISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
88- 1	OF	000-023	6.4	76.0	44.10	1.11	39.7	018	77.50	16.00	0.0	0.50	68.00	100.0						
88- 2	CK1	020-028	6.4	1.2	0.70	0.03	23.3	006	4.75	1.12	0.0	0.10	8.60	69.5	10YR53	10YR34	88	3	7	S
88- 3	OM	023-047	6.5	82.1	47.60	0.97	49.1	010	83.75	14.75	0.0	0.0	172.00	57.3						
88- 4	CZ	047- +	6.6	1.6	0.95	0.05	19.0	7	6.75	1.52	0.0	0.12	10.10	83.2	10YR42	10YR32	85	6	7	LS

PLOT 89 CRYIC MESISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
89- 0	OF1	000-008	5.0	90.0	52.20	0.99	52.7	72	36.25	14.62	0.0	1.75	115.00	45.9						
89- 1	OF2	008-025	5.5	92.1	53.40	1.23	43.4	66	55.00	15.12	0.0	2.00	125.00	57.8						
89- 2	OM	025-072	6.7	87.9	51.00	1.25	40.8	10	88.75	18.87	0.0	0.0	142.00	75.9						
89- 3	CZ	072-080	6.9	3.6	2.07	0.09	23.0	6	12.50	3.00	0.07	0.10	15.20	100.0	10YR42	10YR32	55	14	30	SCL

PLOT 90 REGO GLEYSOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
90- 1	OF	000-023	6.2	92.1	53.40	1.32	40.5	036	68.75	16.62	0.0	1.25	125.00	69.4					
90- 2	OM	023-037	6.5	91.0	52.80	0.85	62.1	4	73.75	16.37	0.0	0.0	136.00	66.3					
90- 3	CG	037- +	7.0	3.4	1.97	0.12	16.4	2	14.00	3.72	0.0	0.10	20.50	87.2	10YR42	10YR32			

PLOT 91 REGO GLEYSOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
91- 1	OH	025-000	6.8	84.0	48.70	1.78	27.4	28	76.25	19.75	0.0	1.12	76.00	100.0						
91- 2	C	000-021	6.8	1.0	0.56	0.04	14.0	4	5.75	1.70	0.03	0.12	8.00	95.0	10YR43	10YR42	81	16	1	LS
91- 3	CKG1	021-040	7.0	0.5	0.30	0.03	10.0	4	5.00	1.52	0.05	0.15	12.40	54.2	10YR56	10YR44	79	10	10	SL
91- 4	CKG2	040- +	7.5	0.5	0.30	0.03	10.0	4	8.00	2.35	0.03	0.17	12.40	85.1	10YR62	10YR42	33	54	12	SIL

Table 31

Black Spruce - Salix myrtillifolia - Aulacomnium

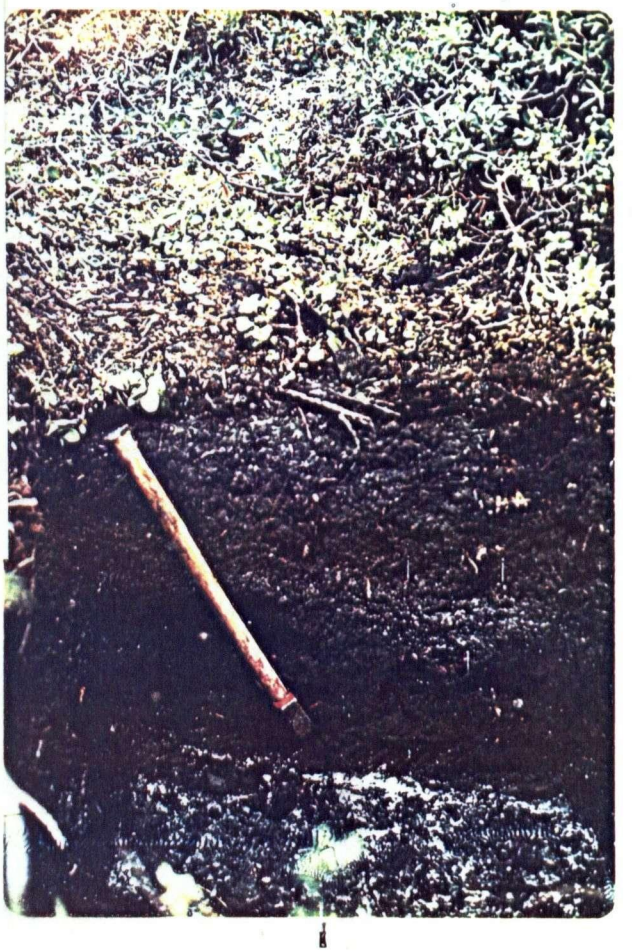




Figs. 43 & 44 Above is a typical community. Below is Salix myrtillifolia growing with the moss Aulacomnium palustre.

Black Spruce - Salix myrtillifolia - Aulacomnium





Figs. 45 & 46 The figure on the left shows an open stand of black spruce. The white flower is Parnassia palustris. On the right is a Cryic Mesisol. The axe is in frozen peat above the permafrost layer.

Black Spruce - Salix myrtillifolia - Aulacomnium



Figs. 47 & 48 Above, Arctostaphylos rubra, a characteristic species of this association. Below is Aulacomnium palustre, the most dominant moss. This species, along with Tomenthypnum nitens, indicate that this association is under the influence of minerotrophic water.



Plant Association 7

Black Spruce - *Salix myrtillifolia* - *Aulacomnium*

Aulacommio (palustris) - Tomenthypno (nitentis) - Equiseto (scirpoidis) - Ledo (groenlandici) - Salico (myrtillifoliae) - Nano-Piceetum marianae

In the Fort Nelson area the Black Spruce - *Salix myrtillifolia* - *Aulacomnium* association occurs in bog areas (as a low moor) under the influence of minerotrophic waters on Rego Gleysols or Cryic Mesisols. This association is not extensive around Fort Nelson, however, a variant of it is common in mountainous areas to the west and according to Jeffrey (1964) it is common in the Mackenzie lowlands in the Northwest Territories. When this association is projected on the edatopic grid, it occurs on hygric hygrotopes and mesotrophic to subeutrophic trophotopes.

Vegetation

In this plant association the tree layer is missing. Black spruce, which is considered only as a tall shrub, is the only constant dominant in the B_1 layer. *Ledum groenlandicum* and *Salix novae-angliae* dominate the B_2 layer in all communities

sampled. Salix myrtillifolia, which was considered to occupy the C layer, occurred exclusively in this plant association with a presence value of 100%. Other species which were always present in the C layer of the sampled communities are Vaccinium vitis-idaea, Equisetum scirpoides, E. arvense, Pedicularis labradorica, and Epilobium angustifolium. It is interesting to note that Parnassia palustris and Spiranthes romanzoffiana were two species which occurred exclusively in this association and that Arctostaphylos rubra and Senecio lugens rarely occurred in other communities.

A wide variety of mosses, liverworts, and lichens were found on the peat in this association (60 species) with Aulacomnium palustre, Hylocomium splendens, and Tomenthypnum nitens typically dominating the moss layer. The constancy of Tomenthypnum nitens especially indicates the validity of this plant association. Peltigera aphthosa and Cladina mitis were two lichens present in all the communities sampled. Cladonia gracilis and especially Cladina arbuscula sometimes had high species significance values which, along with Cladonia cornuta, Peltigera polydactyla and the previously mentioned lichens, comprised the majority of the lichen cover of the sampled communities.

Many species which occur in this bog association indicate the effects of minerotrophic waters. These would include Salix myrtillifolia, Equisetum arvense, Rubus pubescens, Senecio lugens, Petasites palmatus, Parnassia palustris, and especially Tomenthypnum nitens to name a few. Additionally, even some oligotrophic species such as Sphagnum fuscum are occasionally present. Nutritionally, the total vegetation was considered to be from mesotrophic to subeutrophic which would conform to what has been found in other parts of the boreal forest. In the Mackenzie lowlands Jeffrey (1964) describes a similar black spruce bog which he calls a "Black spruce, flats and lower slopes, forest" where the pH of the peat throughout the soil profile ranged from 7.0 - 8.0. In this association, the two most dominant mosses are Hylocomium splendens and Tomenthypnum nitens with Aulacomnium palustre playing a subordinate role.

Soils

Half of the soils found under the Black Spruce - Salix myrtillifolia - Aulacomnium association are Rego Gleysols without a permafrost layer and the other half are Cryic Mesisols, in which permafrost layers occur. The surface organic layers show a considerable range of pH's from 4.3 to 6.8 which could be expected since moss species range from

Sphagnum fuscum (occurring rarely) to Tomenthypnum nitens (occurring constantly) within individual communities. Tomenthypnum nitens is considered as a characteristic moss of soils with high base saturation. These soils originate from at least some calcareous parent materials.

The Cryic Mesisols have thick mesic peat horizons where the pH ranges from 5.8 to 6.7. The upper surface of permafrost layers in the soils of this association is generally deeper than in the Black Spruce - Sphagnum fuscum bogs. In general, the organic horizons have relatively high total nitrogen contents ranging from .97 to 1.78%, however, this is still slightly less than the total N content of the Mesic Luvisolic LFH (avg. 1.55%). The Rego Gleysols found in the above association are very similar to the Klowee Series of the Sikanni Terrain System (Valentine, 1971).

Alliance 5 Sphagno (fusci) - Rubo (chamaemori)
Piceion marianae Annas et Krajina

This alliance is related to the order Ledetalia palustris, described by Nordhagen (1936), or by Braun Blanquet (1948/50, chiefly 1949) or the Sphagnetalia fusci described by Tüxen (1955). In a narrower sense, such similar ecosystems were

placed in an alliance termed Sphagnion fusci by Braun Blanquet (1948/50, chiefly 1949) or by Tüxen (1955). In either case Picea mariana cannot play a role in Europe since it does not occur there.

Because in the Boreal White and Black Spruce zone of North America, most of the character species of the Piceetalia marianae are found in the high moor bogs, it would be difficult to separate two different orders, one of them on organic soils of high moor bogs and the other on mineral soils, over which acid mor humus is thin. Picea mariana is especially common in both of them enforcing that they should be termed as Piceetalia marianae.

This alliance and its only plant association are missing in the Sub-Boreal Spruce Zone.

PLANT ASSOCIATION 8

BLACK SPRUCE - SPHAGNUM FUSCUM

Sphagno (fusci) - Rubo (chamaemori) -
Oxyccoco (microcarpi) - Ledo
(groenlandici) - Piceetum marianae

Characteristic Combination of Species

Layer	Constants (presence > 60%) * characteristic	Characteristic non - constants > II
Tree	Picea mariana	
	Larix laricina	
Shrub	Ledum groenlandicum	
	Chamaedaphne calyculata	
Herb	Vaccinium vitis-idaea	Eriophorum vaginatum
	Rubus chamaemorus*	
	Oxycoccus microcarpus	
	Drosera rotundifolia	
	Andromeda polifolia	
Moss	Sphagnum fuscum*	
	Cladina mitis	
	Pleurozium schreberi	
	Cladonia cornuta*	
	Dicranum undulatum	
	Icmadophila ericetorum*	
	Cladina rangiferina	
	Mylia anomala*	
	Peltigera canina	
	Calypogeia sphagnicola*	
	Cephalozia connivens*	
	Cladonia gonecha*	
	Hylocomium splendens	
	Aulacomnium palustre	
	Cetraria nivalis	
	Polytrichum strictum	

Table 32

BLACK SPRUCE - SPHAGNUM FUSCUM

Sphagno (fusci) - Rubo (chamaemori) -

Oxyccoco (microcarpi) - Ledo

(groenlandici) - Piceetum marianae

Plot No.	27	46	93	94	95
Elevation in M	380	365	425	425	425
Latitude	58° 47'	58° 46'	58° 43'	58° 42'	58° 43'
Longitude	122° 43'	122° 38'	122° 42'	122° 22'	122° 25'
Exposure	-	-	-	-	-
Slope Gradient %	0	0	0	0	0
Percent coverage					
Total A	20	-	-	5	-
A_1	5	-	-	-	-
A_2	10	-	-	-	-
A_3	6	-	-	5	-
Total B	25	90	72	70	65
B_1	+	31	3	14	15
B_2	25	78	70	62	55
C	25	28	19	22	30
Dh	95	90	96	92	90
Dw	+	-	+	+	-
Plot Coverage %					
Litter	95	96	98	98	97
Decaying Wood	1	-	+	+	+
Mineral Soil	-	-	-	-	-
Rock	-	-	-	-	-
Hygrotope	Hygric				
Trophotope	Oligotrophic				
Parent Material	Organic				

Table 33

BLACK SPRUCE - SPHAGNUM FUSCUM

PLOT NUMBER		027	046	093	094	095																P	MS	RS
ST NO.	SPECIES	SPECIES SIGNIFICANCE AND VIGOR																						
A1																								
1	LARIX LARICINA	3.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.5	3-3
2	PICEA MARIANA	3.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.5	3-3
A2																								
	PICEA MARIANA	4.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	2.4	4-4
	LARIX LARICINA	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
A3																								
	PICEA MARIANA	4.1	.	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	3.2	4-4
B1																								
	PICEA MARIANA	3.1	6.1	7.1	5.2	5.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.7	3-7
	LARIX LARICINA	.	2.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
3	PINUS CONTORTA	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
4	SALIX BEBBIANA	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
B2																								
5	LEDUM GROENLANDICUM	8.2	8.2	5.2	7.2	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	7.7	5-8
	PICEA MARIANA	4.1	6.1	7.1	5.1	5.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.8	4-7
6	CHAMAECAPHNE CALYCULATA	+.2	3.2	2.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	2.2	+-3
	LARIX LARICINA	1.1	1.1	.	1.1	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	1.2	+-1
7	BETULA GLANDULOSA	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
8	SALIX GLAUCA	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
	SALIX BEBBIANA	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
9	VACCINIUM CAESPITOSUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
C																								
10	VACCINIUM VITIS-IDAEA	5.2	4.2	4.2	4.2	6.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.2	4-6
11	RUBUS CHAMAEMORUS	1.2	5.2	4.2	3.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.1	+-5
12	OXYCOCCUS MICROCARPUS	1.2	2.2	2.2	2.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.2	1-2
13	DROSERA ROTUNDIFOLIA	1.2	1.2	+.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	1.2	+-1
14	ANDROMEDA POLIFOLIA	+.2	1.2	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.5	+-1
15	ERIOPHORUM VAGINATUM	.	1.2	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.2	1-2
16	SMILACINA TRIFOLIA	.	+.1	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
17	EQUISETUM SYLVATICUM	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	3.4	5-5
18	GEOCAULON LIVIDUM	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
19	CAREX AQUATILIS	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
20	OXYCOCCUS PALUSTRIS	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
DH																								
21	SPHAGNUM FUSCUM	8.	6.	8.	5.	7.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	7.5	5-8
22	CLADINA MITIS	5.	+.	4.	5.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.0	+-5
23	PLEUROZIUM SCHREBERI	+.	5.	2.	+.	5.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.4	+-5
24	CLADONIA CORNUTA.	3.	1.	+.	4.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.1	+-4
25	DICRANUM UNDULATUM	+.	+.	+.	+.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	+.9	+-1
26	ICMADOPHILA ERICETORUM	.	+.	4.	3.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	3.2	+-4
27	CLADINA RANGIFERINA	3.	+.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	1.7	+-3
28	MYLIA ANOMALA	+.	.	+.	+.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.7	+-1

Table 34

PLOT NUMBER		027	046	093	094	095																								
ST NO.	SPECIES	SPECIES SIGNIFICANCE AND VIGOR																										P	MS	RS
29	PELTIGERA CANINA	+.	+.	+.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.7	+-1
30	CALYPOGEIA SPHAGNICOLA	+.	.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
31	CEPHALOZIA CONNIVENS	+.	.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
32	CLADONIA GONECHA	+.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
33	HYLOCOMIUM SPLENDENS	+.	3.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.6	+-3
34	AULACOMNIUM PALUSTRE	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
35	CETRARIA NIVALIS	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
36	POLYTRICHUM STRICTUM	+.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
37	SPHAGNUM SUBFULVUM	4.	.	.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	3.2	4-4
38	SPHAGNUM RECURVUM	.	3.	.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	3.0	3-4
39	CLADONIA GRACILIS	+.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.4	+-4
40	SPHAGNUM CAPILLACEUM	.	1.	.	.	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.2	1-2
41	CLADONIA FIMBRIATA	+.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
42	PELTIGERA APHTHOSA	1.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
43	SPHAGNUM MAGELLANICUM	.	1.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
44	CEPHALOZIELLA SUBDENTATA	.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
45	CLADINA ARBUSCULA	.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
46	CLADONIA PLEUROTA	.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
47	PELTIGERA POLYDACTYLA	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
48	SPHAGNUM SUBNITENS	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.5	3-3
49	CLADINA ALPESTRIS	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
50	CLADONIA UNCIALIS	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
51	BARBILOPHOZIA BARBATA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
52	BRYUM PSEUDOTRIQUETRUM	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
53	CEPHALOZIA MACROSTACHYA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
54	CEPHALOZIA PLENICEPS	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
55	CETRARIA VIRIDIS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
56	CLADONIA COCCIFERA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
57	CLADONIA DEFORMIS	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
58	CLADONIA MULTIFORMIS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
59	DICRANUM ACUTIFOLIUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
60	GEOCALYX GRAVEOLENS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
61	JAMESONIELLA AUTUMNALIS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
62	LOPHOZIA MARCHICA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
63	PELTIGERA MALACEA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
64	POHLIA NUTANS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
65	POLYTRICHUM JUNIPERINUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
DW																														
	PELTIGERA POLYDACTYLA	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
	CALYPOGEIA SPHAGNICOLA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
66	CEPHALOZIELLA DIVARICATA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	CEPHALOZIELLA SUBDENTATA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	JAMESONIELLA AUTUMNALIS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	LOPHOZIA MARCHICA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
67	PHILONOTIS FONTANA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	POHLIA NUTANS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	POLYTRICHUM STRICTUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+

Table 34 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 46 CRYIC SPHAGNO-FIBRISOL — BUCKINGHORSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
46- 1	OF	000-030	3.7	89.0	51.60	0.60	86.0	44	8.75	3.00	0.0	1.62	71.00	20.1					
46- 2	OFZ	030- +	3.7	90.0	52.20	0.78	66.9	8	12.50	1.50	0.0	0.0	84.00	17.0					

PLOT 28 SPHAGNO-FIBRISOL — BUCKINGHORSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
28- 1	OF1	000-016	3.9	91.0	52.80	0.46	114.8	108	18.75	5.12	0.0	1.12	169.00	15.0					
28- 2	OF2	016-035	3.9	92.9	53.90	0.54	99.8	026	26.25	6.75	0.0	0.13	134.00	24.9					
28- 3	OF3	035-052	4.0	92.9	53.90	0.75	71.9	012	40.00	8.00	0.0	0.0	98.00	49.6					
28- 4	OF4	052- +	4.2	96.0	52.20	0.63	82.9	010	36.25	7.12	0.0	0.0	114.00	38.5					

PLOT 27 CRYIC SPHAGNO-FIBRISOL — BUCKINGHORSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
27-15	OF	000-042																	
27-14	OFZ	042-081	4.7	87.9	51.00	0.89	57.3	020	45.00	5.75	0.0	0.25	68.00	75.4					
27-13	OM1	081-085	5.3	72.1	41.80	0.99	42.2	008	56.25	5.87	0.0	0.0	139.50	44.7					
27-12	OM2	085-101	5.7	77.9	45.20	1.00	45.2	008	62.50	5.87	0.0	0.0	153.00	44.8					
27-11	CG	101- +	6.9	1.3	0.73	0.04	18.2	008	12.00	2.35	0.05	0.37	16.30	90.6	10YR53	10YR33	14	70	14 SIL *

PLOT 27 CRYIC SPHAGNO-FIBRISOL — BUCKINGHORSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
27-25	OF	000-031	4.1	87.9	51.00	0.60	85.0	132	22.50	3.37	0.0	1.25	74.00	36.8					
27-23	OFZ	031-038	5.6	82.1	47.60	0.85	56.0	008	70.00	7.00	0.0	0.0	115.00	67.3					
27-22	OM	038-056		72.1	41.80	0.79	52.9	010	65.00	6.12	0.0	0.0	123.00	58.0					
27-26	CG	056- +	6.3	2.9	1.70	0.08	21.3	016	15.00	2.32	0.0	0.32	13.90	100.0	10YR52	10YR33			

Table 35

Black Spruce - Sphagnum fuscum



Fig. 49 Relatively good growth of black spruce (up to 12 m tall) with Sphagnum fuscum over permafrost south of Fort Nelson.



Fig. 50 A tightly packed Sphagnum fuscum mound with Oxycoccus microcarpus in fruit.

Black Spruce - Sphagnum fuscum

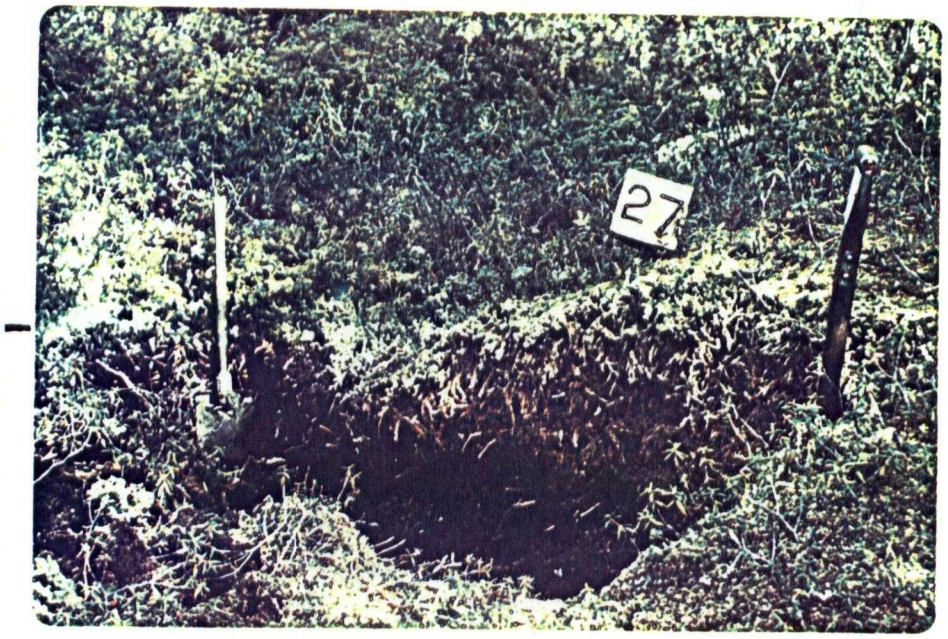


Fig. 51 A growing colony of Icmadophila ericetorum over a mound of Sphagnum fuscum. Here the various Cladonia and Cladina species are not growing on the highest mounds but in troughs between actively growing Sphagnum.

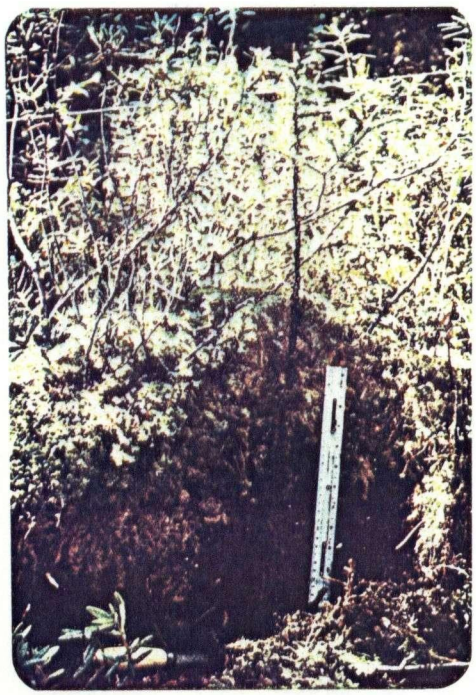


Fig. 52 An old colony of Icmadophila ericetorum paving the way for further expansion of lichens onto a Sphagnum mound.

Black Spruce - Sphagnum fuscum



Figs. 53 & 54 Above, a Cryic Sphagno Fibrisol. Shovels are sitting on permafrost. Below, the knife, in the bottom of the picture, shows the germination point of the small black spruce. As the Sphagnum mound grows in height, black spruce develops adventitious roots on the stem, an adaptation for bog conditions.



Plant Association 8

Black Spruce - *Sphagnum fuscum*

Sphagno (fusci) - Rubo (chamaemori) - Oxyccoco (microcarpi) - Ledo (groenlandici) - Piceetum marianae

The Black Spruce - *Sphagnum fuscum* association is the most characteristic vegetation of plateau bogs (sensu Tarnocai, 1974) in the Fort Nelson area. These plateau bogs are very common over the poorly drained fine textured mineral parent materials of the flat or gently undulating topography of the Fort Nelson lowlands. Permafrost was found under all communities examined in this association. When projected on the edatopic grid the Black Spruce - *Sphagnum fuscum* occurs on hygric hygrotopes and on oligotrophic to submesotrophic trophotopes (under ombrotrophic conditions).

Vegetation

Growth of trees is very poor and often can be considered to reach only shrub size. *Picea mariana* dominates the tree and shrub layers while, *Larix laricina*, although generally present, is only a minor component.

Characteristic shrubs, which are also indicative of oligotrophic conditions, are Ledum groenlandicum and Chamaedaphne calyculata. The first species was present in all plots with an average species significance of 7.7 while Chamaedaphne calyculata, which was present in 80% of the plots, had an average species significance of 2.2. However, Chamaedaphne calyculata occurs as a constant species in two other plant associations, one belonging to the Laricetalia Laricinae and another to the Sphagno (magellanici) - Scheuchzerietalia palustris, in which it occurs with its highest species significance. Both plant associations will be discussed later.

The herb layer, which is usually composed of only a few species, has Vaccinium vitis-idaea, Rubus chamaemorus, and Oxycoccus microcarpus constantly present, the first two with high species significance values. Drosera rotundifolia is generally present, being especially common when very wet microsites are present in the communities. Andromeda polifolia, also frequently present, is a small shrub, but like Vaccinium vitis-idaea, is included in the herb layer.

The most characteristic moss of this association is Sphagnum fuscum which is the major biomass contributor towards the buildup of high moors in the Fort Nelson area.

Generally the surface of these communities consist of low mounds of Sphagnum fuscum, varying in size but generally 30 - 40 cm high. Sphagnum fuscum, being the most oligotrophic moss, is particularly well adapted for growing upwards being supplied mainly by rainwater. This is why Sphagnum fuscum can build mounds, frequently well above the surface of the water table. The other species of Sphagnum (S. recurvum, S. magellanicum, S. subfulvum, and S. subnitens) found in this association are usually never growing on the apex or raised mounds. According to Krajina (pers. comm.) only S. capillaceum may participate in building these mounds. The liverworts, Calypogeia sphagnicola, and Cephalozia connivens, as well as the moss Polytrichum strictum, are generally found associated with Sphagnum fuscum on the mounds. In some areas it was noted that Sphagnum fuscum had grown too high above the water table to maintain sufficient water for its own growth and was replaced by feather mosses, especially Pleurozium schreberi and Hylocomium splendens. In one instance, this condition was found in a mound in the order of two meters high and resembled a palsa mound, however, the well developed palsas found in the Yukon and described from many northern areas throughout Canada were not found at Fort Nelson.

The development of Sphagnum fuscum into mounds which subject the Sphagnum to moisture stress and subsequent in-

vasion by other species is an interesting phenomenon. Sphagnum fuscum, which grows in a very tightly packed fashion when it is in a relatively dry position is subject to smothering by the lichen Icmadophila ericetorum which can expand over and kill the Sphagnum, allowing it to decay. Additionally, immediately below the surface of a growing colony of Icmadophila, the Sphagnum is more highly decomposed than at greater depths. This suggests that Icmadophila, through its smothering effects on the living cells of Sphagnum fuscum, additionally promotes conditions for the decomposition of the Sphagnum. As the colonies of Icmadophila grow older and expand outwards, the older portions die, dry out and allow lichens such as Cladina mites, Cladonia cornuta and others to occupy the site. It does not appear that Icmadophila ever expands back over areas it once occupied. Once the Sphagnum has died, the surface usually becomes very dry (under dry weather conditions) producing microsites mainly suitable for lichen growth. Additionally, once the Sphagnum has died, it can subside or sink due to compression of the weakened dead cell walls. This will partially account for depressions to develop. The living Sphagnum can, however, continue to grow into higher mounds maintaining sufficient moisture to continue growth. The permafrost also grows higher with the insulating effect of the Sphagnum mounds which can eventually drain enough water into the depressions to allow Sphagnum subnitens,

S. subfulvum etc. to again reinvade lichen sites while the mound tops are subject to increasing moisture stress. In this manner, microsite mounds and depressions are never at dynamic equilibrium but are continuously succeeding each other. This process appears to be frequent in the Fort Nelson area. The following diagram illustrates a cross section of one such community with a rather unusually thin permafrost layer.

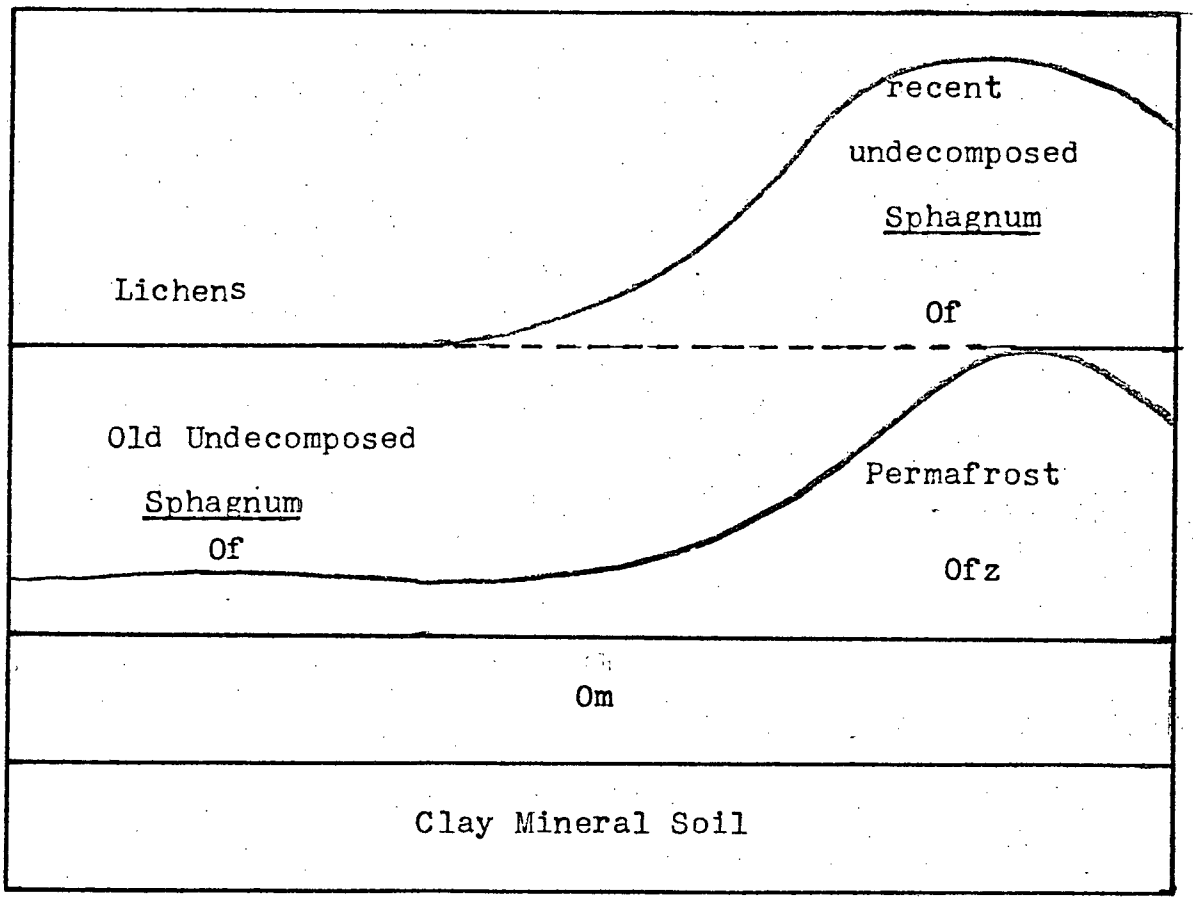


Figure 55 Cross-section of a Cryic Fibrisol (Plot 27)

Lewis and Dowding (1926) describe similar peat areas where lichens are in depressions between Sphagnum mounds in bogs near Edmonton, Alberta, however, they have not mentioned the involvement of Icmadophila ericetorum.

Variations of the Black Spruce - Sphagnum fuscum association have been described under various names for many areas throughout the boreal forest. Equivalent terms are as follows: "Black Spruce - Peat Moss Association" for Alberta (conforms in part) (Moss, 1953); "Muskeg" for Saskatchewan (Jeglum, 1972); "Black Spruce - Sphagnum types" for Manitoba (Tarnocai, 1974); "Sphagnum fuscum phase of the Black Spruce / Leather-leaf site type" in Ontario (Jeglum et al., 1974); "Spruce / Sphagnum type" for Labrador (Wilton, 1965). Additional terms have been used by various other authors.

In the discussion about the alliance Sphagno (fusci) - Rubo (chamaemori) - Piceion marianae, it has been stressed that European high moors are without any spruce. It might be worth pointing out that in the arctic tundras of North America, Sphagnum fuscum is replaced by Sphagnum lenense (Krajina, pers. comm.).

Soils

The soils of the Black Spruce - Sphagnum fuscum association are similar, but not identical, to soil members described by Valentine (1971) for the Klua Complex which occupies extensive areas east of Fort Nelson. The two soils described by Valentine, for this complex, are Cryic Fibric Mesisols and Cryic Fenno-Fibrisols and are probably the most common soils, however, the area mapped as the Klua Complex additionally contains Cryic Sphagno Fibrisols where undecomposed Sphagnum peat is present to the permafrost layer.

In the soils examined under the Black Spruce - Sphagnum fuscum association, permafrost was found at depths below 30 - 50cm. All the soils were classified as Cryic Sphagno Fibrisols. Some of the soils examined had Om layers, however, they were either in the permafrost or were too thin to affect the classification. The presence of Om layers or sedge peat at depths, as indicated by Valentine, suggests that the soils have undergone succession from a previously richer nutritional state to the present poor nutritional state. This fits well with the classical explanation for the development of high moor or ombrotrophic peatland (sensu Sjors, 1961) from low moor bogs or fens.

Only two soils were chemically analyzed, however, the general characteristics of these Cryic Sphagno Fibrisols can be outlined. These soils are extremely acidic with low N for organic soils, high C/N ratios, high C.E.C., and low base saturations. These are the characteristics expected of ombrotrophic peatlands. Results of the analysis are presented in Table 35.

ORDER III

Laricetalia laricinae Annas et Krajina

The laricetalia laricinae, when projected on the edatopic grid, occupies subhygric to hygric hygrotopes and subeutrophic trophotopes. Soils are represented by mesisols and humisols of the organic order and by gleysols from mineral soils. Since the order, which has some close relationships with the Piceetalia marianae, contains only one alliance (no. 6) the order and alliance vegetation and environmental characteristics are the same.

This order occurs in the Sub-Boreal Spruce zone but has not been studied there. The Laricetalia laricinae is well represented in other parts of the Boreal White and Black Spruce zone, as in Eastern Canada, however, its evaluation as a higher synsystematic unit (as an order) is presented here for the first time. This order, however, has no counterpart in Europe.

Order and alliance character species are as follows:

Larix laricina	Carex tenuiflora
Pyrola asarifolia	Sphagnum capillaceum

Carex paupercula	Bryum pseudotriquetrum
Smilacina trifolia	Calliergidium pseudostramineum
Carex dioica	Plagiomnium rugicum
Carex leptalea	Calliergon richardsonii
Equisetum arvense	Campylium stellatum
Carex disperma	Dicranum acutifolium
Potentilla palustris	

There are two plant associations (no. 9 and no. 10) belonging to the alliance Menyantho (trifoliatae) - Laricion laricinae and order Laricetalia laricinae whose descriptions follow.

PLANT ASSOCIATION 9

TAMARACK - SWAMP BIRCH - MENYANTHES

Sphagno (capillacei - recurvi) - Menyantho (trifoliatae) - Pyrolo (asarifoliae) - Oxyccoco (palustris) - Betulo (glanduliferae) - Laricetum laricinae

Characteristic Combination of Species
(from 4 plots only)

Layer	Constants (presence > 60%) * characteristic	Characteristic non - constants
Tree	Larix Laricina	
Shrub	Betula glandulifera*	Salix pedicellaris
	Chamaedaphne calyculata	
	Ledum groenlandicum	
	Myrica gale	
	Picea mariana	
Herb	Menyanthes trifoliata	Equisetum fluviatile
	Oxycoccus palustris*	Habenaria hyperborea
	Pyrola asarifolia	
	Carex paupercula	
	Carex dioica	
	Carex aquatilis	
	Drosera rotudifolia	
	Carex interior*	
	Smilacina trifolia	
	Vaccinium vitis-idaea	
	Utricularia intermedia	
	Habenaria dilatata*	
Moss	Sphagnum capillaceum	
	Aulacomnium palustre	
	Calliergon stramineum*	
	Sphagnum recurvum	
	Calliergon giganteum	
	Paludella squarrosa*	
	Drepanocladus revolvens*	
	Bryum pseudotriquetrum	
	Meesia triquetra*	
	Tomenthypnum nitens	

Table 36

TAMARACK - SWAMP BIRCH - MENYANTHES

Sphagno (capillacei - recurvi) - Menyantho (trifoliatae) - Pyrolo (asarifoliae) - Oxyccoco (palustris) - Betulo (glanduliferae) - Laricetum laricinae

Plot No.	53	76	77	78
Elevation in M	430	430	430	430
Latitude	58° 40'	58° 40'	58° 39'	58° 40'
Longitude	122° 43'	122° 44'	122° 44'	122° 44'
Exposure	-	-	-	-
Slope Gradient %	0	0	0	0
Percent coverage				
Total A	25	25	16	25
A_1	10	10	5	10
A_2	8	15	7	15
A_3	7	12	7	15
Total B	85	87	70	90
B_1	7	6	3	7
B_2	80	85	68	87
C	72	65	68	85
Dh	88	93	91	87
Dw	1	+	-	+
Plot coverage %				
Litter	97	94	95	95
Decaying Wood	1	2	2	1
Mineral Soil	-	-	-	-
Rock	-	-	-	-
Hygrotope	Hygric - Subhydric			
Trophotope	Subeutrophic			
Parent Material	Organic			

Table 37

TAMARACK - SWAMP BIRCH - MENYANTHES

BOREAL WHITE & BLACK SPRUCE ZONE

ST	NO.	SPECIES	SPECIES SIGNIFICANCE AND VIGOR																				P	MS	RS
		PLOT NUMBER	053	076	077	078																			
A1																									
	1	LARIX LARICINA	4.2	4.2	4.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.5	4-4
A2																									
		LARIX LARICINA	4.2	5.2	4.2	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.1	4-5
A3																									
		LARIX LARICINA	4.2	5.2	4.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.0	4-5
	2	PICEA MARIANA	1.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.3	1-1
B1																									
		LARIX LARICINA	2.1	.	2.0	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	1.8	1-2
		PICEA MARIANA	2.1	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.6	2-2
	3	BETULA GLANDULIFERA	.	4.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	2.7	4-4
	4	BETULA RESINIFERA	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	1.8	3-3
B2																									
		BETULA GLANDULIFERA	7.3	8.3	8.3	8.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	8.2	7-8
	5	CHAMAEDAPHNE CALYCULATA	3.2	4.2	4.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.3	3-4
		LARIX LARICINA	2.2	3.2	5.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.2	2-5
	6	LEDUM GROENLANDICUM	2.2	1.2	1.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	1.6	1-2
	7	MYRICA GALE	5.2	8.2	.	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	6.6	5-8
		PICEA MARIANA	1.1	.	1.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	1.6	1-2
	8	SALIX PEDICELLARIS	.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	1.8	3-3
C																									
	9	MENYANTHES TRIFOLIATA	8.3	5.3	6.2	8.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	7.5	5-8
	10	OXYCOCCUS PALUSTRIS	4.3	4.3	3.2	3.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.1	3-4
	11	PYROLA ASARIFOLIA	2.3	5.3	2.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.0	1-5
	12	CAREX PAUPERCULA	+.2	4.2	2.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.0	+-4
	13	CAREX DIOICA	2.2	3.2	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	3.3	2-4
	14	CAREX AQUATILIS	.	4.2	3.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	3.2	1-4
	15	DROSERA ROTUNDIFOLIA	.	3.3	3.2	2.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	2.9	2-3
	16	CAREX INTERIOR	.	3.2	2.2	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	2.5	2-3
	17	SMILACINA TRIFOLIA	1.2	.	2.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	2.3	1-3
	18	VACCINIUM VITIS-IDAEA	1.2	1.2	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	1.3	1-1
	19	UTRICULARIA INTERMEDIA	+.2	1.2	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	1.1	+-1
	20	HABENARIA DILATATA	.	1.2	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	+.8	+-1
	21	ANDROMEDA POLIFOLIA	+.2	.	6.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	4.4	+-6
	22	CAREX DIANDRA	.	3.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	2.2	2-3
	23	CAREX LEPTALEA	+.	.	.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.8	+-3
	24	EQUISETUM FLUVIATILE	+.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.8	+-3
	25	TRIGLOCHIN MARITIMA	.	+.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.1	+-2
	26	EQUISETUM ARVENSE	+.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
	27	GALIUM TRIFIDUM	.	+.3	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
	28	HABENARIA HYPERBOREA	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
	29	LISTERA CORDATA	+.2	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
	30	POTENTILLA PALUSTRIS	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	1.1	2-2
	31	PEDICULARIS LABRADORICA	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.3	1-1

Table 38

PLOT NUMBER	053	076	077	078																								
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																										P	MS	RS
32 PECICULARIS MACROCONTA	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.3	1-1
33 CAREX DISPERMA	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
34 CAREX ROSTRATA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
35 CAREX TENUIFLORA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
36 ERIOPHORUM GRACILE	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
37 ERIOPHORUM VIRIDI-CARINATUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
38 GALIUM PALUSTRE	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
39 HABENARIA OBTUSATA	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
40 OXYCOCCUS MICROCARPUS	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
41 PEDICULARIS PARVIFLORA	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
42 PYROLA CHLORANTHA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
43 UTRICULARIA MINOR	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
44 VIOLA EPIPSILA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
OH																													
45 SPHAGNUM CAPILLACEUM	4.	6.	5.	6.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.7	4-6
46 AULACOMNIUM PALUSTRE	+.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	+.5	+-+
47 CALLIERGON STRAMINEUM	+.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	+.5	+-+
48 SPHAGNUM RECURVUM	.	1.	8.	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	5.4	1-8
49 CALLIERGON GIGANTEUM	5.	4.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	4.6	4-5
50 PALUDELLA SQUARROSA	.	4.	4.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	3.5	+-4
51 DREPANOCLADUS REVOLVENS	.	3.	+.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	3.2	+-4
52 BRYUM PSEUDOTRIQUETRUM	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	+.2	+-+
53 MEESIA TRIQUETRA	.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	+.2	+-+
54 TOMENTHYPNUM NITENS	.	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	+.2	+-+
55 PLEUROZIUM SCHREBERI	6.	.	.	5.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	5.1	5-6
56 POLYTRICHUM JUNIPERINUM	4.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	3.1	3-4
57 HYLOCOMIUM SPLENDENS	2.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	2.2	2-3
58 DREPANOCLADUS VERNICOSUS	.	3.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.8	+-3
59 CALLIERGIDIUM PSEUDOSTRAMINEUM	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
60 DICRANUM UNDULATUM	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
61 PLAGIOMNIUM RUGICUM	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
62 POHLIA NUTANS	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
63 SPHAGNUM FUSCUM	.	.	.	6.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	4.4	6-6
64 SPHAGNUM SUBNITENS	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	1.1	2-2
65 CLADINA ALPESTRIS	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.3	1-1
66 CLADINA MITIS	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.3	1-1
67 CLADINA RANGIFERINA	.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.3	1-1
68 CALLIERGIDIUM PSEUDOSTRAMINEUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
69 CALLIERGON RICHARDSONII	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
70 CALLIERGON SARMENTOSUM	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
71 CALYPOGEIA SPHAGNICOLA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
72 CAMPYLIUM STELLATUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
73 CEPHALOZIA CONNIVENS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
74 CINCLIDIUM STYGIUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
75 DICRANUM ACUTIFOLIUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
76 DREPANOCLADUS TUNDRAE	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
77 LEIOCOLEA RUTHEANA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
78 MEESIA ULIGINOSA	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
79 POHLIA SPHAGNICOLA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+

Table 38 (continued)

TAMARACK - SWAMP BIRCH - MENYANTHES

ST NO.	SPECIES	053	076	077	078																P	MS	RS
Dh																							
80	DICRANUM TAURICUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
81	GEOCALYX GRAVEOLENS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
82	JAMESONIELLA AUTUMNALIS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
83	LEPIDOZIA REPTANS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
84	TETRAPHIS GENICULATA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+

Table 38 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

TERRAIN SYSTEM AFTER VALENTINE (1971)

BOREAL WHITE & BLACK SPRUCE ZONE

PLOT 53 TYPIC MESISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	TEXTURE %SI	TEXTURE %C
53- 1	OM1	000-030	6.0	92.9	53.90	2.01	26.8	006	57.50	9.87	0.0	0.50	96.00	71.5					
53- 2	OM2	030- +	5.6	91.0	52.80	2.58	20.5	006	60.00	10.50	0.0	0.0	96.00	73.7					

PLOT 76 TYPIC MESISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	TEXTURE %SI	TEXTURE %C
76- 1	OF	000-015	6.0	92.1	53.40	1.54	34.7	072	52.50	14.12	0.0	2.00	91.00	76.4					
76- 2	OM	015- +	5.6	84.0	48.70	1.85	26.3	<1	70.00	11.12	0.0	0.0	105.00	77.6					

PLOT 77 TYPIC MESISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	TEXTURE %SI	TEXTURE %C
77- 1	OF	000-013	6.3	91.0	52.80	1.01	52.3	006	51.25	12.87	0.0	1.00	77.00	85.1					
77- 2	OM	013- +	5.6	87.1	50.50	1.72	29.4	002	52.50	9.50	0.0	0.0	91.00	68.4					

PLOT 78 TYPIC MESISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	TEXTURE %SI	TEXTURE %C
78- 1	OF	000-012	6.5	82.1	47.60	1.22	39.0	014	61.25	11.75	0.0	0.50	76.00	96.9					
78- 2	OM1	012-030	5.9	74.1	43.00	2.34	18.4	<1	58.75	9.12	0.0	0.0	153.00	44.4					
78- 3	OM2	030- +	5.4	67.9	39.40	1.96	20.1	002	56.25	8.87	0.0	0.0	163.00	40.0					

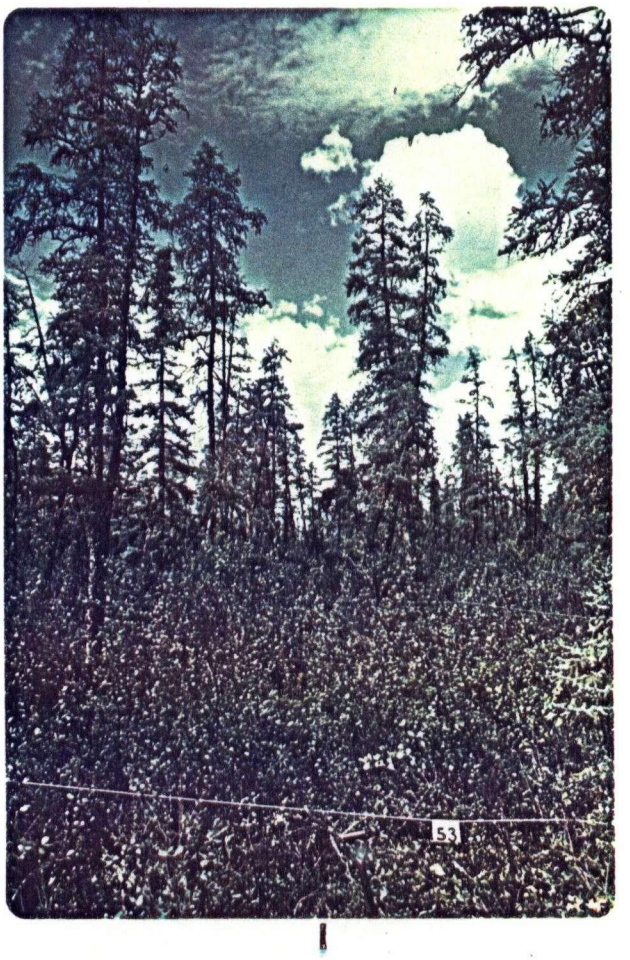
Table 39

Tamarack - Swamp Birch - Menyanthes



Fig. 56 A Tamarack - Swamp Birch - Menyanthes community south of Fort Nelson. These communities are often referred to as "treed fens".

Tamarack - Swamp Birch - Menyanthes



Figs. 57 & 58 A 12 meter tall stand of Larix laricina. Betula glandulifera dominates the shrub layer. Below is Menyanthes trifoliata growing in a shallow pool.



Plant Association 9

Tamarack - Swamp Birch - Menyanthes

Sphagno (capillacei - recurvi) - Menyantho (trifoliatae) - Pyrolo (asarifoliae) - Oxycocco (palustris) - Betulo (glanduliferae) - Laricetum laricinae

The Tamarack - Swamp Birch - Menyanthes association occurs where minerotrophic waters are up to the surface for most of the year. In this study, this association (a transition or treed fen) appears to be a fairly advanced stage of succession from an originally small stream fed lake. This association occupies hygric hygrotopes and subeutrophic trophotopes. Since only 4 plots were established to represent this association, all within one square kilometer, applying the results over larger areas must be done with caution.

Vegetation

The tree layer is dominated by poorly growing Larix laricina with the occasional Picea mariana present in the understory. Betula glandulifera, an association character species, dominated the B_2 layer with an average species significance of 8.2. Chamaedaphne calyculata and Larix

laricina, which were present in the B_2 layer of all the plots, had species significances of 4.3 and 4.2 respectively. The above species, along with Myrica gale, which was present in 3 of the 4 plots with an average species significance of 6.6, comprised most of the B_2 layer. Although Ledum groenlandicum, a characteristic oligotrophic plant, is present in all plots, its cover value is small and its occurrence limited to hummocks (possibly started over decaying wood) or higher irregularities on the community floor.

Menyanthes trifoliata, with an average species significance of 7.5, dominates the herb layer. Moore and Bellamy (1974) report that M. trifoliata is found from extremely poor to extremely rich fens in European mires, however, it reaches its best development in rich fens in the Fort Nelson area. This corresponds to the findings of Jeglum (1971) for the Candle Lake area of Saskatchewan where Menyanthes trifoliata develops best under subeutrophic (pH 6.0 - 6.9) conditions. Other dominant species present in all the sample plots are Oxycoccus palustris, Pyrola asarifolia, and Carex paupercula which, along with C. dioica and C. aquatilis comprise most of the herb layer. Utricularia intermedia and Triglochin maritima are additional indicators of very rich fen conditions.

In terms of average species significance for the sample plots, the moss layer is dominated by Sphagnum capillaceum S. recurvum, S. subnitens, Calliergon giganteum, Paludella squarrosa, and Drepanocladus revolvens. The last four species, plus Calliergon stramineum, which is present in all plots, are considered to be indicators of subeutrophic conditions in the Fort Nelson area. This generally agrees with the findings of Sjörs (1961) for Ontario and Jeglum (1971) for Saskatchewan. Sjörs (1961) reports that Paludella squarrosa, Drepanocladus tundrae, Campylium stellatum, and Leiocolea rutheana are rich fen indicators and that Meesia uliginosa is an extremely rich fen indicator both in Ontario and Fennoscandia. All these subeutrophic indicators are present in the Tamarack - Swamp Birch - Menyanthes association. Additional species which occur, such as Bryum pseudotriquetrum and Drepanocladus vernicosus, are also characteristic of subeutrophic conditions.

In addition to indicators of eutrophic conditions, certain species such as Pohlia sphagnicola, Calypogeia sphagnicola, and Cephalozia connivens are present which are more indicative of oligotrophic conditions of the Piceetalia marianae order. Moore and Bellamy (1974) report that there is no upward transfer of mineral rich water through a Sphagnum hummock and therefore, small oligotrophic environments are

present wherever these hummocks develop. This would account for the presence of the above species as well as the oligotrophic herbs and shrubs.

The Tamarack - Swamp Birch - Menyanthes association is similar to Jeglum's (1972) "Tamarack Swamp" in Saskatchewan and Tarnocai's (1974) "Larix - Carex Type of Horizontal Fen" in Manitoba or Knapp's (1965) open tamarack bog forest.

Soils

The Typic Mesisols of this association, which consists of mesic peat of undetermined depth, were not described by Valentine (1971). Generally the soils have a thin surface Of horizon overlying a more decomposed Om. The thickness of the Of varied, being deeper under Sphagnum and being essentially absent under the brown mosses. The pH of the surface horizon, under average conditions, is slightly acidic averaging 6.2. The underlying Om horizon is more acidic averaging 5.6 which is a usual trend in low moor organic soils. The C/N ratio of the surface horizon averaged 38, which is comparable to the LFH of the mesic luvisols (avg. 36) with the Om having a narrower ratio (avg. 24) which indicates the more advanced breakdown of organic matter in the Om. Ca and Mg contents of the soils

is high, due to minerotrophic waters which originally flowed over calcareous materials (Ca content ranged from 52 to 70 meq/100 gms and Mg from 9 to 14 meq/100 gms). These two cations are responsible for the high base saturation (ranging from 40 - 97%) of these organic soils. It is interesting to note the very low values of available P and exchangeable K. Potassium was not detected on the exchange complex of any of the Om layers.

PLANT ASSOCIATION 10

TAMARACK - BLACK SPRUCE - EQUISETUM ARVENSE

Hylocomio (splendentis) - Ptilio (cristae-castrensis) - Pleurozio (schreberi) - Equiseto (arvensis) - Mitello (nudae) - Smilacino (trifoliae) - Larico (laricinae) - Piceetum marianae

Characteristic Combination of Species

Layer	Constants (presence >60%) * characteristics	Characteristic non - constants II
Tree	Picea mariana	
	Larix laricina	
	Picea glauca	
Shrub	Salix bebbiana	Ribes glandulosum
	Alnus tenuifolia	Salix planifolia
	Ledum groenlandicum	
	Viburnum edule	
	Ribes triste	
	Ribes oxyacanthoides	
Herb	Equisetum arvense	Corallorhiza trifida
	Cornus canadensis	
	Mitella nuda	
	Carex disperma	
	Vaccinium vitis-idaea	
	Smilacina trifolia	
	Moneses uniflora*	
	Pyrola secunda	
	Equisetum pratense	
	Equisetum sylvaticum	
	Linnaea borealis	
	Rubus pubescens	
	Mertensia paniculata	
	Goodyera repens	
	Habenaria orbiculata*	
	Equisetum scirpoides	
	Calamagrostis canadensis*	
	Aralia nudicaulis	
	Petasites sagittatus*	
	Viola renifolia	
	Rubus chamaemorus	
	Epilobium angustifolium	
	Pyrola chlorantha	
Moss	Hylocomium splendens	Drepanocladus uncinatus
	Ptilium crista-castrensis	
	Pleurozium schreberi	
	Aulacomnium palustre	
	Peltigera aphthosa	
	Dicranum acutifolium	

Table 40

TAMARACK - BLACK SPRUCE - EQUISETUM ARVENSE

Hylocomio (splendentis) - Ptilio (cristae-castrensis) - Pleurozio (schreberi) - Equiseto (arvensis) - Mitello (nudae) - Smilacino (trifoliae) - Larico (laricinae) - Piceetum marianae

Plot No.	31	48	56	57	58
Elevation in M	455	475	470	470	470
Latitude	58°43'	58°37'	58°43'	58°43'	58°43'
Longitude	122°46'	122°40'	122°45'	122°45'	122°44'
~~Exposure~~	-	-	N	N	-
Slope Gradient %	0	0	3	3	0
Percent coverage					
Total A	65	61	75	77	40
A_1	25	15	13	17	15
A_2	30	20	33	25	20
A_3	22	26	34	40	15
Total B	45	20	14	20	20
B_1	40	15	5	14	13
B_2	8	12	11	11	10
C	80	70	78	78	73
Dh	80	75	83	85	77
Dw	10	5	4	6	11
Plot Coverage %					
Litter	80	87	86	85	79
Decaying Wood	14	6	7	7	15
Mineral Soil	+	-	-	-	-
Rock	-	-	-	-	-
Hygrotope	Hygric				
Trophotope	Subeutrophic				
Parent Material	Morainal Fluvial				

Table 41

TAMARACK - BLACK SPRUCE - EQUISETUM ARVENSE

ST NO.	SPECIES	031	048	056	057	058	P	MS	RS
	PLOT NUMBER								
A1									
1	PICEA MARIANA	4.2	.	3.2	4.2	4.3	80.0	4.0	3-4
2	PICEA GLAUCA	.	5.2	5.2	5.2	.	60.0	5.0	5-5
3	LARIX LARICINA	5.2	.	.	1.2	4.3	60.0	4.0	1-5
4	POPULUS BALSAMIFERA	.	2.2	.	.	.	20.0	1.0	2-2
A2									
	PICEA MARIANA	4.2	4.2	6.2	5.2	5.2	100.0	5.3	4-6
	LARIX LARICINA	5.2	1.2	2.2	.	.	60.0	3.6	1-5
	PICEA GLAUCA	.	5.2	.	4.2	.	40.0	4.0	4-5
5	BETULA RESINIFERA	3.2	.	.	.	.	20.0	1.5	3-3
	POPULUS BALSAMIFERA	.	3.2	.	.	.	20.0	1.5	3-3
A3									
	PICEA MARIANA	4.2	5.2	5.2	6.2	5.2	100.0	5.5	4-6
	BETULA RESINIFERA	5.2	.	4.2	.	.	40.0	4.0	4-5
	PICEA GLAUCA	.	2.2	.	4.2	.	40.0	2.6	2-4
6	BETULA PAPYRIFERA	.	+.1	.	2.2	.	40.0	1.0	+-2
	LARIX LARICINA	3.2	.	.	.	.	20.0	1.5	3-3
	POPULUS BALSAMIFERA	.	2.1	.	.	.	20.0	1.0	2-2
B1									
	PICEA MARIANA	2.2	3.2	4.2	5.2	4.2	100.0	4.5	2-5
7	SALIX BEBBIANA	5.2	3.1	1.2	2.2	.	80.0	3.8	1-5
8	ALNUS TENUIFOLIA	4.2	5.2	.	.	3.2	60.0	4.1	3-5
	BETULA RESINIFERA	4.2	.	.	.	.	20.0	2.4	4-4
9	SALIX ARBUSCULOIDES	.	.	.	1.2	.	20.0	+.2	1-1
10	SALIX PYRIFOLIA	.	+.1	.	.	.	20.0	+.0	+-+
B2									
11	LECUM GRCENLANDICUM	3.2	2.1	1.1	4.2	1.2	100.0	3.2	1-4
12	VIBURNUM EDULE	+.1	2.1	4.2	1.1	1.1	100.0	2.9	+-4
13	ROSA ACICULARIS	.	4.2	4.2	2.2	4.2	80.0	3.5	2-4
	ALNUS TENUIFOLIA	3.2	3.2	.	.	1.2	60.0	2.4	1-3
14	RIBES TRISTE	.	+.2	1.2	.	2.2	60.0	1.2	+-2
15	RIBES OXYACANTHOIDES	.	+.2	.	+.1	1.2	60.0	+.5	+-1
	BETULA RESINIFERA	2.2	.	.	.	1.2	40.0	1.2	1-2
16	RIBES GLANDULOSUM	.	1.1	.	2.1	.	40.0	1.2	1-2
17	ALNUS CRISPA	.	+.2	.	2.1	.	40.0	1.0	+-2
18	SALIX PLANIFOLIA	1.2	.	.	.	+.	40.0	+.4	+-1
	POPULUS BALSAMIFERA	.	+.1	.	+.1	.	40.0	+.0	+-+
19	RIBES HUDSONIANUM	4.2	.	.	.	.	20.0	2.4	4-4
	PICEA MARIANA	3.2	.	.	.	.	20.0	1.5	3-3
20	SALIX NOVAE-ANGLIAE	.	.	.	2.2	.	20.0	1.0	2-2
21	LONICERA DIOICA	.	.	.	.	1.1	20.0	+.2	1-1
	SALIX BEBBIANA	.	1.1	.	.	.	20.0	+.2	1-1
22	CORNUS STOLONIFERA	.	+.2	.	.	.	20.0	+.0	+-+
	LARIX LARICINA	+.1	.	.	.	.	20.0	+.0	+-+
23	SALIX DRUMMONDIANA	.	.	.	.	+.	20.0	+.0	+-+

Table 42

PLCT NUMBER

SPECIES SIGNIFICANCE AND VIGOR

ST NO.	SPECIES	031	048	056	057	058															P	MS	RS
C																							
24	EQUISETUM ARVENSE	6.2	2.2	3.2	5.2	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.5	2-7
25	CORNUS CANADENSIS	4.2	5.2	5.2	5.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.2	4-5
26	MITELLA NUDA	4.2	4.2	4.2	2.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.1	2-4
27	CAREX CISPERMA	4.2	4.2	3.2	1.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.6	1-4
28	VACCINIUM VITIS-IDAEA	2.2	4.2	1.2	3.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.4	1-4
29	SMILACINA TRIFOLIA	4.2	+.	2.2	1.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.0	+-4
30	MONESES UNIFLORA	+.2	3.3	+.2	1.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	1.9	+-3
31	PYROLA SECUNDA	1.2	+.	1.2	1.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	1.4	+-1
32	EQUISETUM PRATENSE	+.2	1.2	7.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	4.9	+-7
33	EQUISETUM SYLVATICUM	.	5.3	5.2	3.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	4.8	3-5
34	LINNAEA BOREALIS	.	3.3	2.2	1.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	2.6	1-3
35	RUBUS PUBESCENS	.	3.2	2.2	1.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	2.3	1-3
36	MERTENSIA PANICULATA	.	1.2	2.2	+.1	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	1.3	+-2
37	GOODYERA REPENS	.	+.2	+.2	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
38	HABENARIA ORBICULATA	.	+.3	+.2	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
39	EQUISETUM SCIRPOIDES	.	2.2	3.2	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	3.8	2-5
40	CALAMAGROSTIS CANADENSIS	5.2	.	+.1	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	3.4	+-5
41	ARALIA NUDICAULIS	+.2	1.2	.	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	2.5	+-4
42	PETASITES SAGITTATUS	4.2	.	.	+.1	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	2.4	+-4
43	VIOLA RENIFOLIA	.	3.2	+.2	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.6	+-3
44	RUBUS CHAMAEMORUS	1.2	.	.	1.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	1.0	+-1
45	EPILOBIUM ANGUSTIFOLIUM	.	1.2	.	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.5	+-1
46	PYROLA CHLORANTHA	1.2	+.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.5	+-1
47	CAREX VAGINATA	2.2	.	.	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.6	2-4
48	PETASITES PALMATUS	.	4.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.6	2-4
49	CAREX PAUPERCULA	3.2	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.6	+-3
50	GALIUM BOREALE	2.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.0	+-2
51	RANUNCULUS LAPPONICUS	2.2	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.0	+-2
52	GALIUM TRIFLORUM	.	1.2	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.8	1-1
53	CAREX DIOICA	+.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
54	ACTAEA RUBRA	.	+.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
55	CAREX LEPTALEA	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
56	CIRCAEA ALPINA	.	+.2	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
57	CORALLORHIZA TRIFIDA	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
58	GEOCAULON LIVIDUM	.	+.2	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
59	GLYCERIA STRIATA	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
60	LISTERA CORDATA	+.2	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
61	PYROLA ASARIFOLIA	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
62	MAIANTHEMUM CANADENSE	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.5	3-3
63	CAREX TENUIFLORA	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
64	GYMNOCARPIUM DRYOPTERIS	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
65	POTENTILLA PALUSTRIS	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
66	RUBUS ACAULIS	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
67	GALIUM TRIFIDUM	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
68	ARCTOSTAPHYLOS RUBRA	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
69	ASTER CILIOLATUS	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
70	CALYPSO BULBOSA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
71	CARDAMINE PRATENSIS	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+

Table 42 (continued)

PLOT NUMBER		031	048	056	057	058																				
ST NO.	SPECIES	SPECIES SIGNIFICANCE AND VIGOR																							P	MS	RS
	72 CAREX CANESCENS	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
	73 CAREX LAEVICULMIS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	74 CAREX LOLIACEA	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	75 CAREX MICROGLOCHIN	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	76 ERIOPHORUM BRACHYANTHERUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	77 GLYCERIA PULCHELLA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	78 LISTERA BOREALIS	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	79 LYCOPUS UNIFLORUS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	80 POLEMONIUM ACUTIFLORUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	81 RHYNCHOSPORA ALBA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
DH																										
	82 HYLOCOMIUM SPLENDENS	7.	8.	7.	8.	7.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	7.9	7-8
	83 PTILIUM CRISTA-CASTRENSIS	5.	4.	5.	5.	5.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.3	4-5
	84 PLEUROZIUM SCHREBERI	4.	4.	5.	4.	5.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.1	4-5
	85 AULACOMNIUM PALUSTRE	1.	3.	+.	2.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.1	+-3
	86 PELTIGERA APHTHOSA	.	1.	1.	2.	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	1.8	1-2
	87 DICRANUM ACUTIFOLIUM	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
	88 SPHAGNUM CAPILLACEUM	6.	.	.	.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	4.3	3-6
	89 PLAGIOMNIUM RUGICUM	2.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	1.0	+-2
	90 DREPANOCLADUS UNCINATUS	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.C	+-+
	91 TOMENTHYPNUM NITENS	.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
	92 CALLIERGON RICHARDSONII	5.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	3.4	5-5
	93 DREPANOCLADUS EXANNULATUS	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.5	3-3
	94 BRACHYTHECIUM REFLEXUM	.	.	.	.	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
	95 DREPANOCLADUS ADUNCUS	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
	96 PELTIGERA MALACEA	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
	97 BRACHYTHECIUM SALEBROSUM	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	98 BRYUM PSEUDOTRIQUETRUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
	99 CALLIERGIDIUM PSEUDOSTRAMINEUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	100 CALLIERGON STRAMINEUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	101 CAMPYLIUM CHRYSOPHYLLUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	102 CAMPYLIUM HISPIDULUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	103 CAMPYLIUM STELLATUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	104 CLADINA PSEUDOEVANSII	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
	105 CRATONEURON WILLIAMSII	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	106 HERZOGIELLA TURFACEA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.C	+-+
	107 HYPNUM LINDBERGII	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	108 LEPIDOZIA REPTANS	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	109 LOPHOCOLEA HETEROPHYLLA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	110 PELTIGERA LEUCOPHLEBIA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	111 PELTIGERA POLYDACTYLA	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	112 PLAGIOCHILA ASPLENIODES	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	113 POLYTRICHUM STRICTUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
	114 THUIDIUM RECOGNITUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
DW																										
	HYLOCOMIUM SPLENDENS	3.	1.	2.	3.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.1	1-3
	PLEUROZIUM SCHREBERI	2.	1.	2.	2.	3.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.6	1-3
	PTILIUM CRISTA-CASTRENSIS	2.	1.	+.	+.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	1.5	+-2

Table 42 (continued)

TAMARACK - BLACK SPRUCE - EQUISETUM ARVENSE

PLOT NUMBER	031	048	056	057	058																	P	MS	RS
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																							
115 BLEPHARCSTOMA TRICHOPHYLLUM	+.	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
116 DICRANUM FUSCESCENS	+.	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
DREPANOCLADUS UNCINATUS	+.	+.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
117 EURHYNCHIUM PULCHELLUM	+.	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
118 JAMESONIELLA AUTUMNALIS	+.	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
TOMENTHYPNUM NITENS	+.	+.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	+.3	+-+
BRACHYTHECIUM SALEBROSUM	+.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
CAMPYLIUM HISPIDULUM	+.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
119 CEPHALOZIA CONNIVENS	+.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
120 CLADONIA OCHROCHLORA	+.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
LEPIDOZIA REPTANS	+.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
LOPHOCOLEA HETEROPHYLLA	+.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
121 LOPHOCOLEA MINOR	+.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
PLAGIOCHILA ASPLENIOIDES	+.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
122 POHLIA NUTANS	+.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
123 PTILIDIUM PULCHERRIMUM	+.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.0	+-+
PLAGIOMNIUM RUGICUM	1.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.4	+-1
AULACOMNIUM PALUSTRE	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
BRACHYTHECIUM REFLEXUM	.	.	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
124 DICRANUM FRAGILIFOLIUM	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
125 DICRANUM TAURICUM	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
HERZOGIELLA TURFACEA	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
126 ONCOPHORUS WAHLENBERGII	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
127 PELTIGERA CANINA	+.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
POLYTRICHUM STRICTUM	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
128 TETRAPHIS PELLUCIDA	+.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
129 TRITOMARIA EXSECTIFORMIS	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
130 AMBLYSTEGIUM SERPENS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
131 BRACHYTHECIUM ALBICANS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
132 BRACHYTHECIUM ASPERRIMUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
133 CALYPOGEIA SPHAGNICOLA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
CAMPYLIUM STELLATUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
134 CEPHALOZIA AFFINIS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
135 CEPHALOZIELLA DIVARICATA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
136 CLADONIA CORNUTA	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
137 CLADONIA FIMBRIATA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
DICRANUM ACUTIFOLIUM	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
138 DICRANUM MUEHLENBECKII	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
139 DICRANUM POLYSETUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
140 DICRANUM UNDULATUM	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
141 GEOCALYX GRAVEOLENS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
142 LOPHOZIA INCISA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
143 LOPHOZIA PORPHYROLEUCA	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
144 MARCHANTIA AQUATICA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
145 MNIUM SPINULOSUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
146 NEPHROMA RESUPINATUM	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
147 ORTHOCAULIS KUNZEANUS	.	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
PELTIGERA APHTHOSA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
PELTIGERA POLYDACTYLA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
148 PLAGIOMNIUM CILIARE	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+

Table 42 (continued)

TAMARACK - BLACK SPRUCE - EQUISETUM ARVENSE

ST NO.	SPECIES	PLOT NUMBER 031	048	056	057	058	SPECIES SIGNIFICANCE AND VIGOR	P	PS	RS
149	PLAGIOMNIUM CUSPIDATUM	+.	.	.	.	.		20.0	+.0	+-+
150	PYLAISIA POLYANTHA	.	+.	.	.	.		20.0	+.0	+-+
151	TETRAPHIS GENICULATA	+.	.	.	.	.		20.0	+.0	+-+
	THUIDIUM RECOGNITUM	+.	.	.	.	.		20.0	+.0	+-+

Table 42 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 31 TERRIC HUMISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
31- 1	OF	000-008	5.9	94.0	54.50	1.94	28.1	010	67.50	10.75	0.0	0.25	127.00	62.1					
31- 2	OM	008-025	5.6	94.0	54.50	2.18	25.0	006	65.00	9.25	0.0	0.0	82.00	90.9					
31- 3	OH1	025-040		67.9	39.40	1.51	26.1	002	53.75	5.50	0.0	0.0	103.00	57.6					
31- 4	OH2	040-050																	
31- 5	OH3	050-085																	
31- 6	CG	085- +	5.8	4.9	2.87	0.15	19.1	12	8.00	1.67	0.02	0.12	10.70	91.8	10YR51	10YR31	35	45	18 L

PLOT 48 PEATY PHASE REGO HUMIC GLEYSOL — SIKANNI TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
48- 0	OF	055-038	6.0	92.1	53.40	1.45	36.8	68	58.75	10.12	0.0	1.75	113.00	62.7					
48- 1	OH	038-000	6.3	87.1	50.50	1.51	33.4	100	70.00	12.00	0.0	0.50	134.00	61.8					
48- 2	AH	000-010	6.6	8.1	4.70	0.38	12.4	016	19.25	3.62	0.0	0.10	25.50	90.6	10YR42	10YR21			
48- 3	CG	010- +	6.8	1.6	0.92	0.04	23.0	036	9.00	2.07	0.07	0.15	12.30	91.9	10YR52	10YR32	24	35	40 C

PLOT 56 PEATY PHASE REGO HUMIC GLEYSOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
56- 1	OF	038-030	5.3	89.0	51.60	1.10	46.9	102	27.50	9.50	0.0	2.25	106.00	37.1					
56- 2	OM1	030-029	6.1	86.0	49.90	1.47	33.9	008	65.00	16.62	0.0	0.63	131.00	63.0					
56- 3	OM2	029-000	5.5	87.9	51.00	0.85	60.0	118	43.75	9.37	0.0	0.0	77.00	69.2					
56- 4	AH	000- +	6.2	7.6	4.41	0.14	31.5	026	9.75	2.67	0.05	0.12	26.80	47.0	10YR43	10YR22	23	55	21 SIL

PLOT 57 TERRIC MESISOL — CHUATSE TERRAIN SYSTEM

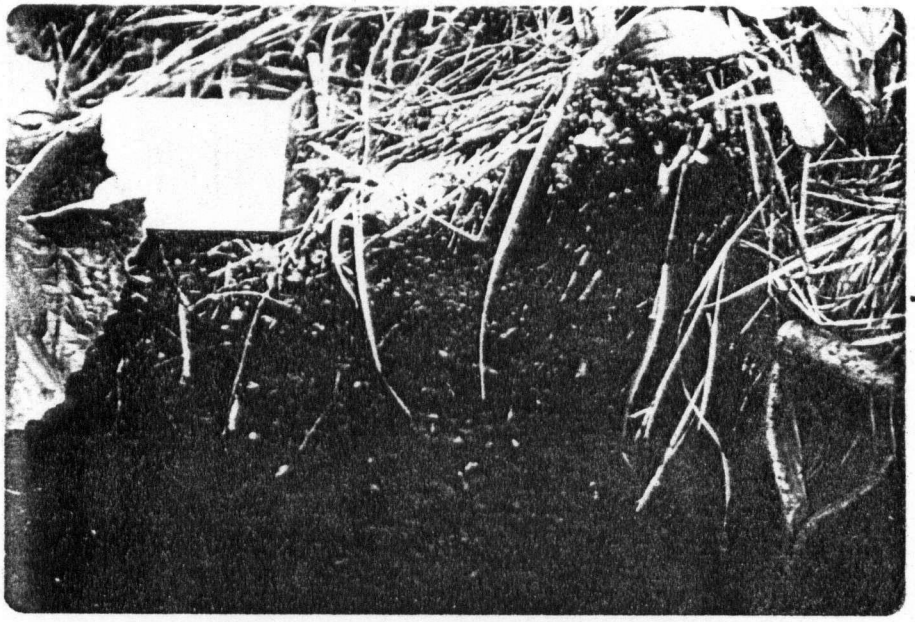
SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
57- 1	OF1	000-008	4.7	94.0	54.50	0.84	64.9	120	21.25	5.62	0.0	2.62	83.00	35.7					
57- 2	OF2	008-022	6.2	90.0	52.20	1.14	45.8	050	61.25	16.62	0.0	1.50	74.00	100.0					
57- 3	OM	022-051	6.2	91.0	52.80	1.18	44.7	022	75.00	17.00	0.0	0.0	113.00	81.6					
57- 4	CG	051- +	6.3	0.7	0.42	0.02	21.0	013	3.25	0.62	0.0	0.05	5.00	78.5	10YR53	10YR33	85	6	7 LS

PLOT 58 TERRIC MESISOL — CHUATSE TERRAIN SYSTEM

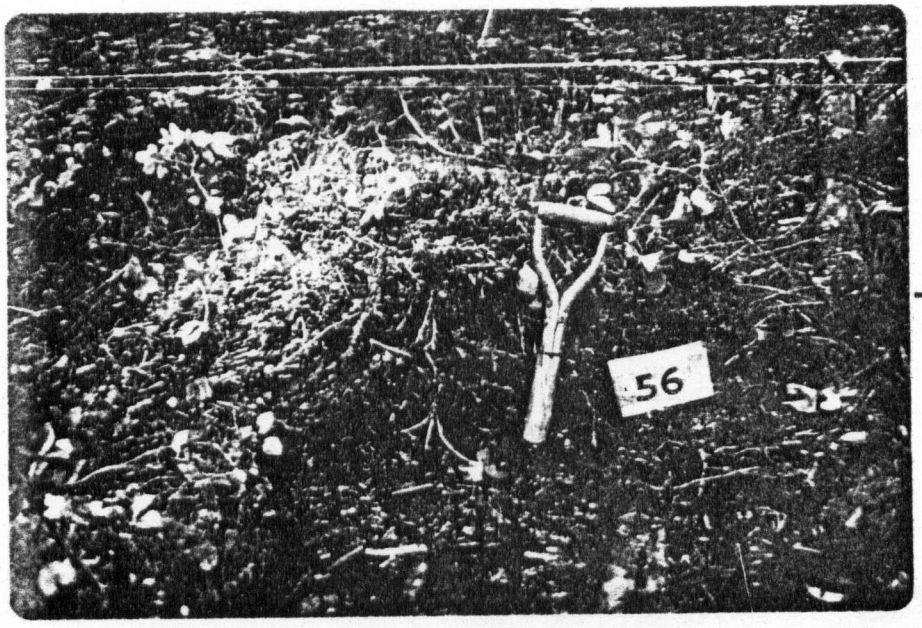
SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
58- 1	OF	000-012	4.5	86.0	49.90	1.47	33.9	132	33.75	10.12	0.0	2.75	82.00	57.0					
58- 2	OM	012-045	6.0	89.0	51.60	1.64	31.5	014	71.25	18.12	0.0	0.0	128.00	70.0					
58- 3	CG	045- +	6.3	2.4	1.39	0.11	12.6	007	13.00	3.55	0.05	0.12	16.70	100.0	10YR42	10YR43	34	40	25 L

Table 43

Tamarack - Black Spruce - Equisetum arvense



Figs. 59 & 60 Above, a Terric Humisol. The very dark color indicates a high degree of decomposition of organic matter due to the influence of minerotrophic water. Below, a peaty phase of a Rego Humic Gleysol.



Plant Association 10

Tamarack - Black Spruce - *Equisetum arvense*

Hylocomio (splendentis) - Ptilio (cristae-castrensis) Pleurozio (schreberi) - Equiseto (arvensis) - Mitello (nudae) - Smilacino (trifoliae) - Larico (laricinae) - Piceetum marianae

The Tamarack - Black Spruce - *Equisetum arvense* association generally occurs near the margins of streams in gently undulating terrain where there is active seepage of water through the soil. In some respects, this association can be considered as the boreal analogue of *Lysichitum* associations of the Coastal Western Hemlock Biogeoclimatic Zone. This association is very rich in the number of plant species present with a total of 154 being recorded from the five plots. Eighty-one species of vascular plants were present, 58 being herbs and the remaining 23 being shrubs and trees. Hygrotopically this association has been assessed as hygric and trophotopically as subeutrophic.

Vegetation

Picea mariana, *P. glauca*, and *Larix laricina* dominate the A_1 layer; *Picea mariana* and *Larix laricina*

the A_2 layer, and Picea mariana alone dominates the A_3 layer. Populus balsamifera, Betula resinifera, and B. papyrifera additionally occur sporadically in the tree layer. The B_1 layer is dominated by Picea mariana which indicates that the probable successional development is towards black spruce. Salix bebbiana (occurring frequently also in Piceetalia glaucae) and Alnus tenuifolia are characteristic of the upper shrub layer, the latter species is one of the many which indicates the affinities of this association to alluvial white spruce communities as well as the Populetalia balsamiferae.

The B_2 layer is dominated by Ledum groenlandicum, Viburnum edule, Rosa acicularis, and Alnus tenuifolia. Ledum groenlandicum, a characteristic species of the Piceetalia marianae, indicates that there is sufficient raw humus accumulation to promote this species while Viburnum edule and Alnus tenuifolia, characteristic of the orders Piceetalia glaucae and Populetalia balsamiferae, indicate a high nutritional quality of the sites. Other shrub species frequently present which are characteristic of the Piceetalia glaucae order are Ribes triste and R. oxyacanthoides.

The herb layer is dominated by Equisetum arvense, Cornus canadensis, Mitella nuda, Carex disperma, Vaccinium vitis-idaea, Smilacina trifolia, Moneses uniflora and Pyrola

secunda which are present in all plots. Some of the species present in the herb layer which are indicative of the Piceetalia glaucae are Rubus pubescens, Viola renifolia, Galium boreale, Actaea rubra, Aralia nudicaulis, Mitella nuda, Goodyera repens, Equisetum pratense, Galium triflorum, and Circaea alpina.

Constant dominant mosses which occupy most of the moss layer are Hylocomium splendens, Ptilium crista-castrensis, Pleurozium schreberi, and Aulacomnium palustre. Peltigera aphthosa is the only lichen usually present.

Soils

The soils under the Tamarack - Black Spruce association are Peaty Phase Rego Humic Gleysols, Terric Mesisols, and Terric Humisols. Although two soil orders and three soil great groups are represented by the above soils, they are all closely related and their differences, as indicated by the names in the classification, are in reality not great since the differences between the organic order and gleysolic order are arbitrarily defined on the depth of the peat layer. Four of the five soils are characterized by an Of and Om horizon overlying the mineral soil with one soil having a predominant Oh middle tier. The pH of the surface horizon, which is formed in a large

part by feather mosses, ranging from 4.5 - 6.0 which is higher than the pH of equivalent surface horizons of the Black - Spruce - Moss association, the pH of which, was generally below 4.0. The underlying peat horizons are generally mildly acidic as are the mineral soils (pH 5.6 -6.3).

In general, biological activity in these soils is high which is reflected in the high degree of breakdown of organic matter of the underlying peat. These soils generally have narrower C/N ratios than organic soils with predominant Of horizons such as those of the Sphagno-Fibrisols (Black Spruce - Sphagnum fuscum association). The richness of these sites, as reflected by the vegetation, is due mainly to the rapid lateral movement of minerotrophic waters which act both as a nutrient source and as a flushing agent which can remove toxic products of anaerobic respiration. Moore and Bellamy (1974) suggest this latter function may be equally important to the commonly mentioned effects as a nutrient source of seepage waters.

Although Valentine (1971) has not specifically described these soils, they resemble some of the inclusions mentioned in his map unit of the Simpson series which is basically a Carbonated Orthic Humic Gleysol. The soils examined under the Tamarack - Black Spruce - Equisetum arvense

association lack the secondary carbonate enrichment of the Simpson series.

ORDER IV

Populetalia balsamiferae Krajina 1969

The Populetalia balsamiferae occur on the eutrophic trophotopes and subhygric and hygric hygrotopes. Soils are Regosols on alluvial floodplains. It has the following character species:

Populus balsamifera
Alnus tenuifolia
Equisetum hyemale

The Populetalia balsamiferae are described in Europe as the Populetalia albae by Braun-Blanquet (1931).

The Populetalia balsamiferae are composed of two alliances (no. 7 and no. 8).

Alliance 7 Populion balsamiferae Annas et Krajina

This alliance occurs on eutrophic trophotopes and subhygric to hygric hygrotopes. There are no alliance character species for the Populion balsamiferae. It is

characterized by the absence of the character species characterizing alliance no. 8. Soils of the alliance are floodplain Regosols deposited earlier than those of alliance no. 8. The Populion balsamiferae has two plant associations (no. 11 and no. 12).

PLANT ASSOCIATION 11

FLOODPLAIN BALSAM POPLAR

Equiseto (pratensis) - Pyrolo (asarifoliae) -
Alno (tenuifoliae) - Populetum balsamiferae

Characteristic Combination of Species

Layer	Constants (presence > 60%) * characteristic	Characteristic non - constants > II
Tree	Populus balsamifera	
Shrub	Picea glauca	Rubus idaeus var. strigosus
	Alnus tenuifolia	
	Cornus stolonifera*	
	Viburnum edule	
	Rosa acicularis	
Herb	Pyrola asarifolia	
	Equisetum pratense	
	Equisetum hyomale	
	Rubus pubescens	
	Vicia americana*	

Table 44

FLOODPLAIN BALSAM POPLAR

Equiseto (pratensis) - Pyrolo (asarifoliae) -

Alno (tenuifoliae) - Populetum balsamiferae

Plot No.	64	65	73	74	83	84	85
Elevation in M	300	300	300	300	300	300	300
Latitude	58° 38'	58° 38'	58° 39'	58° 39'	58° 40'	58° 40'	58° 40'
Longitude	122° 32'	122° 32'	122° 34'	122° 34'	122° 39'	122° 39'	122° 37'
Exposure	NE	NE	-	-	-	-	-
Slope Gradient %	1	1	0	0	0	0	0
Percent coverage							
Total A	78	79	75	79	70	83	64
A_1	40	15	35	50	22	28	25
A_2	20	40	20	20	35	40	35
A_3	25	19	20	19	30	20	15
Total B	45	20	58	45	60	30	68
B_1	42	5	40	23	9	20	48
B_2	9	17	28	32	55	20	25
C	7	13	6	8	19	13	6
Dh	-	+	-	-	-	-	-
Dw	4	5	4	2	3	1	2
Plot Coverage %							
Litter	-	-	-	-	-	-	-
Decaying Wood	8	10	10	10	10	10	10
Mineral Soil	92	90	90	90	90	90	90
Rock	-	-	-	-	-	-	-
Hygrotope	Subhygric - hygric						
Trophotope	Eutrophic						
Parent Material	Alluvium						

Table 45

FLOODPLAIN BALSAM POPLAR

PLOT NUMBER	064	065	073	074	083	084	085													P	MS	RS
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																					
A1																						
1 POPULUS BALSAMIFERA	7.3	6.3	7.3	8.3	5.2	6.3	5.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	7.0	5-8
A2																						
POPULUS BALSAMIFERA	5.2	7.2	5.2	5.2	5.2	7.3	5.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.9	5-7
A3																						
POPULUS BALSAMIFERA	6.2	.	5.2	5.2	.	5.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	71.4	5.1	4-6
2 PICEA GLAUCA	.	5.3	.	.	5.2	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.	42.9	4.2	4-5
3 ALNUS TENUIFOLIA	.	.	.	.	.	4.3	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	2.0	4-4
B1																						
ALNUS TENUIFOLIA	7.3	.	7.2	5.2	4.2	5.2	7.2	.	.	.	.	.	.	.	.	.	.	.	.	85.7	5.9	4-7
PICEA GLAUCA	.	4.2	.	1.2	.	.	5.2	.	.	.	.	.	.	.	.	.	.	.	.	42.9	3.5	1-5
POPULUS BALSAMIFERA	.	.	.	.	.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	1.2	3-3
B2																						
4 CORNUS STOLONIFERA	2.2	4.2	6.2	5.2	5.2	3.3	4.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.1	2-6
5 VIBURNUM EDULE	1.2	4.2	2.2	4.2	4.2	3.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.7	1-4
6 ROSA ACICULARIS	1.2	3.2	4.2	4.2	4.2	.	5.2	.	.	.	.	.	.	.	.	.	.	.	.	85.7	4.2	1-5
ALNUS TENUIFOLIA	4.2	.	4.2	4.2	3.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	71.4	3.9	3-4
PICEA GLAUCA	1.2	.	1.2	3.2	1.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	71.4	2.7	1-4
7 RIBES OXYACANTHOIDES	.	2.2	1.2	2.2	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	57.1	1.4	1-2
8 RUBUS IDAEUS	.	.	.	.	1.2	.	+.2	1.2	.	.	.	.	.	.	.	.	.	.	.	42.9	+.6	+-1
9 ALNUS CRISPA	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.5	2-2
10 PRUNUS VIRGINIANA	.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	1-1
11 LONICERA DIOICA	.	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
C																						
12 PYROLA ASARIFOLIA	4.3	3.2	1.2	3.3	1.2	+.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.0	+-4
13 EQUISETUM PRATENSE	+.2	1.2	2.3	2.2	+.2	+.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	100.0	1.5	+-2
14 EQUISETUM HYEMALE	1.2	.	.	+.2	1.2	4.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	71.4	3.0	+-4
15 RUBUS PUBESCENS	.	3.2	.	4.2	2.2	1.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	71.4	2.7	+-4
16 VICIA AMERICANA	+.2	.	3.	+.2	.	+.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	71.4	1.4	+-3
17 EQUISETUM ARVENSE	+.2	.	4.2	2.2	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	57.1	2.2	+-4
18 MITELLA NUDA	.	1.2	.	.	1.2	1.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	57.1	1.0	+-1
19 GALIUM TRIFLORUM	+.2	.	+.2	.	+.2	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	57.1	+.0	+-+
20 CORNUS CANADENSIS	.	4.2	.	.	4.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	42.9	3.0	2-4
21 ARALIA NUDICAULIS	.	1.2	.	.	4.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	42.9	2.1	+-4
22 MAIANTHEMUM CANADENSE	.	+.2	.	.	+.2	1.3	.	.	.	.	.	.	.	.	.	.	.	.	.	42.9	+.2	+-1
23 LINNAEA BOREALIS	.	.	.	1.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	28.6	+.4	1-1
24 EQUISETUM SYLVATICUM	.	.	1.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	28.6	+.1	+-1
25 ACTAEA RUBRA	.	+.2	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	28.6	+.0	+-+
26 SMILACINA TRIFOLIA	.	+.2	.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	28.6	+.0	+-+
27 PETASITES PALMATUS	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.5	2-2
28 SOLIDAGO CANADENSIS	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.5	2-2
29 AGROPYRON CANINUM	.	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	1-1
30 ACHILLEA MILLEFOLIUM	.	.	.	.	.	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
31 CINNA LATIFOLIA	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+

Table 46

PLOT NUMBER	064	065	073	074	083	084	085															P	MS	RS
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																							
32 CIRCAEA ALPINA	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
33 FRAGARIA VIRGINIANA	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
34 GALIUM BOREALE	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
35 LATHYRUS OCHROLEUCUS	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
36 MERTENSIA PANICULATA	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
37 PYROLA CHLORANTHA	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
38 SENECIO LUGENS	.	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
39 THALICTRUM SPARSIFLORUM	.	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
40 VICIA RENIFOLIA	.	.	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
DH																								
41 ATRICHUM UNDULATUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
42 BRACHYTHECIUM ALBICANS	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
43 BRACHYTHECIUM REFLEXUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
44 BRACHYTHECIUM SALEBROSUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
45 CAMPYLIUM CHRYSOPHYLLUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
46 CAMPYLIUM HISPIDULUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
47 LEPTOBRYUM PYRIFORME	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
48 MARCHANTIA POLYMORPHA	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
49 MNIUM SPINULOSUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
50 PLAGIOMNIUM CUSPIDATUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
51 PLAGIOMNIUM DRUMMONDII	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
52 THUIDIUM RECOGNITUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
DW																								
53 PELTIGERA CANINA	+.	+.	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	42.9	+.0	+-+
54 PELTIGERA POLYDACTYLA	+.	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	42.9	+.0	+-+
55 PTILIUM CRISTA-CASTRENSIS	.	1.	.	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	28.6	+.4	1-1
56 PELTIGERA APHTHOSA	.	.	.	+.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	28.6	+.1	+-1
57 HYLOCOMIUM SPLENDENS	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	1-1
BRACHYTHECIUM SALEBROSUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
CAMPYLIUM CHRYSOPHYLLUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
CAMPYLIUM HISPIDULUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
58 CROSSOCALYX HELLERIANUS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
59 DREPANOCLADUS UNCINATUS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
60 HERZOGIELLA TURFACEA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
61 HOMALOTHECIUM AENEUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
62 JAMESONIELLA AUTUMNALIS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
63 LOPHOCOLEA MINOR	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
64 NEPHROMA BELLUM	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
PLAGIOMNIUM CUSPIDATUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+
65 PYLAISIA POLYANTHA	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	14.3	+.0	+-+

Table 46 (continued)

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 64 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
64- 1	CK1	000-016	7.0	0.6	0.36	0.14	2.6	5	7.25	2.85	0.03	0.27	22.30	46.6	10YR42	10YR32	6	56	36	SICL
64- 2	CK2	016-043	7.0	3.1	1.80	0.09	20.0	006	7.25	1.97	0.03	0.20	18.60	50.8	10YR52	10YR32	57	27	14	SL
64- 3	CK3	043- +	6.9	5.4	3.13	0.08	39.1	007	6.75	1.10	0.03	0.12	16.00	50.0	10YR42	10YR32	60	26	12	SL

PLOT 65 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
65- 1	CK1	000-011	7.5	1.1	0.64	0.11	5.8	9	8.75	1.42	0.0	0.27	11.50	91.3	10YR52	10YR32				
65- 2	CK2	011-032	6.7	2.6	1.51	0.19	7.9	9	8.25	4.15	0.03	0.27	14.60	87.0	10YR52	10YR32	20	58	21	SIL
65- 3	CK3	032- +	7.2	2.3	1.33	0.06	22.2	26	5.50	1.30	0.0	0.15	8.30	83.7	10YR52	10YR32	78	14	7	LS

PLOT 73 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
73- 1	CK1	000-031	7.3	2.4	1.37	0.10	13.7	003	6.00	1.82	0.02	0.35	9.00	91.1	10YR42	10YR32	49	42	8	L
73- 2	CK2	031- +	7.5	2.0	1.16	0.09	12.9	005	8.00	0.82	0.05	0.22	11.90	76.5	10YR42	10YR32	18	64	17	SIL

PLOT 74 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
74- 1	CK1	000-004	7.0	2.7	1.56	0.09	17.3	007	9.00	1.55	0.07	0.27	16.20	67.3	10YR52	10YR32	1	76	22	SIL
74- 2	CK2	004- +	6.8	3.4	1.95	0.13	15.0	005	8.25	2.37	0.02	0.20	15.80	68.7	10YR42	10YR32	20	62	16	SIL

PLOT 83 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
83- 1	CK1	000-009	7.3	1.7	0.99	0.16	6.2	001	6.00	1.05	0.0	0.15	10.00	72.2	10YR52	10YR32				
83- 2	AH	009-013	6.4	42.9	24.90	0.76	32.8	002	43.75	9.12	0.0	0.75	76.00	70.9						
83- 3	C	013-025	7.2	2.6	1.48	0.13	11.4	2	4.75	3.00	0.02	0.17	11.60	68.5	10YR42	10YR22	46	35	17	L
83- 4	CK2	025- +	7.6	0.0	0.0	0.08	0.0	2	5.00	1.95	0.0	0.17	7.50	95.3	10YR42	10YR32				

PLOT 84 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
84- 1	CK1	000-008	7.4	2.4	1.40	0.12	11.7	004	7.75	1.57	0.05	0.22	13.10	73.3	10YR42	10YR32	23	65	11	SIL
84- 2	CK2	008-012	6.5	2.2	1.28	0.11	11.6	2	5.50	0.05	0.05	0.27	14.40	40.1	10YR52	10YR32	38	44	17	L
84- 3	CK3	012- +	6.5	1.6	0.93	0.09	10.3	4	5.75	1.30	0.0	0.15	6.30	100.0	10YR42	10YR22	55	31	13	SL

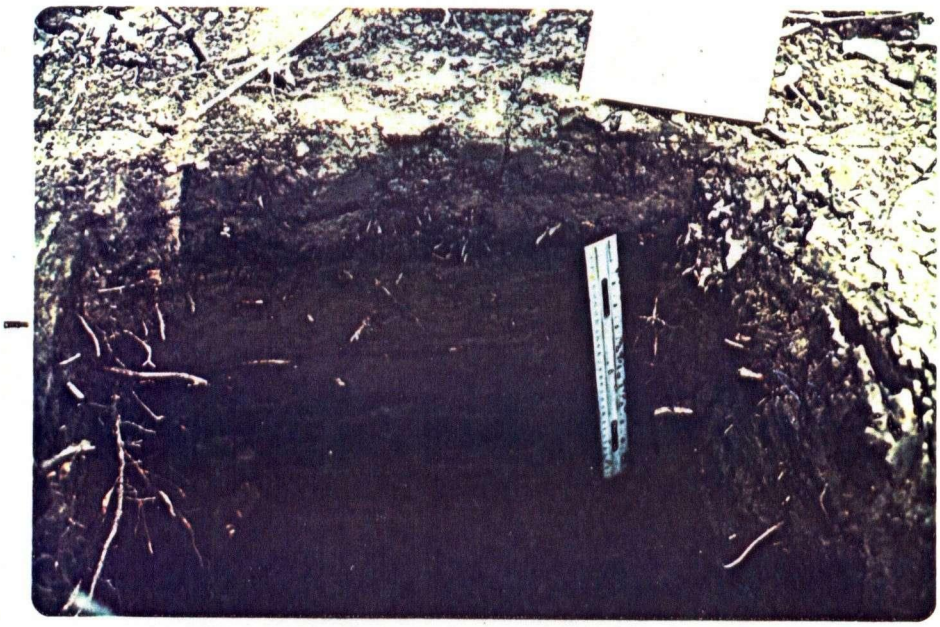
PLOT 85 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
85- 1	CK1	000-006	7.4	3.4	1.98	0.12	16.5	003	10.00	1.67	0.0	0.40	19.00	63.8	10YR52	10YR32				
85- 2	CK2	006-019	6.8	3.5	2.03	0.13	15.6	002	7.25	2.80	0.0	0.27	14.70	70.7	10YR52	10YR31				
85- 3	CK3	019- +	7.0	1.8	1.06	0.10	10.6	002	6.25	1.35	0.02	0.17	12.80	60.9	10YR42	10YR32	48	32	19	L

Table 47

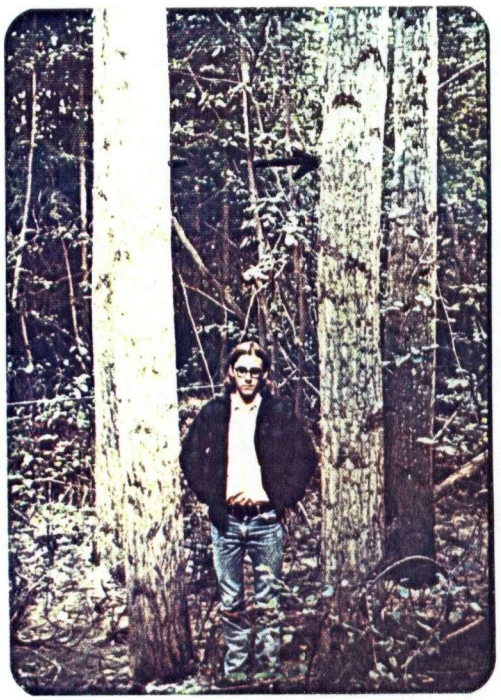
Floodplain Balsam Poplar

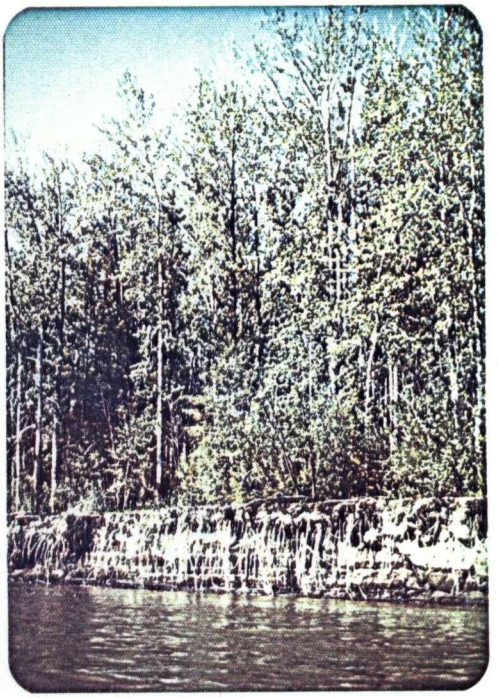




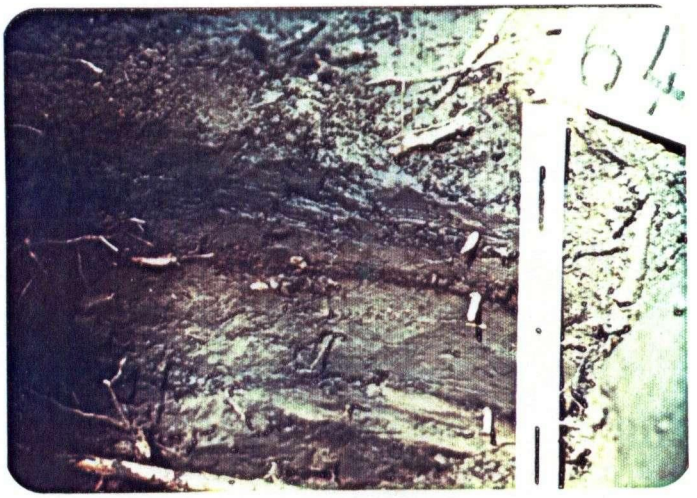
Figs. 61 & 62 Floodplain Balsam Poplar ecosystems on the Prophet River south of Fort Nelson. Below, a typical Cumulic Regosol showing buried organic layers.

Floodplain Balsam Poplar

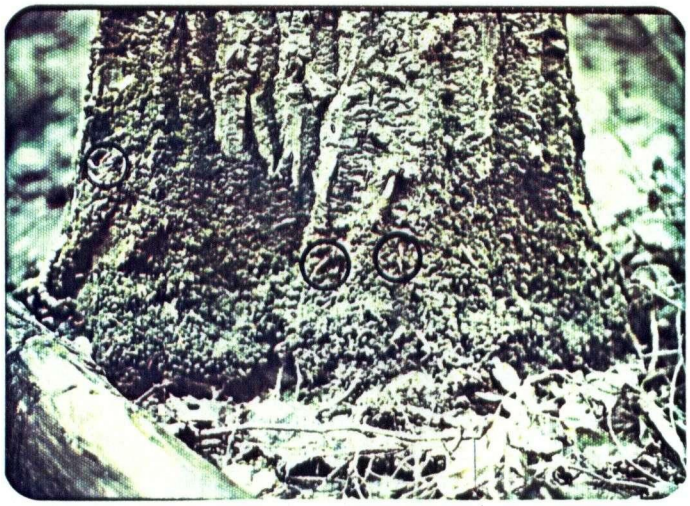




Figs. 63, 64 & 65 The photograph on the above left shows high water mark. Below, a typical Cumulic Regosol.



Floodplain Balsam Poplar



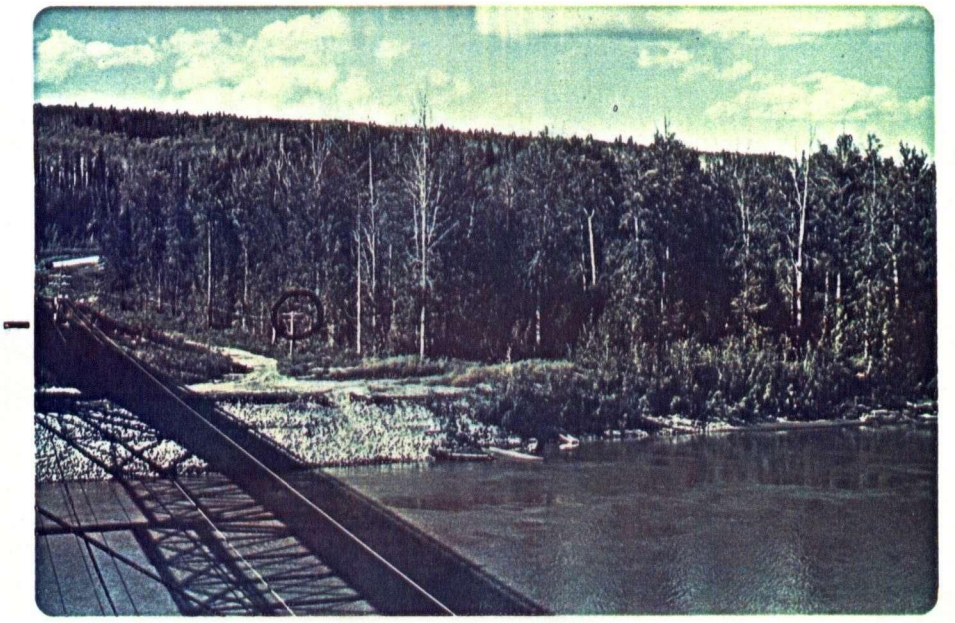
Figs. 66 & 67 Above, epicormic rooting on Populus balsamifera after flooding. This adaptation allows the tree to survive under conditions where thick sediment deposits are laid down on the floodplains by flooding rivers. Below - an overmature Populus balsamifera community being replaced by Picea glauca.



Floodplain Balsam Poplar



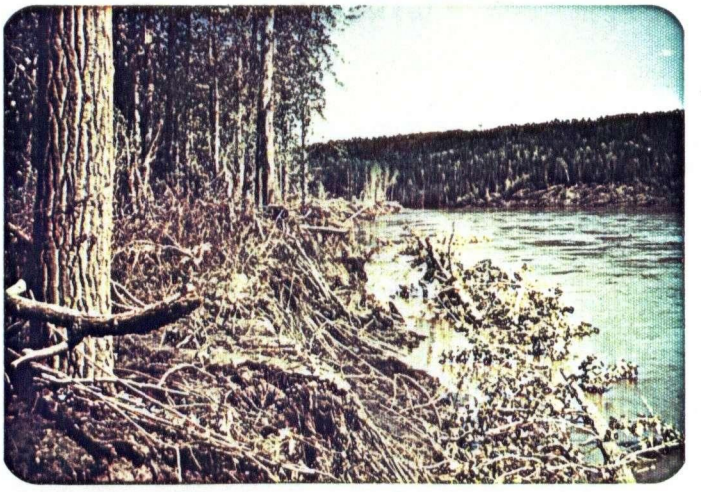
Figs. 68 & 69 Upper photograph shows the Muskwa River at peak flood. Telephone pole, circled in upper photograph is shown below under normal water level.



Floodplain Balsam Poplar



Figs. 70 & 71 Picea glauca established under a Populus balsamifera stand. Below - erosion on a balsam poplar stand on the Fort Nelson River.



Plant Association 11

Floodplain Balsam Poplar

Equiseto (pratensis) - Pyrolo (asarifoliae) - Alno (tenuifoliae) - Populetum balsamiferae

The Floodplain Balsam Poplar association occurs in the mid-position of the young alluvial floodplains at slightly higher positions than the Sandbar Willow and Floodplain Alder associations. The topography is generally flat with the remnants of old bars and depositional ridges on the surface. This association is common along all the major rivers. When projected on the edatopic grid, this association occupies eutrophic trophotopes and subhygric to hygric hygrotopes.

Vegetation

Structurally, balsam poplar ecosystems are much more complex than the Sandbar Willow and Floodplain Alder associations in terms of vegetation development. The well developed tree layer is characteristically composed of Populus balsamifera with Picea glauca in the understory. The upper shrub layer is dominated by Alnus tenuifolia with

the B_2 being characterized by Cornus stolonifera, Viburnum edule, Rosa acicularis, Picea glauca, and Ribes oxyacanthoides. A moderately developed herb layer is present with percent coverage averaging around 10% for the sample plots. Pyrola asarifolia and Equisetum pratense are the only two constant dominants in the herb layer. Equisetum hyemale, Rubus pubescens, and Vicia americana are constants with Equisetum hyemale sometimes having a high species significance. In most of these communities the moss layer is absent on mineral soil and is only poorly developed on decaying wood.

Jeffrey (1964) recognized two community types - a Balsam Poplar - Equisetum hyemale forest and a Balsam Poplar - Equisetum pratense forest which he differentiated on the relative dominance of the two species of Equisetum. In the Fort Nelson area, it was felt that these differences were relatively minor considering the vegetation in totality and therefore, these communities are viewed as variants of the same association. Additionally, all the communities appear to be rapidly succeeding towards a White Spruce association which makes the differences relatively short lived.

This association belongs to what Knapp (1965) refers to as the balsam poplar riverine woodlands in Boreal North America.

Soils

Soils are Cumulic Regosols whose development has not progressed appreciably from the soils of the Sandbar Willow and Floodplain Alder ecosystems. The balsam poplar plant communities develop on soils defined by Valentine (1971) as the Snake series. No LFH horizon was present in any of the communities sampled, however, Valentine includes a thin L horizon in his description. The presence or absence of surface organic horizons will depend upon the year of sampling and to whether or not there has been any recent flooding. Base saturation is generally high in these soils - in a few cases approaching 100% with calcium dominating the exchange complex. The pH is essentially circumneutral varying from 7.0 to 7.5 in surface mineral horizons. The moisture regime is estimated to be from hydric, during short periods of flooding, to subhygric during much of the growing season. These soils support ecosystems with the greatest standing volume of wood of any of the sites studied as well as having the highest site index for Populus balsamifera in the Fort Nelson area.

PLANT ASSOCIATION 12

FLOODPLAIN ALDER

Populo (balsamiferae) - Alnetum tenuifoliae

Characteristic Combination of Species

Layer	Constants (presence > 60%) * characteristic	Characteristic non - constants > II
Shrub	Alnus tenuifolia* Populus balsamifera	

Table 48

FLOODPLAIN ALDER

Populo (balsamiferae) - Alnetum tenuifoliae

Plot No.	67	63	69	68
Elevation in M	300	300	300	300
Latitude	58 34'	58 38'	58 39'	58 38'
Longitude	122 33'	122 32'	122 33'	122 33'
Exposure	W	NE	N	W
Slope Gradieht %	2	2	2	1
Percent coverage				
Total A	-	-	-	80
A_1	-	-	-	25
A_2	-	-	-	40
A_3	-	-	-	30
Total B	93	93	84	30
B_1	-	90	83	30
B_2	93	8	3	-
C	1	1	2	1
Dh	-	-	-	-
Dw	-	-	-	-
Plot Coverage %				
Litter	-	-	-	-
Decaying Wood	-	-	-	-
Mineral Soil	100	100	100	100
Rock	-	-	-	-
Hygrotope	Hygric			
Trophotope	Eutrophic			
Parent Material	Recent Alluvium			

Table 49

FLOODPLAIN ALDER

BOREAL WHITE & BLACK SPRUCE ZONE
PAGE 1

PLOT NUMBER	067	063	069	068																	P	MS	RS
ST NO. SPECIES	SPECIES SIGNIFICANCE AND VIGOR																						
A1																							
1 POPULUS BALSAMIFERA	.	.	.	5.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	3.7	5-5
A2																							
POPULUS BALSAMIFERA	.	.	.	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	5.0	7-7
A3																							
POPULUS BALSAMIFERA	.	.	.	6.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	4.4	6-6
B1																							
2 ALNUS TENUIFOLIA	4.3	4.2	8.2	6.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	6.2	4-8
POPULUS BALSAMIFERA	.	9.3	5.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	6.2	3-9
B2																							
ALNUS TENUIFOLIA	9.2	4.2	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	75.0	5.5	2-9
3 SALIX RIGIDA	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	3.7	5-5
POPULUS BALSAMIFERA	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	1.1	2-2
C																							
4 EQUISETUM HYEMALE	.	+.	2.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.1	+-2
5 EQUISETUM ARVENSE	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
6 EQUISETUM SCIRPOIDES	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+
7 EQUISETUM SYLVATICUM	.	.	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	25.0	+.0	+-+

Table 50

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

TERRAIN SYSTEM AFTER VALENTINE (1971)

BOREAL WHITE & BLACK SPRUCE ZONE

PLOT 69 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM — RECENT BARS LAND TYPE

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
69- 1	CK1	000-011	7.4	2.9	1.70	0.12	14.2	007	9.00	1.97	0.0	0.27	19.00	59.6	10YR52	10YR32			
69- 2	CK2	011- +	7.0	2.7	1.54	0.11	14.0	010	8.00	1.32	0.0	0.22	15.30	62.7	10YR52	10YR32			

PLOT 67 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM — RECENT BARS LAND TYPE

PLOT 63 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM — RECENT BARS LAND TYPE

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	C.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
63- 1	CK1	000-017	7.5	2.4	1.39	0.05	27.8	010	8.00	1.22	0.07	0.17	15.90	59.6	10YR41	10YR32	38	40	21 L
63- 2	CK2	017- +	6.6	2.4	1.40	0.10	14.0	011	8.00	0.82	0.03	0.20	12.20	74.2	10YR52	10YR32	24	59	15 SIL

PLOT 68 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM — RECENT BARS LAND TYPE

Table 51

Floodplain Alder



Fig. 72 A point-bar on the Fort Nelson with Salix interior next to the river. Alnus tenuifolia is the shrub in front of the taller Populus balsamifera.

Plant Association 12

Floodplain Alder

Populo (balsamiferae) - Alnetum tenuifoliae

These ecosystems generally occur adjacent to the Sandbar Willow association and are slightly higher topographically on the floodplain. When projected on the edatopic grid, this plant association occupies eutrophic trophotopes and hygric hygrotopes.

Vegetation

These communities are very simple, characterized by the constant dominant Alnus tenuifolia. The tree layer is generally absent in these communities. Following Alnus tenuifolia, Populus balsamifera will become established which will eventually produce a Floodplain Balsam Poplar association. This plant association is similar to the Salix - Alnus zone described by Jeffrey (1964), however, part of Jeffrey's Populus - Alnus zone would be included in this unit. It is felt that once Alnus tenuifolia is relegated to a position subordinate to Populus balsamifera, one is dealing with an immature Populus balsamifera community rather than a distinct type. Thus in plant succession, this plant association precedes the previous plant association (no. 11).

Soils

Soils are classified as Cumulic Regosols and occur on what Valentine (1971) refers to as the Point Bar land type of the Muskwa Terrain system. No noticeable soil development is evident due to the frequent flooding and deposition of fresh silt. These soils have essentially the same characteristics as the following association (no. 13), which are physically and nutritionally similar to the soils of plant association no. 11.

Alliance 8 Salicion interioris Annas et Krajina

Since there is only one plant association (no. 13) in this alliance, the vegetational and environmental characteristics of this alliance are the same as those of the plant association.

The constant high species significance of willows in this wettest part of the floodplain sedimentary deposits, substantiates this alliance. These willows are almost completely missing in alliance no. 7.

PLANT ASSOCIATION 13

SANDBAR WILLOW

Salicetum interioris

Characteristic Combination of Species

Layer	Constants (presence > 60%) * characteristic	Characteristic non - constants > II
Shrub	Salix interior*	
	Populus balsamifera	
	Salix rigida*	
Herb	Equisetum hyemale	Solidago canadensis
	Equisetum pratense	

Table 52

SANDBAR WILLOW

Salicetum interioris

Plot No.	86	87	70	66	62
Elevation in M	300	300	300	300	300
Latitude	58 40'	58 40'	58 38'	58 38'	58 38'
Longitude	122 37'	122 37'	122 33'	122 33'	122 32'
Exposure	N	N	N	W	NE
Slope Gradient %	2	3	3	5	4
Percent coverage					
Total A	-	-	-	-	-
A_1	-	-	-	-	-
A_2	-	-	-	-	-
A_3	-	-	-	-	-
Total B	36	14	60	82	80
B_1	32	-	30	-	-
B_2	6	11	40	82	80
C	2	21	6	1	1
Dh	-	-	-	-	-
Dw	-	-	-	-	-
Plot Coverage %					
Litter	-	-	-	-	-
Decaying Wood	-	-	-	-	-
Mineral Soil	100	100	100	100	100
Rock	-	-	-	-	-
Hygrotope	Hygric				
Trophotope	Eutrophic				
Parent Material	Recent Alluvium				

Table 53

SANDBAR WILLOW

ST NO.	SPECIES	086	087	070	066	062															P	MS	RS
B1																							
1	SALIX INTERIOR	6.2	.	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	4.8	5-6
2	POPULUS BALSAMIFERA	3.2	.	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	3.0	3-4
3	ALNUS TENUIFOLIA	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
B2																							
	SALIX INTERIOR	4.2	4.2	6.2	9.2	9.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	7.6	4-9
	POPULUS BALSAMIFERA	+.2	+.2	3.2	2.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.1	+-3
4	SALIX RIGIDA	.	.	4.2	+.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	3.0	+-4
	ALNUS TENUIFOLIA	.	.	.	2.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	2.0	2-3
5	PICEA GLAUCA	.	.	.	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	1.0	2-2
6	SALIX LASIANDRA	.	.	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
7	ROSA ACICULARIS	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
C																							
8	EQUISETUM HYEMALE	2.	5.2	1.2	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	80.0	3.6	1-5
9	EQUISETUM PRATENSE	+.	+.2	1.3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	60.0	+.5	+-1
10	SOLIDAGO CANADENSIS	.	.	+.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	40.0	+.0	+-+
11	EQUISETUM SYLVATICUM	.	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.2	1-1
12	ACHILLEA SIBIRICA	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
13	CALAMAGROSTIS CANADENSIS	.	.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+
14	EQUISETUM FLUVIATILE	.	.	.	.	+.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	20.0	+.0	+-+

Note: the 086–062 columns are headed "PLOT NUMBER"; the columns from 086 through the last unnumbered one are headed "SPECIES SIGNIFICANCE AND VIGOR".

Table 54

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

PLOT 86 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM — RECENT BARS LAND TYPE

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
86-11	CK1	000-014																		
86-12	CK2	014- +	6.5	0.0	0.0	0.04	0.0	4	5.00	0.70	0.05	0.07	2.80	100.0	10YR41	10YR41	80	9	9	LS *

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 86 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM — RECENT BARS LAND TYPE

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
86-21	CK1	000-014	7.0	2.3	1.32	0.10	13.2	009	7.75	1.32	0.07	0.17	12.30	75.8	10YR42	10YR32	26	64	9	SIL *
86-22	CK2	014- +	6.9	4.3	2.49	0.09	27.7	004	8.00	1.17	0.05	0.12	7.60	100.0	10YR42	10YR32	73	19	7	SL *

PLOT 87 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM — RECENT BARS LAND TYPE

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
87- 1	CK1	000-007	6.7	6.2	3.60	0.13	27.7	006	10.00	1.75	0.10	0.20	15.00	80.3	10YR42	10YR42	54	34	11	SL *
87- 2	CK2	007- +	7.2	0.4	0.21	0.02	10.5	004	3.75	0.35	0.05	0.07	3.40	100.0	10YR51	10YR41	76	10	12	SL *

PLOT 70 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM — RECENT BARS LAND TYPE

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
70- 1	CK1	000-010	6.2	1.4	0.81	0.07	11.6	004	7.50	1.47	0.02	0.17	13.70	67.0	10YR52	10YR32	26	57	16	SIL *
70- 2	CK2	010- +	7.4	3.7	2.16	0.07	30.9	004	3.25	0.60	0.02	0.10	5.90	67.4	10YR52	10YR32	79	12	8	LS *

PLOT 66 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM — RECENT BARS LAND TYPE

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
66- 1	CK	000- +	7.3	2.1	1.22	0.09	13.6	012	7.25	1.45	0.0	0.17	12.10	73.8	10YR52	10YR32				

PLOT 62 CUMULIC REGOSOL — MUSKWA TERRAIN SYSTEM — RECENT BARS LAND TYPE

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C	
62- 1	CK1	000-017		1.2	0.70	0.09	7.8	008	8.00	1.30	0.05	0.20	12.20	78.3	10YR52	10YR32	26	56	16	SIL *
62- 2	CK2	017- +	6.8	2.0	1.16	0.06	19.3	009	5.25	0.72	0.03	0.07	8.00	75.9	10YR51	10YR32	78	17	7	SL

Table 55

Sandbar Willow



Figs. 73 & 74 Salix interior on a recent point bar deposit along with some Equisetum hyemale. Below, Salix interior is visible in the front, Alnus tenuifolia in the middle and Populus balsamifera at the back which represents stages of floodplain succession.



Sandbar Willow

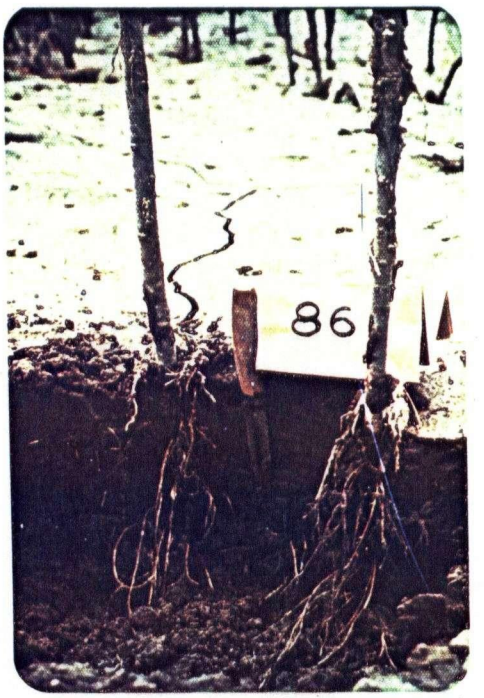


Fig. 75 Salix interior very quickly develops adventitious roots on its stem in response to sedimentation. These roots developed in the same growing season of the flood which deposited the sediment.

Plant Association 13

Sandbar Willow

Salicetum interioris

Sandbar willow (Salix interior) associations occur on downstream edges of point-bar deposits along the Fort Nelson, Muskwa, Prophet and as discussed by Jeffrey (1961b, 1964) along the Liard and Peace Rivers. In the Fort Nelson area these ecosystems occur on what Valentine (1971) refers to as the Recent Bar land type of the Muskwa Terrain system. This ecosystem occupies eutrophic trophotopes and hygric hygrotopes of the edatopic grid.

Vegetation

Structurally the Sandbar Willow communities are extremely simple with Salix interior being the only constant dominant as well as characteristic species. Other species associated with this community are Salix rigida, Alnus tenuifolia, and Equisetum hyemale. Horton (1965) reported other willows such as Salix lutea and S. planifolia to be present on these sites along the Peace River, however, they were not found in any of the communities studied in the Fort

Nelson area. The Sandbar Willow association is similar to the Salix zone of the riparian shrub type of Jeffrey (1964). Jeffrey found that on the Lower Liard, Salix lasiandra was the first species to colonize new alluvium, however, on the Fort Nelson River, the first colonizer was usually Salix interior. These communities are very transitory and through a very short period of time are replaced through succession.

Soils

Soils are Cumulic Regosols with essentially no development as they are flooded almost every year. The estimated moisture regime of these soils, therefore, varies from hydric (for short periods) to subhygric. Nutritionally these soils are very rich, with generally high base saturations and circumneutral pH's. Base saturations ranged from 60 - 78% and pH ranged from 6.2 - 7.5 in the soils of the Sandbar Willow and Floodplain Alder ecosystems.

ORDER V

Spiraeo - Myricetalia galis Kojima et Krajina 1975

This order was originally described as being characterized by the only alliance Spiraeo (douglasii) - Myricion galis Kojima et Krajina, known from Vancouver Island and not occurring in the area of this study. It is substituted here by alliance no. 9.

Alliance 9 Drepanoclado (vernicosi) - Menyantho (trifoliatae) - Myricion galis.

This alliance contains only one plant association whose description follows.

PLANT ASSOCIATION 14

MYRICA GALE - MENYANTHES

Drepanoclado (vernicosi) - Calliergono (gigantei) - Menyantho (trifoliatae) - Myricetum galis

Plot No.	60	61
Elevation in M	430	430
Latitude	58 40'	58 40'
Longitude	122 44'	122 44'
Exposure	-	-
Slope Gradient %	0	0
Percent coverage		
Total B_2	25	33
C	82	85
Dh	98	88
Plot Coverage %		
Litter	100	100
Mineral Soil	-	-
Hygrotope	Hygric	
Trophotpe	Subeutrophic	
Parent Material	Organic	

Table 56

MYRICA GALE - MENYANTHES

BOREAL WHITE & BLACK SPRUCE ZONE
PAGE 1

PLOT NUMBER		060	061																			P	MS	RS
ST NO.	SPECIES	SPECIES SIGNIFICANCE AND VIGOR																						
B2																								
	1 MYRICA GALE	6.2	7.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	7.1	6-7
C																								
	2 MENYANTHES TRIFOLIATA	7.2	0.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	8.0	7-8
	3 PEDICULARIS MACRODONTA	5.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.7	+-5
	4 TRIGLOCHIN MARITIMA	4.2	4.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.5	4-4
	5 CAREX DIANDRA	4.2	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.5	+-4
	6 UTRICULARIA INTERMEDIA	3.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	3.4	3-3
	7 GALIUM TRIFIDUM	+.2	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.7	+-3
	8 CAREX AQUATILIS	.	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	4.7	5-5
	9 CAREX LIMOSA	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	4.7	5-5
	10 EPILOBIUM LEPTOPHYLLUM	.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.6	2-2
	11 EPILOBIUM PALUSTRE	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
	12 LEMNA MINOR	.	+.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
DH																								
	13 DREPANOCLADUS VERNICOSUS	9.	6.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	8.3	6-9
	14 CALLIERGON GIGANTEUM	5.	8.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	7.4	5-8

Table 57

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

BOREAL WHITE & BLACK SPRUCE ZONE

TERRAIN SYSTEM AFTER VALENTINE (1971)

PLOT 61 HYDRIC FENNO FIBRISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)		PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	TEXTURE %SI	TEXTURE %C
61- 1	OF	000-	+	5.6	92.9	53.90	1.53	35.2	10	43.75	8.00	0.0	0.38	115.00	46.0					

PLOT 60 HYDRIC FENNO FIBRISOL — CHUATSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)		PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	TEXTURE %SI	TEXTURE %C
60- 1	OF	000-	+	5.7	87.9	51.00	1.76	29.0	6	33.75	6.75	0.0	0.0	98.00	42.2					

Table 58

Myrica gale - Menyanthes



Figs. 76 & 77 A fen dominated by Myrica gale - Menyanthes trifoliata, Pedicularis macrodonta, and Carex diandra. Below, Betula glandulosa is encroaching onto the fen. This species is followed by Larix laricina.



Plant Association 14

Myrica gale - Menyanthes

Drypanoclado (vernicosi) - Calliergono (gigantei) - Menyantho (trifoliatae) - Myricetum galis

The Myrica gale - Menyanthes association is the only association of the Spiraeo - Myricetalia galis order described in this study from the Fort Nelson area. Only two sample plots were established on one fen which is not sufficient to characterize the association in terms of characteristic species. This association occurs on sub-eutrophic trophotopes and hygric hygrotopes.

Vegetation

The vegetation of the Myrica gale - Menyanthes association is characterized by a relatively low number of species which can tolerate conditions with extremes of high moisture and low oxygen. In the fen studied, Myrica gale formed a dense low shrub layer. This species was found only in minerotrophic conditions in the Fort Nelson area which may be due to the inability of nitrogen fixing bacteria to infect Myrica gale at low pH's as suggested by Moore and Bellamy (1974).

Menyanthes trifoliata, which dominates the herb layer, is highly specialized for existing in oxygen deficient environments, not only with modified anatomy which allows easy movement of gas through the plants' airspace but also with physiological modifications which reduce respiration rates prior to anaerobic conditions of respiration (Moore and Bellamy, 1974). Triglochin maritima, which is present with a high species significance, is another species highly specialized morphologically for promoting gas exchange through large airspaces in the stem. Species which indicate permanent standing water at the soil surface are Utricularia intermedia and Lemna minor.

The moss layer of this association is dominated by Drepanocladus vernicosus and Calliergon giganteum which are both rich fen indicators in the Fort Nelson area.

Soils

The soil of the Myrica gale - Menyanthes association is classified as a Hydric Fenno Fibrisol and consists of fibric peat and living roots of undetermined depth. Sampling these soils is very problematic since it was not possible to separate living roots from dead organic material and in fact, the samples analyzed (Table 58) probably consisted,

to a large extent, of living roots. The water samples, which are discussed in a following chapter, probably reflect the growing conditions of the site better than soil analysis.

The pH of the two soils is 5.6 and 5.7. The C/N ratio ranges from 29 - 35 and the base saturation is from 42 - 46%.

The Myrica gale - Menyanthes is similar to the "Low Shrub Fen" described by Jeglum et at. (1974) or the "Drepanocladus - Carex" type of horizontal fen described by Tarnocai (1974). For the Fort Nelson area, this association represents the "rich fen" utilizing Sjörs' (1961) terminology. The richness of the site is indicated by the vegetation and as well by analysis of fen waters and soils.

ORDER VI

Sphagno (magellanici) - Scheuchzerietalia palustris Annas et Krajina

This order, in which the pitcher plant (Sarracenia purpurea) may grow in British Columbia, is different from the order of Scheuchezerietalia, described in Europe by Nordhagen (1936), Braun-Blanquet (1948/50) or Tüxen (1955). Its ecotopes are hydric and oligotrophic. It is represented by only one alliance (no. 10).

Alliance 10 Sphagno (magellanici) - Sarracenio (purpureae) - Scheuchzerion palustris Annas et Krajina

PLANT ASSOCIATION 15

PITCHER PLANT - SPHAGNUM

Sphagno (magellanici) - Sarracenio (purpureae) - Oxyccoco (microcarpi) - Scheuchzerio (palustris) - Andromedetum polifoliae

Plot No.	11	34
Elevation in M	550	550
Latitude	58 31'	58 31'
Longitude	122 42'	122 42'
Exposure	-	-
Slope Gradient %	0	0
Percent coverage		
Total B_2	-	1
C	7	65
Dh	99	98
Plot Coverage %		
Litter	100	100
Mineral Soil	-	-
Hygrotope	Hygric	
Trophotope	Submesotrophic - mesotrophic	
Parent Material	Organic	

Table 59

PITCHER PLANT - SPHAGNUM

BOREAL WHITE & BLACK SPRUCE ZONE
PAGE 1

SPECIES SIGNIFICANCE AND VIGOR

ST NO.	SPECIES	PLOT NUMBER 011	034																		P	MS	RS
B2																							
1	CHAMAEDAPHNE CALYCULATA	4.	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.1	4-5
2	PICEA MARIANA	3.1	1.+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.9	1-3
3	LARIX LARICINA	2.1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.6	2-2
C																							
4	ANCROMEDA POLIFOLIA	6.	6.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	6.5	6-6
5	SCHEUCHZERIA PALUSTRIS	5.	6.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.8	5-6
6	OXYCOCCUS MICROCARPUS	5.	5.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.5	5-5
7	SARRACENIA PURPUREA	4.	3.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	4.1	3-4
8	CAREX PAUCIFLORA	2.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.4	2-2
9	DROSERA ANGLICA	1.	2.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.0	1-2
10	DROSERA ROTUNDIFOLIA	2.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	2.0	1-2
11	CAREX AQUATILIS	1.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	1.5	1-1
12	ERIOPHORUM SCHEUCHZERI	2.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.6	2-2
13	ERIOPHORUM CHAMISSONIS	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.0	1-1
14	MENYANTHES TRIFOLIATA	.	1.2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.0	1-1
15	OXYCOCCUS PALUSTRIS	.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.0	1-1
16	SMILACINA TRIFOLIA	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.0	1-1
17	ERIOPHORUM VAGINATUM	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+
DH																							
18	SPHAGNUM MAGELLANICUM	6.	7.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	7.1	6-7
19	SPHAGNUM RECURVUM	6.	4.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	5.9	4-6
20	SPHAGNUM PULCHRUM	1.	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	1.5	1-1
21	CLADOPODIELLA FLUITANS	1.	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	100.0	1.2	+-1
22	SPHAGNUM ANNULATUM	.	7.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	5.7	7-7
23	SPHAGNUM CUSPIDATUM	1.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	1.0	1-1
24	CEPHALOZIA CONNIVENS	+.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	50.0	+.0	+-+

Table 60

SOIL CHEMICAL ANALYSIS (FRACTION <2MM)

TERRAIN SYSTEM AFTER VALENTINE (1971)

BOREAL WHITE & BLACK SPRUCE ZONE

PLOT 11 HYDRIC SPHAGNO-FIBRISOL

PLOT 34 HYDRIC SPHAGNO-FIBRISOL — BUCKINGHORSE TERRAIN SYSTEM

SAM NO	HORIZON	SAM. DEPTH (C.M.)	PH H2O	O.M. %	TOT.C %	TOT.N %	C/N RATIO	P PPM	EXCH. CAT. MEQ/100 GM CA	MG	NA	K	C.E.C. MEQ/100 GM	BASE SAT %	COLOR DRY	COLOR MOIST	TEXTURE %S	%SI	%C
34- 1	OF1	000-019	4.0	91.0	52.80	1.24	42.6	164	8.75	4.12	0.0	0.63	144.00	9.5					
34- 2	OF2	019-036	3.9	85.0	49.30	1.26	39.1	010	10.00	3.37	0.0	0.0	128.00	10.6					
34- 3	OF3	036-041	4.0	86.0	49.90	0.99	50.4	026	11.25	3.62	0.0	0.0	70.00	21.6					
34- 4	OF4	041-054	4.2	82.1	47.60	1.31	36.3	032	11.25	3.62	0.0	0.0	85.00	17.6					

Table 61

Pitcher Plant - Sphagnum

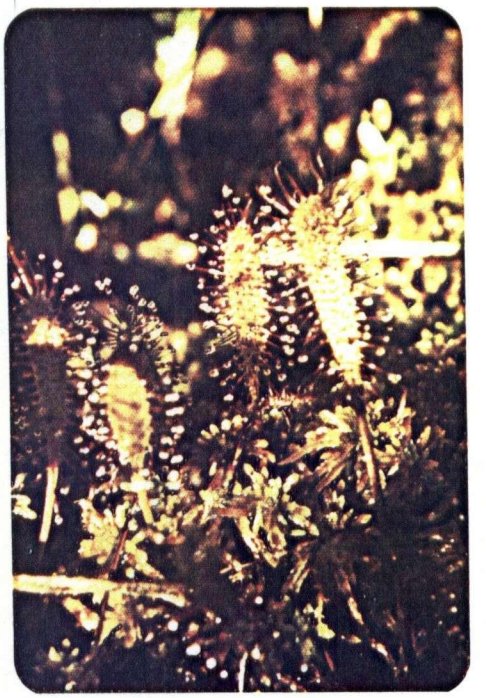


Figs. 78 & 79 This large bog is near Goguka Creek south of Fort Nelson, most of which consists of the Pitcher Plant - Sphagnum association shown below.



Pitcher Plant - Sphagnum





Figs. 80 & 81 Sarracenia purpurea and Drosera anglica. Two species with the carnivorous habit as adaptations for oligotrophic conditions.

Plant Association 15

Pitcher Plant - Sphagnum

Sphagno (magellanici) - Sarracenio (purpureae) - Oxyccoco (microcarpi) - Scheuchzerio (palustris) - Andromedetum polifoliae

The Pitcher Plant - Sphagnum association is found in drainage basins in areas of low relief where there is very little movement of water. Its occurrence is very restricted and is presently known from only two locations in British Columbia. Sarracenia purpurea (pitcher plant) was first discovered by the author in British Columbia in 1968 at Goguka Creek south of Fort Nelson (Krajina 1968) and again south of Parker Lake in 1972 in what is now the Parker Lake ecological reserve no. 47 (Krajina et al. 1974). The two sample plots representing the Pitcher Plant - Sphagnum association are restricted to the Goguka Creek area. This area bears a resemblance to part of the "closed drainage basins" described by Dirschl (1972) for the Saskatchewan River Delta.

Vegetation

Andromeda polifolia and Chamaedaphne calyculata which both indicate oligotrophic conditions, dominate the low

shrub layer with taller shrubs being absent. Scheuchzeria palustris, Oxycoccus microcarpus, Sarracenia purpurea, Carex pauciflora, Drosera anglica, and D. rotundifolia which dominate the herb layer again all indicate oligotrophic conditions in the Fort Nelson area.

The moss layer is basically occupied by Sphagnum spp. with S. magellanicum, S. recurvum, and S. annulatum being dominant. Sphagnum magellanicum is typically a species of nutrient poor hydric conditions in the Fort Nelson area. Jeglum (1974) and Moore and Bellamy (1974) report similar habitat conditions for this species in Saskatchewan and Scandinavia respectively. There are two species of Sphagnum, previously not known from British Columbia, Sphagnum pulchrum and S. annulatum.

It is interesting to note that the three species of plants, which have the carnivorous habit for supplanting mineral uptake in very oligotrophic conditions, occupy a significant portion of the community.

Soils

The soils of the Pitcher Plant - Sphagnum association are Hydric Sphagno Fibrisols with the single soil sampled showing the expected characteristics (wide C/N ratio, low pH, low ca, etc.) of nutrient poor conditions.

TABLE 62

SYNTHESIS OF FLORISTIC STRUCTURE OF PLANT ASSOCIATIONS AND THEIR HIGHER UNITS

		PICEETALIA GLAUCAE			PICEETALIA MARIANAE					LARICETALIA LARICINAE		POPULETALIA BALSAMIFERAE			(SPIRAEO -) MYRICETALIA GALIS	SPHAGNO (MAGELLANICI) - SCHEUCHZERIETALIA PALUSTRIS
Order		1			2					3					5	6
Alliance		1			2		3		4	5		6		7	9	10
Association	1	2	3	4	5	6	7	8		9	10	11	12	13	14	15
Number of plots	17	8	5	5	13	5	6	5		4	5	7	4	5	2	2
CHARACTERISTIC SPECIES:																
ORDER 1 & Alliance 1:	*															
(A) 1. *Picea glauca*	V 5.0	V 5.6	IV 3.0	IV 2.6	II 2.9	·	I 2.2	·	·	III 5.0	V 4.2	·	I 1.0	·	·	
2. *Populus tremuloides*	V 6.6	II 2.0	V 3.8	IV 3.6	II 1.9	I +.2	·	·	·	·	·	·	·	·	·	
3. *Betula papyrifera*	III 3.5	IV 3.4	·	·	II 1.0	·	·	·	·	II 1.0	·	·	·	·	·	
(B) 4. *Viburnum edule*	V 5.2	V 4.9	V 3.2	III 1.4	II +.2	I +.2	I +.0	·	·	V 2.9	V 3.7	·	·	·	·	
5. *Alnus crispa*	IV 4.6	·	II 4.3	III 2.4	III 1.6	II 2.3	·	·	·	II 1.0	I +.5	·	·	·	·	
6. *Shepherdia canadensis*	IV 4.2	II +.8	III 1.9	III 4.4	I +.0	·	II +.0	·	·	·	·	·	·	·	·	
7. *Ribes oxyacanthoides*	III 2.0	IV 2.7	·	·	·	·	I +.0	·	·	III +.5	III 1.4	·	·	·	·	
8. *Amelanchier alnifolia*	III 2.4	I +.0	·	I +.2	·	·	·	·	·	·	·	·	·	·	·	
9. *Ribes triste*	II +.7	IV 2.1	I +.0	·	·	I +.2	·	·	·	III 1.2	·	·	·	·	·	
(C) 10. *Rubus pubescens*	V 3.3	V 4.4	II 1.7	·	I +.0	I +.0	V 2.0	·	·	IV 2.3	IV 2.7	·	·	·	·	
11. *Viola renifolia*	IV 1.2	IV 2.7	IV +.3	·	I +.0	I +.2	III +.8	·	·	III 1.6	I +.0	·	·	·	·	
12. *Galium boreale*	III 1.4	I +.0	III 1.2	·	·	I +.0	·	·	·	II 1.0	I +.0	·	·	·	·	
13. *Actaea rubra*	III +.2	II +.1	·	·	·	·	·	·	·	II +.0	II +.0	·	·	·	·	
14. *Aster ciliolatus*	II +.1	I +.0	·	·	·	·	·	·	·	I +.0	·	·	·	·	·	
(D) 15. *Rhytidiadelphus triquetrus*	I +.0	II 3.0	·	·	·	·	·	·	·	·	·	·	·	·	·	
Association 1:																
(B) 16. *Lonicera dioica*	III 1.1	I +.0	·	·	·	·	·	·	·	I +.2	I +.0	·	·	·	·	
17. *Sorbus scopulina*	I +.0	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
(C) 18. *Aralia nudicaulis*	V 4.3	II 1.2	·	·	·	·	·	·	·	III 2.5	III 2.1	·	·	·	·	
19. *Calypso bulbosa*	I +.0	·	·	·	·	·	·	·	·	I +.0	·	·	·	·	·	
20. *Fragaria bracteata*	I +.0	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
(D) 21. *Eurhynchium pulchellum*	III +.0	I +.0	·	·	·	I +.0	·	·	·	·	·	·	·	·	·	
22. *Brachythecium asperrimum*	I +.0	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
23. *Mnium blyttii*	I +.0	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
24. *Peltigera horizontalis*	I +.0	·	·	·	·	·	·	·	·	·	·	·	·	·	·	
25. *Tortula mucronifolia*	I +.0	·	·	·	·	·	·	·	·	·	·	·	·	·	·	

*See page 254 for explanation of table

	Order		1				2				3			4			5	6	
	Alliance		1		2	3		4	5		6		7		8	9	10		
	Association	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15			
	Number of plots	17	8	5	5	13	5	6	5	4	5	7	4	5	2	2			
CHARACTERISTIC SPECIES:																			
Association 2:																			
(B)	26. *Ribes lacustre*	.	II 1.4	.	.	I +.0	.	I +.0	.	.	.	.	.	.	.	.			
	27. *Salix monticola*	.	I +.0	.	.	.	.	.	.	.	.	.	.	.	.	.			
(C)	28. *Mitella nuda*	IV 2.0	V 4.3	II +.4	.	I +.0	I +.2	III 1.2	.	.	V 4.1	III 1.0	.	.	.	.			
	29. *Goodyera repens*	II +.7	V 1.7	I +.2	.	II +.0	II +.4	.	.	.	IV +.3	.	.	.	.	.			
	30. *Equisetum pratense*	I +.0	V 6.4	III 1.1	.	.	I +.0	I +.0	.	.	IV 4.9	V 1.5	.	III +.5	.	.			
	31. *Galium triflorum*	I +.0	IV 1.8	.	.	.	.	.	.	.	II +.8	III +.0	.	.	.	.			
	32. *Circaea alpina*	.	III 3.4	.	.	.	.	.	.	.	II +.0	I +.0	.	.	.	.			
	33. *Matteuccia struthiopteris*	.	II 4.5	.	.	.	.	.	.	.	.	.	.	.	.	.			
	34. *Cinna latifolia*	I +.0	II 2.3	.	.	.	.	.	.	.	.	I +.0	.	.	.	.			
	35. *Carex deweyana*	.	II 1.2	.	.	.	.	.	.	.	.	.	.	.	.	.			
	36. *Thalictrum sparsiflorum*	.	II +.1	.	.	.	.	.	.	.	.	I +.0	.	.	.	.			
	37. *Fragaria virginiana*	I +.0	II +.1	I +.0	.	I +.0	.	I 1.4	.	.	.	I +.0	.	.	.	.			
	38. *Aconitum delphinifolium*	.	II +.8	.	.	.	.	.	.	.	.	.	.	.	.	.			
	39. *Delphinium glaucum*	.	II +.0	.	.	.	.	.	.	.	.	.	.	.	.	.			
	40. *Gymnocarpium dryopteris*	.	II +.0	.	.	.	.	.	.	.	I 1.0	.	.	.	.	.			
	41. *Geum macrophyllum*	.	I +.0	.	.	.	.	.	.	.	.	.	.	.	.	.			
(D)	42. *Brachythecium reflexum*	I +.0	II +.0	.	.	I +.0	I +.0	.	.	.	I 1.0	I +.0	.	.	.	.			
	43. *Brachythecium curtum*	.	I +.0	.	.	.	.	.	.	.	.	.	.	.	.	.			
	44. *Distichium capillaceum*	.	I +.0	.	.	.	.	.	.	.	.	.	.	.	.	.			
	45. *Ditrichum heteromallum*	.	I +.0	.	.	.	.	.	.	.	.	.	.	.	.	.			
	46. *Mnium marginatum*	.	I +.0	.	.	.	.	.	.	.	.	.	.	.	.	.			
	47. *Plagiomnium medium*	.	I +.0	.	.	.	.	.	.	.	.	.	.	.	.	.			
	48. *Plagiomnium ciliare*	.	I +.0	.	.	.	.	.	.	.	.	.	.	.	.	.			
	49. *Plagiomnium rostratum*	.	I +.0	.	.	.	.	.	.	.	.	.	.	.	.	.			
	50. *Platydictya jungermannioides*	.	I +.0	.	.	.	.	.	.	.	.	.	.	.	.	.			
	51. *Nephroma helveticum*	.	I +.0	.	.	.	.	.	.	.	.	.	.	.	.	.			
Association 3:																			
(B)	52. *Salix bebbiana*	III 2.8	IV 1.3	IV 4.2	I 2.4	I +.8	.	I +.0	I +.2	.	IV 3.8	.	.	.	.	.			
	53. *Salix scouleriana*	I +.0	.	V 3.5	I +.2	I 1.3	.	.	.	.	.	.	.	.	.	.			
(C)	54. *Lycopodium annotinum*	I +.0	I +.0	V 3.7	.	II 1.2	II +.8	.	.	.	.	.	.	.	.	.			
	55. *Elymus innovatus*	.	.	IV 5.1	I 3.4	.	.	.	.	.	.	.	.	.	.	.			
	56. *Lathyrus ochroleucus*	IV 1.8	.	IV 3.0	II +.0	I +.0	.	.	.	.	.	I +.0	.	.	.	.			
	57. *Maianthemum canadense*	III 2.1	II +.5	IV 1.2	III 1.1	.	.	.	.	.	I 1.5	III +.2	.	.	.	.			
	58. *Lycopodium complanatum*	I 1.2	.	III 3.0	II 2.6	I +.3	.	.	.	.	.	.	.	.	.	.			
ORDER 2:																			
(A)	59. *Picea mariana*	III 2.4	.	III 4.4	V 3.6	V 6.1	V 6.2	V 6.2	V 5.8	IV 1.6	V 5.5	.	.	.	.	V 2.9			
	60. *Pinus contorta*	I 2.0	.	V 5.3	V 5.1	IV 4.9	I 1.0	.	I +.2	.	.	.	.	.	.	.			
(B)	61. *Ledum groenlandicum*	II +.0	.	V 6.5	V 3.2	IV 3.0	IV 5.2	V 6.7	V 7.7	V 1.8	V 3.2	.	.	.	.	.			
(C)	62. *Vaccinium vitis-idaea*	III 1.1	II 2.0	V 5.3	V 5.3	V 4.7	V 4.1	V 5.2	V 5.2	IV 1.3	V 3.4	.	.	.	.	.			
	63. *Geocaulon lividum*	I +.0	.	III +.0	V 2.7	III 1.1	I +.0	IV 1.3	I +.2	.	II +.0	.	.	.	.	.			
	64. *Oxycoccus microcarpus*	.	.	.	.	.	II +.8	IV 1.7	V 2.2	II +.0	.	.	.	.	.	V 5.5			
	65. *Empetrum nigrum*	.	.	.	.	II +.1	I +.2	.	.	.	.	.	.	.	.	.			
	66. *Carex loliacea*	.	.	.	.	.	I +.2	I +.7	.	.	I +.0	.	.	.	.	.			

Table 62 (continued)

	Order	1			2					3		4			5	6
	Alliance	1			2	3		4	5	6		7	8		9	10
	Association	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Number of plots	17	8	5	5	13	5	6	5	4	5	7	4	5	2	2
CHARACTERISTIC SPECIES:																
ORDER 2 (Cont.):																
(D)	67. *Pleurozium schreberi*	III 2.3	II 3.1	V 5.5	V 5.0	V 7.2	V 6.4	V 2.7	V 4.4	III 5.1	V 5.1	.	.	.	.	.
	68. *Barbilophozia barbata*	.	.	.	I +.0	.	.	.	I +.0	.	.	.	.	.	.	.
	69. *Peltigera aphthosa*	II +.5	I +.0	IV 3.7	IV 3.7	V 3.4	II 2.3	V 2.8	II +.4	.	IV 1.8	.	.	.	.	.
	70. *Peltigera malacea*	I +.0	.	I +.2	I +.0	II +.1	.	.	I +.0	.	I +.2	.	.	.	.	.
Alliance 2 & Association 4:																
(A)	71. *Pinus banksiana*	.	.	.	III 4.1	.	.	.	.	.	.	.	.	.	.	.
(B)	72. *Vaccinium myrtilloides*	.	.	.	III 1.1	.	.	.	I +.0	.	.	.	.	.	.	.
	73. *Potentilla fruticosa*	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.	.
(C)	74. *Arctostaphylos uva-ursi*	.	.	.	V 5.0	.	.	II 2.2	.	.	.	.	.	.	.	.
	75. *Lycopodium obscurum*	.	.	I +.2	II 3.2	.	.	.	.	.	.	.	.	.	.	.
	76. *Pyrola grandiflora*	.	.	.	I 2.4	.	.	.	.	.	.	.	.	.	.	.
	77. *Oryzopsis pungens*	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.	.
(D)	78. *Polytrichum juniperinum*	.	.	I +.0	IV +.3	I +.0	.	.	I +.0	III 3.1	.	.	.	.	.	.
	79. *Dicranum polysetum*	.	.	.	III +.0	.	.	.	.	.	.	.	.	.	.	.
	80. *Cephalozielia divaricata*	.	.	.	III +.0	.	.	III +.0	.	.	.	.	.	.	.	.
	81. *Ptilidium pulcherrimum*	.	.	.	III +.0	II +.0	I +.0	.	.	.	.	.	.	.	.	.
	82. *Ceratodon purpureus*	.	.	I +.0	II +.0	I +.0	I +.0	I +.0	.	.	.	.	.	.	.	.
	83. *Brachythecium albicans*	I +.0	.	.	I +.0	I +.0	I +.0	.	.	.	.	I +.0	.	.	.	.
	84. *Dicranum fuscescens*	I +.0	.	.	I +.0	I +.0	.	.	.	.	.	.	.	.	.	.
	85. *Ptilidium ciliare*	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.	.
	86. *Cladina mitis*	.	.	.	V 5.3	II +.0	I 2.4	V 1.7	V 5.0	II +.3	.	.	.	.	.	.
	87. *Cladina alpestris*	.	.	.	V 3.2	.	.	I +.0	I +.2	II +.3	.	.	.	.	.	.
	88. *Cladonia gracilis*	I +.0	.	.	V +.9	I +.0	II 1.6	V 1.0	II 2.4	.	.	.	.	.	.	.
	89. *Cladina rangiferina*	I +.0	.	.	IV 4.3	II +.0	I 2.4	IV +.1	IV 1.7	II +.3	.	.	.	.	.	.
	90. *Peltigera canina*	I 1.2	I +.4	I 2.4	IV +.3	II 1.0	II +.0	III +.4	IV +.7	.	.	.	.	.	.	.
	91. *Cladonia uncialis*	.	.	.	III 3.0	.	I +.0	.	I +.2	.	.	.	.	.	.	.
	92. *Cetraria nivalis*	.	.	.	III +.0	.	.	.	III +.0	.	.	.	.	.	.	.
	93. *Cladonia fimbriata*	.	I +.0	.	II +.0	.	.	I +.0	II +.4	.	.	.	.	.	.	.
	94. *Cetraria cucullata*	.	.	.	I +.0	.	.	I +.0	.	.	.	.	.	.	.	.
	95. *Cetraria ericetorum*	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.	.
	96. *Cetraria islandica*	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.	.
	97. *Cladonia amaurocraea*	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.	.
	98. *Cladonia bacillaris*	.	.	.	I +.0	I +.0	.	.	.	.	.	.	.	.	.	.
	99. *Cladonia coccifera*	.	.	.	I +.0	.	.	.	I +.0	.	.	.	.	.	.	.
	100. *Cladonia crispata*	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.	.
	101. *Cladonia multiformis*	.	.	I +.0	I +.0	I +.0	.	I +.0	I +.0	.	.	.	.	.	.	.
	102. *Stereocaulon tomentosum*	.	.	.	I +.0	.	.	I +.0	.	.	.	.	.	.	.	.
Alliance 3:																
(B)	103. *Betula glandulosa*	.	.	I +.2	.	I +.0	II 1.6	.	I +.2	.	.	.	.	.	.	.
	104. *Vaccinium membranaceum*	.	.	.	.	I 1.4	I +.0	.	.	.	.	.	.	.	.	.
(C)	105. *Vaccinium caespitosum*	.	.	.	.	I +.1	I +.0	.	I +.0	.	.	.	.	.	.	.

Table 62 (continued)

	Order	1			2					3		4			5	6
	Alliance	1			2	3		4	5	6		7		8	9	10
	Association	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Number of plots	17	8	5	5	13	5	6	5	4	5	7	4	5	2	2
CHARACTERISTIC SPECIES:																
Alliance 3 (Cont.):																
(D)	106. *Ptilium crista-castrensis*	IV 3.3	IV 4.2	II 3.2	.	V 5.2	III 5.9	.	.	.	V 5.3	.	.	.	.	.
	107. *Herzogiella turfacea*	.	.	.	.	I +.0	I +.0	I +.0	.	.	I +.0	.	.	.	.	.
Association 5:																
(D)	108. *Barbilophozia hatcheri*	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.
	109. *Barbilophozia lycopodioides*	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.
	110. *Lophozia ventricosa*	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.
	111. *Pohlia cruda*	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.
	112. *Pohlia elongata*	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.
	113. *Tritomaria exsectiformis*	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.
	114. *Cladina aberrans*	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.
	115. *Nephroma arcticum*	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.
	116. *Nephroma resupinatum*	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.	.
Association 6:																
(B)	117. *Salix pyrifolia*	.	.	.	I +.0	.	II 2.4	.	.	.	I +.0	.	.	.	.	.
(C)	118. *Equisetum sylvaticum*	I +.0	.	IV +.7	.	II +.0	V 5.3	I +.0	I 3.4	.	IV 4.8	II +.1	II +.0	I +.2	.	.
	119. *Petasites palmatus*	II 1.3	I +.0	II 2.3	.	I +.0	III 2.4	IV 1.3	.	.	II 2.6	I +.5	.	.	.	.
	120. *Listera cordata*	.	.	I +.0	.	.	III 1.1	I +.0	.	III +.0	II +.0	.	.	.	.	.
	121. *Ranunculus lapponicus*	.	.	.	.	.	II 1.6	.	.	.	II 1.0	.	.	.	.	.
(D)	122. *Sphagnum girgensohnii*	.	.	.	.	.	III 5.1	.	.	.	.	.	.	.	.	.
	123. *Philonotis fontana*	.	.	.	.	.	III +.0	II +.0	.	.	.	.	.	.	.	.
	124. *Sphagnum subnitens*	.	.	.	.	.	II +.4	I +.0	I 1.5	II 1.1	.	.	.	.	.	.
	125. *Campylium hispidulum*	I +.1	II +.0	.	I +.0	I +.0	II +.0	II +.0	.	.	I +.0	I +.0	.	.	.	.
	126. *Cephalozia pleniceps*	.	.	.	.	.	II +.0	.	I +.0	.	.	.	.	.	.	.
	127. *Polytrichum commune*	I +.0	.	.	.	.	I +.2	.	.	.	.	.	.	.	.	.
	128. *Scapania paludosa*	.	.	.	.	.	I +.2	.	.	.	.	.	.	.	.	.
	129. *Calliergon cordifolium*	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.
	130. *Drepanocladus capillifolius*	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.
	131. *Mnium spinulosum*	.	I +.0	.	.	.	I +.0	.	.	.	.	I +.0	.	.	.	.
	132. *Plagiomnium cuspidatum*	I +.0	I +.0	.	.	.	I +.0	.	.	.	.	I +.0	.	.	.	.
	133. *Plagiothecium piliferum*	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.
	134. *Lepidozia reptans*	.	I +.0	.	.	.	I +.0	.	.	.	I +.0	.	.	.	.	.
	135. *Lophozia alpestris*	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.
	136. *Lophozia ascendens*	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.
	137. *Cladonia nemoxyna*	.	.	.	.	.	II 2.4	.	.	.	.	.	.	.	.	.
Alliance 4 & Association 7:																
(B)	138. *Salix myrtillifolia*	.	.	.	.	.	.	V 6.0	.	.	.	.	.	.	.	.
	139. *Salix novae-angliae*	.	.	I 1.0	.	I +.0	I +.2	V 3.5	.	.	I 1.0	.	.	.	.	.
	140. *Salix arbusculoides*	.	.	.	.	.	I +.2	V 2.1	.	.	I +.2	.	.	.	.	.
	141. *Salix glauca*	.	.	.	I +.0	.	.	I 1.4	I +.2	.	.	.	.	.	.	.
	142. *Salix athabascensis*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
	143. *Vaccinium uliginosum*	.	.	.	.	I 2.2	II 1.6	II 2.1	.	.	.	.	.	.	.	.

Table 62 (continued)

Order		1				2				3			4	5	6
Alliance		1		2		3	4	5		6		7	8	9	10
Association	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of plots	17	8	5	5	13	5	6	5	4	5	7	4	5	2	2
CHARACTERISTIC SPECIES:															
Alliance 4 & Association 7 (Cont.):															
(C) 144. *Equisetum scirpoides*	I +.0	IV 2.0	I +.0	II +.4	II +.2	II +.0	V 3.7	.	.	III 3.8	.	II +.0	.	.	.
145. *Pedicularis labradorica*	.	.	.	II 1.6	.	.	V 1.8	.	II +.3	.	.	.	.	.	.
146. *Arctostaphylos rubra*	.	.	.	.	.	.	V 4.5	.	.	I +.0	.	.	.	.	.
147. *Senecio lugens*	.	.	.	.	.	.	IV 3.0	.	.	.	I +.0	.	.	.	.
148. *Parnassia palustris*	.	.	.	.	.	.	IV 1.1	.	.	.	.	.	.	.	.
149. *Carex vaginata*	.	.	.	.	.	.	III 3.1	.	.	II 2.6	.	.	.	.	.
150. *Spiranthes romanzoffiana*	.	.	.	.	.	.	III +.0	.	.	.	.	.	.	.	.
151. *Polemonium acutiflorum*	.	I +.0	.	.	.	.	II +.0	.	.	I +.0	.	.	.	.	.
152. *Carex concinna*	.	I +.0	.	.	.	.	II +.0	.	.	.	.	.	.	.	.
153. *Petasites frigidus*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
154. *Carex aurea*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
155. *Equisetum palustre*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
(D) 156. *Aulacomnium palustre*	.	.	.	.	I +.0	III +.0	V 7.5	III +.0	V +.5	V 2.1	.	.	.	.	.
157. *Tomenthypnum nitens*	.	.	.	.	.	II +.0	V 5.7	.	IV +.2	II +.0	.	.	.	.	.
158. *Dicranum undulatum*	I +.0	.	.	II +.0	I +.0	II +.0	V 3.1	V +.9	III +.0	.	.	.	.	.	.
159. *Cephaloziella subdentata*	.	.	.	.	.	I +.0	IV +.1	II +.0	.	.	.	.	.	.	.
160. *Jamesoniella autumnalis*	I +.0	.	.	.	I +.0	.	III +.0	I +.0	.	.	.	.	.	.	.
161. *Pohlia sphagnicola*	.	.	.	.	.	.	III +.0	.	II +.0	.	.	.	.	.	.
162. *Polytrichum strictum*	.	.	.	.	.	I +.0	III +.0	III +.0	.	I +.0	.	.	.	.	.
163. *Brachythecium salebrosum*	I +.0	.	.	.	.	.	II +.0	.	.	I +.0	I +.0	.	.	.	.
164. *Lophozia obtusa*	.	.	.	.	.	I +.0	II +.0	.	.	.	.	.	.	.	.
165. *Blepharostoma trichophyllum*	.	I +.0	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
166. *Dicranum bonjeanii*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
167. *Dicranum elongatum*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
168. *Dicranum muehlenbeckii*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
169. *Lophozia excisa*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
170. *Lophozia longidens*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
171. *Obtusifolium obtusum*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
172. *Sphagnum warnstorfii*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
173. *Splachnum ampullaceum*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
174. *Tritomaria scitula*	.	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.
175. *Cladina arbuscula*	I +.0	.	.	III 1.6	I +.0	.	V 4.5	II +.0	.	.	.	.	.	.	.
176. *Peltigera polydactyla*	I +.0	.	.	II +.0	I +.0	II +.0	IV +.9	II +.0	.	I +.0	.	.	.	.	.
177. *Cladonia chlorophaea*	.	.	.	I +.0	.	.	III +.0	.	.	.	.	.	.	.	.
178. *Cladonia pleurota*	.	.	.	I +.0	.	I +.0	III +.0	II +.0	.	.	.	.	.	.	.
179. *Cladonia grayi*	.	.	.	.	.	.	II +.0	.	.	.	.	.	.	.	.
180. *Cladonia subulata*	.	.	.	.	.	.	II +.0	.	.	.	.	.	.	.	.
Alliance 5 & Association 8:															
(C) 181. *Rubus chamaemorus*	.	.	.	.	.	IV 4.4	I +.0	V 4.1	.	III 1.0	.	.	.	.	.
182. *Eriophorum vaginatum*	.	.	.	.	.	.	.	II 1.2	.	.	.	.	.	.	III +.0
(D) 183. *Sphagnum fuscum*	.	.	.	.	.	.	II 1.5	V 7.5	.	.	.	.	.	.	.

Table 62 (continued)

	Order	1			2					3			4			5	6
	Alliance	1			2	3		4	5	6		7			8	9	10
	Association	1	2	3	4	5	6	7	8	9	10	11	12	13		14	15
	Number of plots	17	8	5	5	13	5	6	5	4	5	7	4	5		2	2
CHARACTERISTIC SPECIES:																	
Alliance 5 & Association 8 (Cont.):																	
(D)	184. *Calypogeia sphagnicola*	.	.	.	.	.	I +.0	II +.0	IV +.3	II +.0	.	.	.	.		.	.
	185. *Cephalozia connivens*	.	.	.	.	.	II +.0	I +.0	IV +.3	II +.0	.	.	.	.		.	III +.0
	186. *Mylia anomala*	.	.	.	.	.	I +.0	I +.0	IV +.7	.	.	.	.	.		.	.
	187. *Lophozia marchica*	.	.	.	.	.	.	.	I +.0	.	.	.	.	.		.	.
	188. *Cephalozia macrostachya*	.	.	.	.	.	.	.	I +.0	.	.	.	.	.		.	.
	189. *Geocalyx graveolens*	.	.	.	.	.	.	.	I +.0	.	.	.	.	.		.	.
	190. *Icmadophila ericetorum*	.	.	.	.	.	.	.	IV 3.2	.	.	.	.	.		.	.
	191. *Cladonia cornuta*	.	.	.	I +.0	I +.0	II +.0	V 1.0	V 3.1	.	.	.	.	.		.	.
	192. *Cladonia gonecha*	.	.	.	.	.	I +.0	III +.0	IV +.3	.	.	.	.	.		.	.
	193. *Cetraria viridis*	.	.	.	.	.	.	.	I +.0	.	.	.	.	.		.	.
	194. *Cladonia deformis*	.	.	.	.	.	.	.	I +.0	.	.	.	.	.		.	.
ORDER 3 & Alliance 6:																	
(A)	195. *Larix laricina*	.	.	.	.	II 2.3	III 3.3	I +.0	IV 1.5	V 5.1	V 4.0	.	.	.		.	III 1.6
(C)	196. *Pyrola asarifolia*	IV 1.9	V 3.3	III 2.0	IV 2.5	I +.0	I +.2	II +.2	.	V 4.0	II +.0	V 3.0	.	.		.	.
	197. *Carex paupercula*	.	.	.	.	.	.	.	.	V 3.0	II 1.6	.	.	.		.	.
	198. *Smilacina trifolia*	I +.0	I +.0	.	.	.	III 2.1	IV +.1	II +.4	IV 2.3	V 3.0	II +.0	.	.		.	III 1.0
	199. *Carex dioica*	.	.	.	.	.	.	IV 1.5	.	IV 3.3	II +.4	.	.	.		.	.
	200. *Carex leptalea*	.	.	.	.	.	.	.	.	III 1.8	II +.0	.	.	.		.	.
	201. *Equisetum arvense*	I +.0	II 1.1	III 1.4	III 2.4	I +.0	III 1.1	V 2.6	.	III +.0	V 5.5	III 2.2	II +.0	.		.	.
	202. *Carex disperma*	.	I +.4	.	.	.	II 2.0	I +.0	.	II +.0	V 3.6	.	.	.		.	.
	203. *Potentilla palustris*	.	.	.	.	.	.	.	.	II 1.1	I 1.0	.	.	.		.	.
	204. *Carex tenuiflora*	.	.	.	.	.	.	.	.	II +.0	I 1.0	.	.	.		.	.
(D)	205. *Sphagnum capillaceum*	.	.	.	.	.	.	I +.0	II 1.2	V 5.7	II 4.3	.	.	.		.	.
	206. *Bryum pseudotriquetrum*	.	.	.	.	.	.	II +.0	I +.0	IV +.2	I +.0	.	.	.		.	.
	207. *Calliergidium pseudostramineum*	.	.	.	.	.	.	.	.	IV +.2	I +.0	.	.	.		.	.
	208. *Plagiomnium rugicum*	.	II 1.2	.	.	.	.	.	.	III +.0	II 1.0	.	.	.		.	.
	209. *Calliergon richardsonii*	.	.	.	.	.	.	I +.0	.	II +.0	I 3.4	.	.	.		.	.
	210. *Campylium stellatum*	.	.	.	.	.	.	.	.	II +.0	I +.0	.	.	.		.	.
	211. *Dicranum acutifolium*	I +.0	.	.	I +.0	I +.0	.	III +.0	I +.0	II +.0	III +.0	.	.	.		.	.
Association 9:																	
(B)	212. *Betula glandulifera*	.	.	.	.	.	.	.	.	V 8.2	.	.	.	.		.	.
	213. *Salix pedicellaris*	.	.	.	.	.	.	I +.0	.	II 1.8	.	.	.	.		.	.
(C)	214. *Oxycoccus palustris*	.	.	.	.	.	.	.	I +.0	V 4.1	.	.	.	.		.	III 1.0
	215. *Carex interior*	.	.	.	.	.	.	.	.	IV 2.5	.	.	.	.		.	.
	216. *Habenaria dilatata*	.	.	.	.	.	.	.	.	IV +.8	.	.	.	.		.	.
	217. *Equisetum fluviatile*	.	.	.	.	.	.	.	.	III 1.8	.	.	.	I +.0		.	.
	218. *Habenaria hyperborea*	.	.	.	.	.	.	.	.	III +.0	.	.	.	.		.	.
	219. *Carex rostrata*	.	.	.	.	.	.	.	.	II +.0	.	.	.	.		.	.
	220. *Habenaria obtusata*	.	I +.0	I +.0	.	.	.	I +.0	.	II +.0	.	.	.	.		.	.
	221. *Pedicularis parviflora*	.	.	.	.	.	.	.	.	I +.0	.	.	.	.		.	.
	222. *Eriophorum gracile*	.	.	.	.	.	.	.	.	II +.0	.	.	.	.		.	.
	223. *Eriophorum viridi-carinatum*	.	.	.	.	.	.	.	.	II +.0	.	.	.	.		.	.

Table 62 (continued)

	Order	1			2					3		4			5	6
	Alliance	1			2	3		4	5	6		7		8	9	10
	Association	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Number of plots	17	8	5	5	13	5	6	5	4	5	7	4	5	2	2
CHARACTERISTIC SPECIES:																
Association 9 (Cont.):																
(C)	224. *Galium palustre*	.	.	.	.	.	.	.	.	II +.0	.	.	.	.	.	.
	225. *Utricularia minor*	.	.	.	.	.	.	.	.	II +.0	.	.	.	.	.	.
	226. *Viola epipsila*	.	.	.	.	.	.	.	.	II +.0	.	.	.	.	.	.
(D)	227. *Calliergon stramineum*	.	.	.	.	.	I +.0	.	.	V +.5	I +.0	.	.	.	.	.
	228. *Paludella squarrosa*	.	.	.	.	.	I +.0	.	.	IV 3.5	.	.	.	.	.	.
	229. *Drepanocladus revolvens*	.	.	.	.	.	I +.0	I +.0	.	IV 3.2	.	.	.	.	.	.
	230. *Meesia triquetra*	.	.	.	.	.	.	.	.	IV +.2	.	.	.	.	.	.
	231. *Meesia uliginosa*	.	.	.	.	.	.	.	.	II +.0	.	.	.	.	.	.
	232. *Calliergon sarmentosum*	.	.	.	.	.	.	.	.	II +.0	.	.	.	.	.	.
	233. *Sphagnum subfulvum*	.	.	.	.	.	.	I +.0	II 3.2	II 4.4	.	.	.	.	.	.
	234. *Cinclidium stygium*	.	I 1.1	.	.	.	I +.0	.	.	II +.0	.	.	.	.	.	.
	235. *Drepanocladus tundrae*	.	.	.	.	.	.	.	.	II +.0	.	.	.	.	.	.
	236. *Leiocolea rutheana*	.	.	.	.	.	.	.	.	II +.0	.	.	.	.	.	.
Association 10:																
(B)	237. *Ribes glandulosum*	I +.0	I +.0	.	.	.	II +.4	I +.0	.	.	II 1.2	.	.	.	.	.
	238. *Salix planifolia*	.	.	.	.	.	.	I +.0	.	.	II +.4	.	.	.	.	.
	239. *Ribes hudsonianum*	.	I +.0	.	.	.	.	I +.0	.	.	I 2.4	.	.	.	.	.
	240. *Salix drummondiana*	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.	.
(C)	241. *Moneses uniflora*	.	I +.0	.	.	I +.0	I +.2	.	.	.	V 1.9	.	.	.	.	.
	242. *Habenaria orbiculata*	II +.3	.	II +.0	.	II +.0	II +.0	.	.	.	IV +.3	.	.	.	.	.
	243. *Calamagrostis canadensis*	II +.7	IV 1.3	I +.0	I +.0	I +.0	.	I +.0	.	.	III 3.4	.	.	I +.0	.	.
	244. *Petasites sagittatus*	.	.	.	.	.	.	.	.	.	III 2.4	.	.	.	.	.
	245. *Corallorhiza trifida*	I +.0	.	.	.	I +.0	.	.	.	.	II +.0	.	.	.	.	.
	246. *Glyceria striata*	.	.	.	.	.	.	.	.	.	II +.0	.	.	.	.	.
	247. *Rubus acaulis*	.	I 1.1	.	.	.	.	.	.	.	I 1.0	.	.	.	.	.
	248. *Glyceria pulchella*	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.	.
	249. *Lycopus uniflorus*	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.	.
	250. *Rhynchospora alba*	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.	.
	251. *Cardamine pratensis*	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.	.
	252. *Carex canescens*	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.	.
	253. *Carex laeviculmis*	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.	.
	254. *Carex microglochin*	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.	.
(D)	255. *Drepanocladus uncinatus*	I +.0	.	.	II +.0	II +.0	I +.0	I +.0	.	.	II +.0	.	.	.	.	.
	256. *Drepanocladus exannulatus*	.	.	.	.	.	.	.	.	.	I 1.5	.	.	.	.	.
	257. *Drepanocladus aduncus*	.	.	.	.	.	.	.	.	.	I +.2	.	.	.	.	.
	258. *Campylium chrysophyllum*	.	I +.0	.	.	.	.	.	.	.	I +.0	I +.0	.	.	.	.
	259. *Cratoneuron williamsii*	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.	.
	260. *Hypnum lindbergii*	.	I +.0	.	.	.	.	.	.	.	I +.0	.	.	.	.	.
	261. *Lophocolea heterophylla*	.	.	.	.	.	.	I +.0	.	.	I +.0	.	.	.	.	.
	262. *Plagiochila asplenioides*	.	I +.0	.	.	.	.	.	.	.	I +.0	.	.	.	.	.
	263. *Thuidium recognitum*	.	I +.0	.	.	.	.	.	.	.	I +.0	I +.0	.	.	.	.
	264. *Cladina pseudoevansii*	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.	.

Table 62 (continued)

	Order		1				2				3				4		5	6
	Alliance		1		2	3		4	5		6		7		8		9	10
	Association	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		
	Number of plots	17	8	5	5	13	5	6	5	4	5	7	4	5	2	2		
CHARACTERISTIC SPECIES:																		
Association 10 (Cont.):																		
(D)	265. *Peltigera leucophlebia*	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.	.		
ORDER 4, Alliance 7 & Alliance 8:																		
(A)	266. *Populus balsamifera*	II +.1	I +.5	I 1.5	.	I +.0	.	I +.0	.	.	II 1.5	V 7.0	IV 6.2	V 3.0	.	.		
(B)	267. *Alnus tenuifolia*	I +.0	V 4.9	.	.	.	.	I +.7	.	.	III 4.1	V 5.9	V 6.2	III 2.0	.	.		
(C)	268. *Equisetum hyemale*	.	.	.	.	.	.	.	.	.	.	IV 3.3	III 1.1	IV 3.6	.	.		
Association 11:																		
(B)	269. *Cornus stolonifera*	III 2.8	IV 4.0	.	.	.	.	.	.	.	I +.0	V 5.1	.	.	.	.		
	270. *Rubus idaeus* var. *strigosus*	I +.0	II +.0	.	.	.	.	.	.	.	.	III +.6	.	.	.	.		
	271. *Prunus virginiana*	.	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.		
(C)	272. *Vicia americana*	I +.9	I +.0	II +.4	.	.	.	.	.	.	.	IV 1.4	.	.	.	.		
	273. *Agropyron pauciflorum*	.	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.		
(D)	274. *Atrichum undulatum*	.	.	.	.	.	.	.	.	.	.	I +.0	.	.	.	.		
Association 12:																		
(B)	267. *Alnus tenuifolia*	I +.0	V 4.9	.	.	.	.	I +.7	.	.	III 4.1	V 5.9	V 6.2	III 2.0	.	.		
Alliance 8 & Association 13:																		
(B)	275. *Salix interior*	.	.	.	.	.	.	.	.	.	.	.	.	V 7.6	.	.		
	276. *Salix rigida*	.	.	.	.	.	.	.	.	.	.	.	II 3.7	III 3.0	.	.		
	277. *Salix lasiandra*	.	.	.	.	.	.	.	.	.	.	.	.	I +.2	.	.		
(C)	278. *Solidago canadensis*	.	.	.	.	.	.	.	.	.	.	I +.5	.	II +.0	.	.		
	279. *Achillea sibirica*	.	.	.	.	.	.	.	.	.	.	.	.	I +.0	.	.		
ORDER 5, Alliance 9 & Association 14:																		
(B)	280. *Myrica gale*	.	.	.	.	.	.	.	.	IV 6.6	.	.	.	.	V 7.1	.		
(C)	281. *Menyanthes trifoliata*	.	.	.	.	.	.	.	.	V 7.5	.	.	.	.	V 8.0	III 1.0		
	282. *Pedicularis macrodonta*	.	.	.	.	.	.	.	.	II +.3	.	.	.	.	V 4.7	.		
	283. *Triglochin maritima*	.	.	.	.	.	.	.	.	III 1.1	.	.	.	.	V 4.5	.		
	284. *Carex diandra*	.	.	.	.	.	.	.	.	III 2.2	.	.	.	.	V 3.5	.		
	285. *Galium trifidum*	.	.	.	.	.	.	.	.	III +.0	I +.2	.	.	.	V 2.7	.		
	286. *Utricularia intermedia*	.	.	.	.	.	.	.	.	IV 1.1	.	.	.	.	V 3.4	.		
	287. *Carex limosa*	.	.	.	.	.	.	.	.	.	.	.	.	.	III 4.7	.		
	288. *Epilobium leptophyllum*	.	.	.	.	.	.	.	.	.	.	.	.	.	III 1.6	.		
	289. *Epilobium palustre*	.	.	.	.	.	.	.	.	.	.	.	.	.	III +.0	.		
	290. *Lemna minor*	.	.	.	.	.	.	.	.	.	.	.	.	.	III +.0	.		
(D)	291. *Drepanocladus vernicosus*	.	.	.	.	.	I +.0	.	.	III 1.8	.	.	.	.	V 8.3	.		
	292. *Calliergon giganteum*	.	.	.	.	.	.	.	.	IV 4.6	.	.	.	.	V 7.4	.		
ORDER 6, Alliance 10 & Association 15:																		
(B)	293. *Andromeda polifolia*	.	.	.	.	.	I +.0	.	III +.5	III 4.4	.	.	.	.	.	V 6.5		
	294. *Chamaedaphne calyculata*	.	.	.	.	.	.	.	IV 2.2	V 4.3	.	.	.	.	.	V 5.1		
(C)	295. *Scheuzeria palustris*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V 5.8		
	296. *Sarracenia purpurea*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V 4.1		
	297. *Carex pauciflora*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V 2.4		
	298. *Drosera anglica*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V 2.0		
	299. *Drosera rotundifolia*	.	.	.	.	.	.	.	IV 1.2	IV 2.9	.	.	.	.	.	V 2.0		
	300. *Eriophorum chamissonis*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III 1.6		
	301. *Eriophorum scheuchzeri*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III 1.0		

Table 62 (continued)

	Order	1			2					3		4			5	6
	Alliance	1			2		3	4	5	6		7		8	9	10
	Association	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Number of plots	17	8	5	5	13	5	6	5	4	5	7	4	5	2	2
CHARACTERISTIC SPECIES:																
ORDER 6, Alliance 10 & Association 15 (Cont.):																
(D)	302. *Sphagnum magellanicum*	.	.	.	.	.	.	.	II +.4	.	.	.	.	.	.	V 7.1
	303. *Sphagnum recurvum*	.	.	.	.	.	.	.	II 3.0	IV 5.4	.	.	.	.	.	V 5.5
	304. *Sphagnum pulchrum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V 1.5
	305. *Cladopodiella fluitans*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	V 1.2
	306. *Sphagnum annulatum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III 5.7
	307. *Sphagnum cuspidatum*	.	.	.	.	.	.	.	.	.	.	.	.	.	.	III 1.0
COMPANION SPECIES:																
(A)	308. *Abies lasiocarpa*	I +.0	II +.8	I +.2	.	II 2.0	I 1.0	.	.	.	.	.	.	.	.	.
	309. *Betula resinifera*	I +.5	I +.0	IV 2.5	I +.2	I +.8	III 1.9	.	.	II 1.8	III 4.0	.	.	.	.	.
(B)	310. *Rosa acicularis*	V 5.1	V 5.0	V 3.0	V 4.1	III 2.0	V 3.0	III 1.6	.	.	IV 3.9	V 4.2	.	I +.0	.	.
	311. *Spiraea betulifolia*	.	.	.	.	.	I +.0	.	.	.	.	.	.	.	.	.
(C)	312. *Achillea millefolium*	.	.	.	.	.	.	IV +.9	.	.	.	I +.0	.	.	.	.
	313. *Carex aquatilis*	.	.	.	.	.	I 1.0	II 1.7	I +.0	IV 3.2	.	.	.	.	III 4.7	V 1.5
	314. *Cornus canadensis*	V 4.5	V 4.8	V 5.8	V 4.2	V 3.8	V 4.8	IV 2.2	.	.	V 5.2	III 3.0	.	.	.	.
	315. *Epilobium angustifolium*	III 1.6	II +.8	V 3.7	V 2.1	I +.0	.	V 1.5	.	.	III +.5	.	.	.	.	.
	316. *Eriophorum brachyantherum*	.	.	.	.	.	I +.0	.	.	.	.	I +.0	.	.	.	.
	317. *Linnaea borealis*	V 4.8	IV 5.0	IV 3.8	V 4.4	III 1.4	I 2.4	IV +.9	.	.	IV 2.6	II +.4	.	.	.	.
	318. *Mertensia paniculata*	IV 2.5	IV 3.1	I +.0	I +.0	I +.0	I +.2	V 1.6	.	.	IV 1.3	I +.0	.	.	.	.
	319. *Pyrola chlorantha*	III +.3	III 1.3	I +.0	III 1.0	II +.0	.	II +.2	.	II +.0	III +.5	I +.0	.	.	.	.
	320. *Pyrola secunda*	V 1.2	III 1.9	IV 1.8	III 1.2	III +.3	IV 1.0	II +.2	.	.	V 1.4	.	.	.	.	.
(D)	321. *Hylocomium splendens*	V 5.7	V 6.8	V 7.9	V 4.0	V 6.9	V 5.6	V 5.7	III 1.6	III 2.2	V 7.9	.	.	.	.	.
	322. *Pohlia nutans*	I +.0	II +.0	I +.0	III +.0	II +.0	III +.0	V +.3	I +.0	III +.0	.	.	.	.	.	.
	323. *Leptobryum pyriforme*	.	.	I +.0	.	.	I +.0	.	.	.	.	I +.0	.	.	.	.
	324. *Marchantia polymorpha*	I +.0	.	.	.	.	.	I +.0	.	.	.	I +.0	.	.	.	.
	325. *Plagiomnium drummondii*	.	I +.0	.	.	.	.	.	.	.	.	I +.0	.	.	.	.
	326. *Tetraphis pellucida*	I +.0	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Table 62

*The Roman numeral in this table refers to constancy classes (see page 21). The Arabic numeral refers to the average species significance (page 19).

Chapter IV

TOPOGRAPHIC SEQUENCE

The locations of the various communities on the landscape is dependent upon the topographic position, soil texture, the amount and flow patterns of water in the system, and the nature or nutrient status of the water. The effect of the fine textured soils, which have developed from sedimentary rocks in the Fort Nelson area, plus the fact that precipitation is low, produces a different topographic sequence than what is normally expected for much of British Columbia. Fig. 82 represents a simplified schematic projection of normal topographic relationships among upland ecosystems in the Fort Nelson area. However, the diagram is limited in that all conditions and plant associations could not be represented.

Xeric associations occur on coarse textured sand deposits which are sufficiently elevated above the rest of the topography to produce rapidly drained sites. These sites support the Lodgepole Pine - Lichen association which is represented in Fig. 82 as occurring on sand dunes.

SIMPLIFIED SCHEMATIC REPRESENTATION OF TOPOGRAPHIC RELATIONSHIPS AMONG UPLAND ECOSYSTEMS

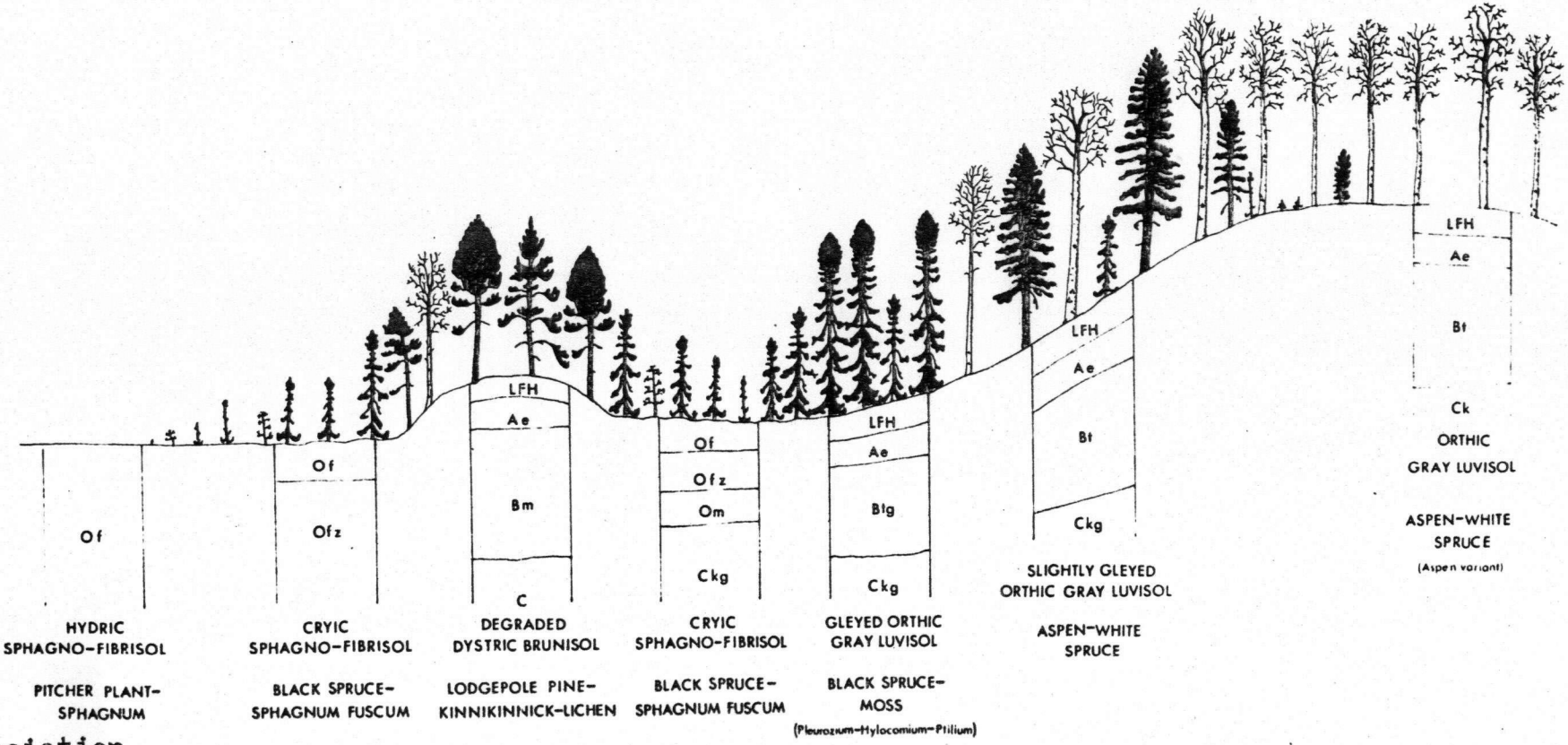


Figure 82

Topographic Sequence



Fig. 83 The Poplar Hills west of Fort Nelson (Valentine's Sikanni Terrain System). The Aspen - White Spruce association lies mostly above the Alaska Highway which is visible cutting across the center of the picture. In areas below the highway (Valentine's Buckinghorse Terrain System), the Black Spruce - Moss association becomes frequent. Along the stream channel which is subject to faster moving seepage water, the Tamarack - Black Spruce - Equisetum arvense association develops.

Very xeric sites, which occur on shallow soils over rock outcrops, are essentially absent in the study area (at least communities suitable for description).

Moderately well drained upland sites with silty loam parent materials generally support the Aspen - White Spruce association, as indicated in Fig. 82. This association occurs from mid-slope to the mildly shedding positions of the area. Extreme or strong shedding topographic positions are rare due to the gentle terrain of the Fort Nelson area, however, such sites are present in escarpment areas west of Fort Nelson. Suitable sample sites were inaccessible and therefore could not be included in this study. The Aspen - White Spruce association can also occur in positions receiving seepage waters below midslope (on brunisols) provided that the texture of the parent material is coarse and that drainage is adequate.

The relatively high percentage of silts and clays tend to retain water in the soil and the fine texture impedes rapid drainage, thereby maintaining a mesic moisture regime, even in shedding topographic positions. Although rare, the Black Spruce - Moss association can sometimes develop on mesic sites, particularly on north aspects. However, as discussed earlier, it appears to require the establishment

of an acid mor humus before black spruce can successfully outcompete other trees on such sites. Under such conditions, black spruce becomes the climatic climax tree.

Another plant association which can develop in neutral to shedding topographic positions, but is not represented on the diagram, is the Lodgepole Pine - Clubmoss. This association appears to develop only where a high percentage of clay is present in the soil profile and only in neutral or slightly shedding topographic positions. Extremely fine textured soils in other topographic positions tend to support Black Spruce - Moss associations due to impeded drainage.

The topographic position, in which the Black Spruce - Moss association normally develops, is in positions where the soils are subject to seepage (minerotrophic) waters as indicated in Fig. 82. Contrary to the normal condition in mountainous areas, especially at lower latitudes, the seepage waters in the Fort Nelson area, in certain cases, appear to adversely affect the site. Again, the fine texture of the soils impedes percolation or lateral movement of water to the extent that the ground water takes on the characteristics of stagnant water with poor "aeration" which favours the development of Black Spruce - Moss communities.

At the base of slopes or in nearly flat topography where water movement, either at the surface or in the soil, is slightly more rapid than in the Black Spruce - Moss association, Black Spruce - Equisetum sylvaticum communities generally occur. If the water movement is sufficiently rapid and additionally nutritionally rich, Tamarack - Black Spruce - Equisetum arvense communities can be found. This latter community is frequently found adjacent to small streams and drainage channels.

In flat or very gentle undulating topography, underlain by fine textured soils with poor development of drainage systems, bog development is common. Where water movement is slow, Black Spruce - Sphagnum fuscum communities develop which, due to accumulation of peat, become independent of the underlying mineral substrate. In similar topographic positions, which are subject to periodic innundation by minerotrophic waters during periods of high water flow, the Black Spruce - Salix myrtillifolia - Aulacomnium communities develop.

In open drainage basins, which have undergone succession from open water, fen communities develop. These communities are under the influence of minerotrophic waters and are represented in this study by the Myrica gale - Menyanthes

and the Tamarack - Swamp Birch - Menyanthes associations. The latter association is an advanced treed successional stage of the Myrica gale - Menyanthes.

In areas where drainage basins have slow movement of water, not highly affected by contact with mineral soils, the Pitcher Plant Sphagnum association can develop. It should be pointed out that only a few bog communities are described in this study and that the classification of bog lands is, therefore, incomplete for the Fort Nelson area.

Chapter V

SURFACE ORGANIC LAYERS

Organic material plays an important dynamic role in forest and peatland ecosystems in the Boreal Zone. One of the main functions of organic matter is forming nutrient capital, especially for trees. As discussed in chapter III, it appears that the humus properties of forest sites have an important effect in soil forming processes and in ecosystem development. Certain trees, such as black spruce, confine most of their roots to the humus and therefore, the growth of such trees is related to the properties of surface organic layers. Other trees, such as trembling aspen, rely more heavily on mineral soils and are capable of cycling large amounts of nutrient. Both types of trees appear to be major contributors to ecosystem dynamics and organic matter development in boreal regions.

Since very little information is present concerning elemental content of surface organic layers for northern areas, an exploratory study was conducted on surface organic horizons. These organic layers were analysed for their

elemental mineral content by ash analysis with the results grouped and presented according to plant associations. Although the data are subject to some serious limitations, including the fact that sampling intensity was not sufficient for adequate statistical analysis of the results, the general lack of information on boreal ecosystems makes the presentation of results worthwhile.

The organic materials used for analysis and comparison were from sampled F-H horizons of mineral soils and from the organic material immediately below the living mosses in peat soils. Ash analysis was carried out by a modified dry ashing method which uses a low ashing temperature and oxidation by nitric acid (Peech in Jackson, 1958, Humphries, 1956). The results of different methods of ashing (dry ashing, modified dry ashing, and wet ashing) were discussed by Klinka and Annas (1973) and the modified dry ashing method used in this study was described.

Determination of the concentration of elements in the ash was carried out on an Atomic Absorption Spectrophotometer (Perkin Elmer model 303/306). Concentrations were determined on the following elements; calcium, magnesium, sodium, potassium, iron, aluminum, and manganese. The results are presented in Table 63 and Figs. 84 to 86.

Elemental Analysis of Surface Organic Horizons. Concentration in ppm of Organic Matter in Original Sample.
(* = No. of Samples)

Association #			Ca	Mg	Na	K	Fe	Al	Mn
4	Lodgepole Pine-Kinnikinnick-Lichen *4	Avg	10185	1434	99	1490	5179	4096	1995
		Range	4126-19023	825-2378	62-139	1156-1902	1112-8878	2113-6975	910-3900
1	Aspen-White Spruce *15	Avg	21488	2176	90	2041	6304	3531	998
		Range	5875-38248	641-3777	60-132	1314-3190	993-17353	1450-6297	171-4533
3	Lodgepole Pine-Clubmoss *5	Avg	13940	2442	98	2687	10381	7573	2234
		Range	8281-17131	1087-3491	63-130	2029-3548	5797-18811	5059-14771	1822-2356
5	Black Spruce-Moss *12	Avg	6963	968	68	956	3658	2613	214
		Range	2912-24930	326-3045	44-125	167-1765	355-12649	687-6362	27-568
2	Floodplain (Young Terrace) White Spruce *4	Avg	28367	2813	78	1126	3326	1993	538
		Range	23578-32159	1572-4586	66-101	893-1318	2143-4356	1543-2475	286-911
6	Black Spruce-Equisetum sylvaticum *5	Avg	10598	1469	72	1035	3975	2377	606
		Range	3289-17408	822-1985	57-91	486-1427	1662-4663	1546-3886	38-1929
10	Tamarack-Black Spruce-Equisetum arvense *5	Avg	25767	2013	91	745	5791	1955	713
		Range	7015-51869	935-3127	39-163	294-1127	117-18179	246-7321	61-2884
9	Tamarack-Swamp-Birch-Menyanthes *4	Avg	30876	2847	197	723	14355	583	1212
		Range	20649-39353	2383-3789	52-279	298-1151	715-3314	231-1036	119-2693
14	Myrica gale-Menyanthes *2	Avg	14689	139	274	325	5231	289	217
		Range	14367-15012	1351-1437	269-280	311-340	1165-9307	260-318	155-280
7	Black Spruce-Salix myrtillifolia-Aulacomnium *6	Avg	30269	2851	68	818	1582	1647	203
		Range	10657-69047	987-4568	37-91	393-1079	441-4143	373-2725	7-597
8	Black Spruce-Sphagnum fuscum *2	Avg	4598	600	169	796	1009	768	35
		Range	2551-6645	562-638	48-291	726-867	893-1125	740-797	20-51

Table 63

The data presented are subject to the following limitations: sampling of organic horizons was conducted throughout the growing season and therefore, no attention was paid to seasonal variation of nutrient content. Likewise, annual variation of nutrient content was not considered. Stand age may affect nutrient content of humus layers. Determinations of elements were for ppm only, which does not indicate total amounts. The methods presently available do not allow complete full recovery of all elements from the organic matter (Klinka and Annas, 1973).

Additionally, the results are from few samples of small size and are, therefore, subject to large sampling error. In lieu of these limitations, the results can only be considered as those of an exploratory study.

Of the 7 elements recovered and determined from the ash in this study, the following average percent yield of elements was obtained from all the samples.

Ca - 59.8%

Fe - 17.7%

Al - 9.3%

Mg - 6.5%

K - 4.3%

Mn - 1.9%

Na - .4%

ELEMENTAL CONTENT OF SURFACE ORGANIC HORIZONS

Concentration in p.p.m. of Organic Matter in Original Sample

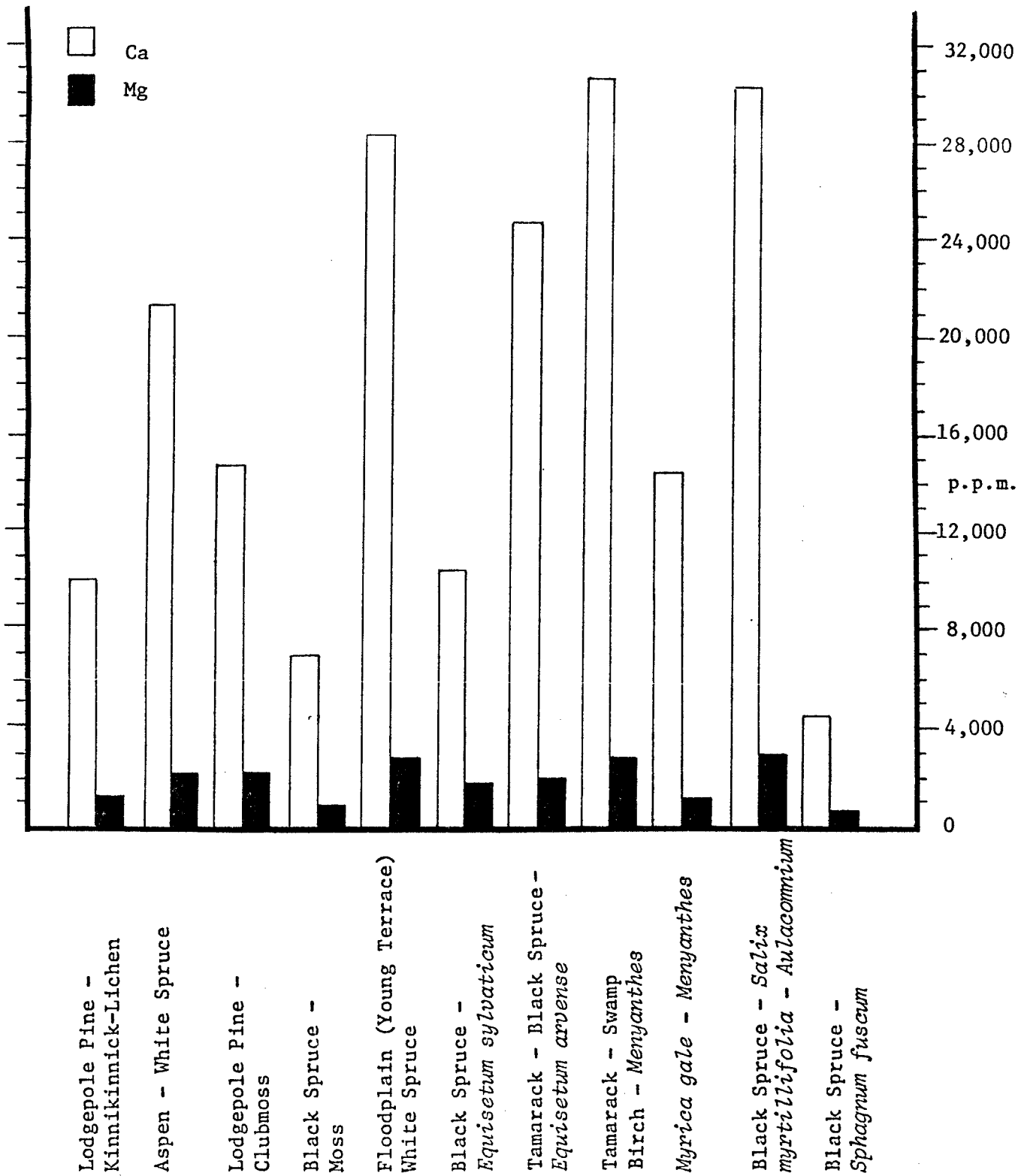


Figure 84

ELEMENTAL CONTENT OF SURFACE ORGANIC HORIZONS

Concentration in p.p.m. or Organic Matter in Original Sample

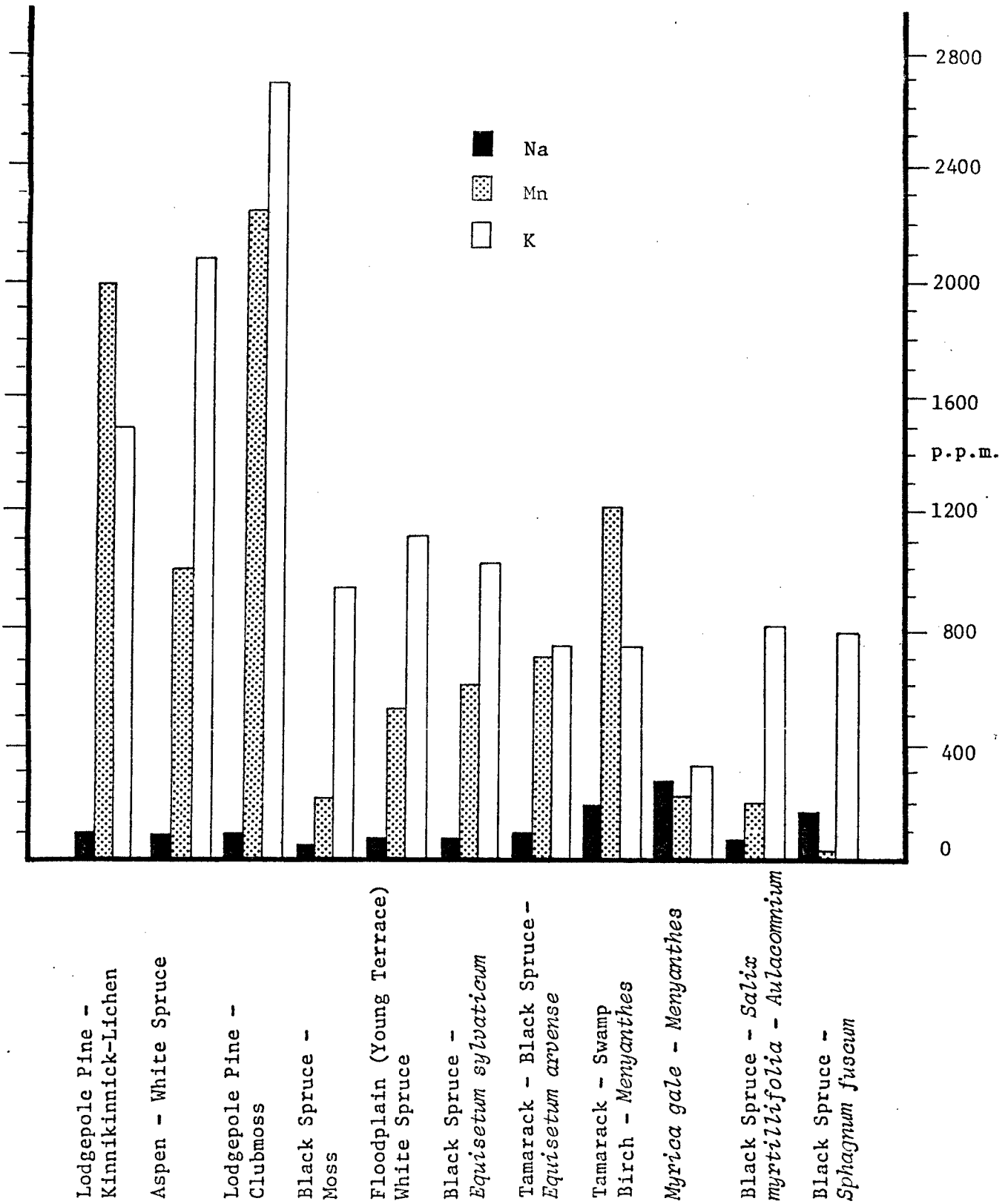


Figure 85

ELEMENTAL CONTENTS OF SURFACE ORGANIC HORIZONS

Concentration in p.p.m. of Organic Matter in Original Sample

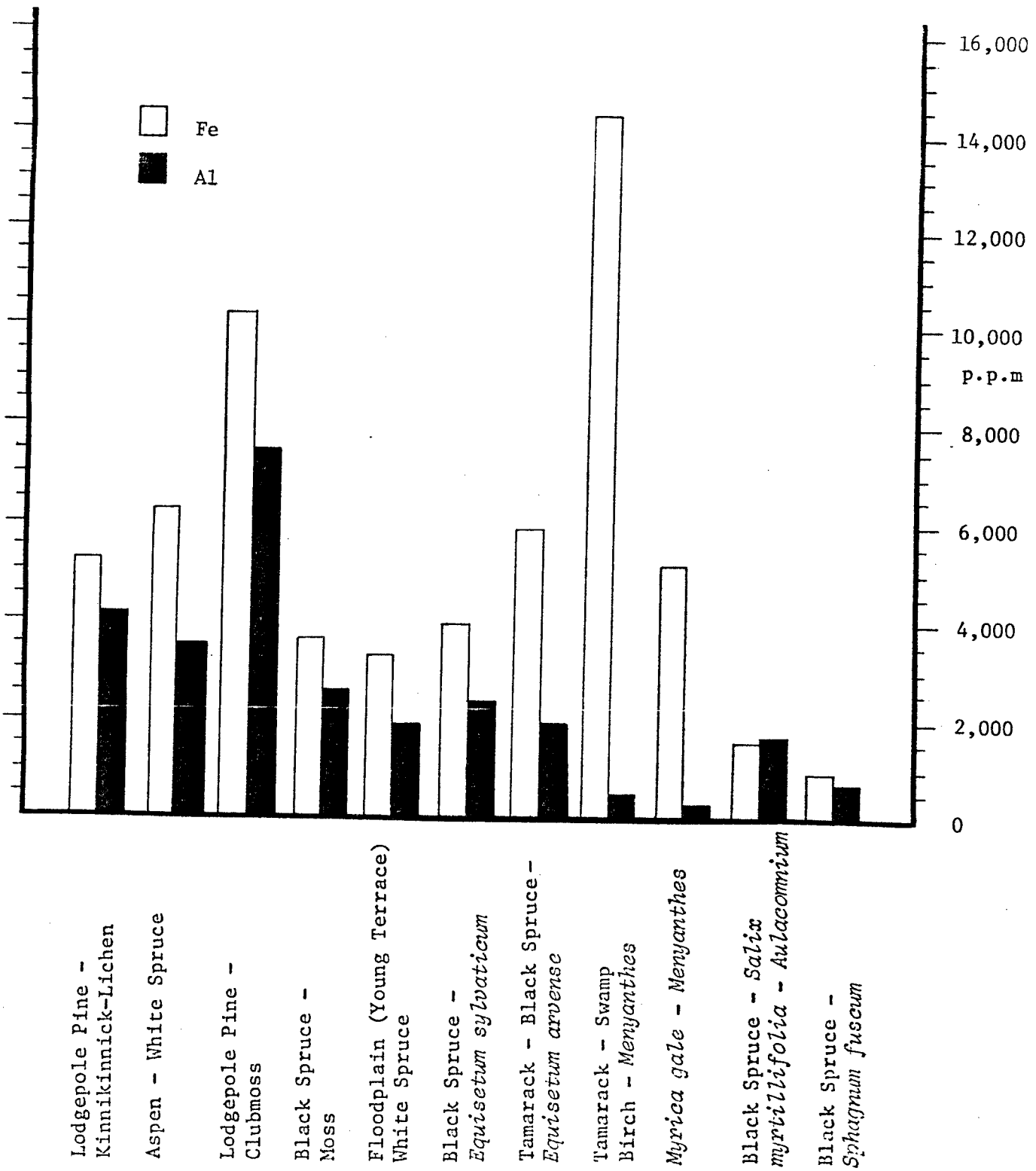


Figure 86

Calcium is the most ecologically significant element found in the ash of the organic material in this study. The organic matter, from 92 samples, contained an average of 2.4% Ca which is indicative of the important role that Ca plays in boreal ecosystems. The importance of Ca in soil forming processes is well known as are the correlations that high Ca has with: high pH; high nutrient status of soils; high activity of bacteria including nitrogen fixing bacteria; and low solubility of heavy metal ions (Epstein, 1972). In terms of plant growth, Ca is essential in many diverse roles, from ion transport in and out of cells (Epstein, 1972), to structural functions of plant cell walls (Devlin, 1969). It is, therefore, not surprising that the amount of Ca in ash of surface horizons appears to be a good indicator of the positions that plant associations have on the edatopic grid.

Plant associations 4 (Lodgepole Pine - Kinnikinnick - Lichen), 5 (Black Spruce - Moss) and 8 (Black Spruce - Sphagnum fuscum) occupy the most oligotrophic trophotopes of the edatopic grid. All three of these associations have lowest average concentrations of Ca in surface organic horizons when compared to the rest of the plant associations of the study (Table 63 and Fig. 84). The Lodgepole Pine - Kinnikinnick - Lichen has an average of 10,185 ppm

of Ca, while the Black Spruce - Moss has an average of 6963 ppm of Ca. The larger amount of Ca in the Lodgepole Pine - Kinnikinnick - Lichen ecosystem could be due either to error from the small sample number, or more likely due to the fact that Populus tremuloides was frequently present in the community. Low Ca values can be expected in this pine - lichen ecosystem since they occur on coarse textured, rapidly drained, easily leached soils. In general, all associations of the Piceetalia marianae have low Ca concentrations with the exception of the Black Spruce - Salix myrtillifolia - Aulacomnium association which was influenced by minerotrophic water.

The low value of Ca present in the Black Spruce - Moss association may be attributed to the nature of the litter of black spruce (including decaying wood) and the remains of feather moss which together contribute most of the biomass to the humus. In black (and white) spruce, the Ca content of needles appears to be proportional to the amount of Ca available to the tree roots (Swan, 1970, 1971). Since black spruce is a shallow rooting species, with roots concentrated in the humus, the Ca cycling ability of black spruce is low, especially where an acid mor humus is present.

Average values of the soil properties of mor humus of the Black Spruce - Moss association, found over mineral

soils, and the moder humus from Orthic Gray Luvisols of the Aspen - White Spruce association, are given below. (Table 64)

	Black Spruce - Moss Mor Avg. of 10 samples	Aspen - White Spruce Moder Avg. of 11 samples
thickness	9 cm	8 cm
pH	3.9	5.4
O.M. %	88.5	90.0
Total N %	.98	1.55
C/N	55.0	35.9
P ppm	112.0	134.0
Ca meq/100 gm	15.4	44.4
Mg meq/100 gm	3.49	10.38
K meq/100 gm	1.88	3.22
CEC meq/100 gm	108.0	107.7
Base Sat. %	21.5	62.8

Table 64 Mor and Moder Humus

The mor humus exhibits a low pH, low total % N, a wide C/N ratio, low exchangeable cations, a high C.E.C., and a low base saturation when compared to the moder humus.

These properties of the mor humus are similar to what has been described elsewhere for Boreal forest mor humus by Roberge, Weetman and Knowles (1970). Roberge et al. additionally point out a characteristic lack of humification and a slow tree-humus nutrient cycling of mor humus which is suggested in this study by the wide C/N ratio.

Other ecological properties of mor humus, discussed by Roberge et al. (1970), include little nitrifying bacterial activity, fungal competition for nutrients, fungal production of organic acids and chelating agents, growth of mosses that rely on air and tree drip for nutrients and accumulation of tree roots in the humus. These characteristics are ecologically significant in that production of mor humus will perpetuate nutrient poor conditions for tree growth, which in the case of black spruce, will tend to become independent of the underlying mineral substrata. Also, organic products leached from the humus will promote degradation of the mineral soil. These conditions and processes appear to be present in the Fort Nelson area in the Black Spruce - Moss association.

Table 63 and Fig. 84 show that Ca concentrations are high in the humus of the orders Piceetalia glaucae and Laricetalia laricinae. Basically these orders occupy the

sub-eutrophic side of the edatopic grid. Under such nutritionally rich conditions, trees such as Picea glauca (as well as other vascular plants) will cycle large amounts of Ca, provided it is available to the roots. This would help to explain the large amount of Ca present in the ash of humus derived largely from coniferous litter in the Alluvial (Young Terrace) White Spruce association.

As discussed earlier, Populus tremuloides cycles large amounts of Ca in the Aspen - White Spruce association. The moder humus of this association maintains a fairly rapid nutrient turnover as is suggested by the C/N ratio and pH. Van Cleve and Noonan (1975) have shown this to be the case in aspen stands in Alaska.

Magnesium closely follows the trend for Ca in the various ecosystems. In vegetation, Mg is a major constituent of chlorophyll and a cofactor of nearly all enzymes. Deficiencies affect almost every facet of metabolism in plants (Epstein, 1972). It is therefore, like Ca, a very important element to plants and plays a somewhat similar role to Ca in soils. The other elements, from the ash analysis, are accumulated differently by the different ecosystems as is indicated in Table 63 and Figs. 85 and 86 and do not follow the patterns of Ca and Mg in conforming to the

edatopic grid. Although K plays such roles as an activator of numerous enzymes to controlling opening and closing of stomata (Epstein, 1972), it does not follow a distinct pattern on the edatopic grid. The exact roles that the other elements play in ecosystems is not as well known as the role of Ca, Mg, and K and will not be discussed here.

An attempt was made at utilizing the results of ash analysis to group the humus into natural groups using a clustering technique (U.B.C. C Group, Hierarchical Grouping Analysis) documented by Lloyd and Gerbrandt (1974). This program performs a grouping to determine the extent to which natural groups exist among a number of items. Clustering was carried out, using several different sets of keys to perform the grouping. The results are presented in Appendix E. It is concluded that in this study, using unweighted results from the ash analysis to cluster humus into groups, although interesting, did not substantially contribute to a more meaningful understanding of the ecological properties of humus. Correlation matrices of the results of ash analysis are additionally presented in the appendix.

Chapter VI

FOREST MENSURATION

Since site quality is of paramount importance in forest management, an attempt was made to utilize mensurational data to quantify an evaluation of site. The most commonly used method of evaluating site is site index, which is expressed as tree height at a reference age. Other methods utilize standing volumes, mean annual increment, vegetation, soils, or other environmental approaches.

In terms of forestry, evaluation of site generally includes an evaluation of productivity. Productivity in forest management usually refers to the production of utilizable wood volumes rather than any total biomass or biological productivity. It is in this narrow forestry sense that productivity is considered here.

Mensurational data gathered in this study are expressed in two ways; as site index and as standing volume. There are, however, serious shortcomings inherent in attempt-

ing to utilize these measurements as numerical site quality estimators.

Site Index

When one is measuring a parameter, used as an indicator of site quality, variations in this parameter should reflect variations in site quality and not some extraneous factor. Unfortunately, measurements of site index often do reflect extraneous factors.

Additionally, some of the basic assumptions of site index curves are sometimes invalid. Jones (1969) points out that many site index curves are based on the following assumptions: (1) that height-age curves are harmonic (are proportioned to each other throughout the ages of the stands) (2) that site index will not change during the life of the stand.

The first assumption is often not valid since trees, with the same site index at age 100, may differ greatly in growth rates at various ages. The height-age curves may differ greatly, coinciding only at age 100. In utilizing B.C. Forest Service height-age curves (Forest Club Handbook, 1971), this may be a problem since the entire

province is only broken into two divisions, Coast and Interior. This problem of differently shaped height-age curves is partially overcome by only measuring site index of trees close to reference age. Warrack and Fraser (1955) report that, for some species, site index curves of 20 or 30 year old stands give unreliable indexes.

Another factor which affects site index is stocking of stands. This is especially a problem in aspen and lodgepole pine stands (Jones, 1969). Genetic differences of species may also result in different growth curves. Genetic differences probably play a very significant role in aspen stands where the entire stand may be the result of a single clone. This factor alone may result in significant errors, in judging the productivity of a site in terms of site index of aspen, in the Fort Nelson area.

Further errors in determining site index result from stand histories. Site index should only be measured on even-aged stands which have never been suppressed or grown in the understory. In spite of all the shortcomings of determining site index with present methods, site index is still generally considered the best indicator of site conditions in North America (Jones, 1969). This "best" is probably due more to the simplicity and usability of site index rather than of its accuracy.

In this study, site index was determined on several of the largest trees of each species on the plot (heights were determined with an abney and ages from increment cores). The tree with the greatest site index was then chosen to represent that species for the plot. This method allows the most accurate determination of site index by utilizing the fewest number of trees. The results of these site index measurements are summarized in table 65 and figure 87. (Individual plot values are presented in the appendix). Again it should be stressed here, that these results are subject to all the previously mentioned limitations. They are, therefore, only considered useful to better subjectively rank the productivity of the various ecosystems and must not be treated as numerical indices of site quality.

Standing Volume

Standing volume may be used to give an indication of site quality. Like site index, standing volume is subject to some serious limitations for numerically assessing site quality. Calculations ignore mortality, ingrowth, and the rate of accretion. Standing volume is subject to stand density and diameter distribution variations. Additionally, stand histories and most of the other factors affecting the reliability of site index also affect standing volume.

Standing volume should be utilized only as a rough guide to the productivity of specific sites and not as a numerical indicator of site quality. For these reasons, no attempt is made to project the measured standing volumes of this study to a given reference age by using volume/age curves. The measurements presented here refer only to the actual volume of wood standing on the plot at the time of sampling. These measurements are, however, very helpful for subjectively accessing site quality.

Procedures

Diameters on all trees over 7.9 cm (3.1") dbh (diameter breast height) were measured with a diameter tape in the field. Heights and ages were measured on selected sample trees, using an abney and increment borer. The height and age of at least one tree of each species, occurring on the plot, was determined. Enough sample trees were measured to be able to adequately assign the stand an age. The largest trees of each species were always selected as sample trees, with the occasional smaller tree being sampled.

Volumes were calculated at the Faculty of Forestry, University of British Columbia, for all trees over 7.9 cm dbh, which occurred on the plots. Local height-diameter regressions

were calculated for each species where enough points were available. The general model used to determine the height diameter regression is

$$H = 4.5 + bD + cD^2 .$$

The constants b and c are determined from regression analysis of heights on diameter from the sampled trees. The statistical results of this regression analysis are presented in Appendix G. Scatter diagrams of the relationships between heights and diameters are also presented there.

Heights were then calculated for each tree, using the above regression equations. This was followed by volume calculations, using the B.C. Forest Service Standard Volume Equations (Forest Club Handbook, 1971). Where insufficient sample trees were present to calculate height-diameter regression constants for a species, the B.C. Forest Service equations were used.

Summaries of volumes, number of trees/hectare, and basal area/hectare, for each association, are presented in Table 66 and Figure 88. Individual plot values for the above features are presented in Appendix F.

Generally, site index and standing volumes follow the trends expected when the ecosystems are projected on the

edatopic grid. It is interesting to note that of all the hygric ecosystems, only the eutrophic ones show high forest productivity. Even though other hygric ecosystems may be subeutrophic, their productivity is relatively poor. This pattern is considerably different in other biogeoclimatic zones where the climate is milder. The cool temperatures for much of the year, in the boreal zone, probably limit biological activity on hygric ecosystems to the point that tree growth is severely curtailed, even though the nutrients may be present. The ecosystems richer than mesotrophic have the higher productivities provided the sites are not too wet.

The ecosystem types are subjectively ranked according to forest productivity as follows: Floodplain Balsam Poplar $\pm =$ Floodplain (Young Terrace) White Spruce $>$ Aspen White Spruce $>$ Tamarack Black Spruce - *Equisetum arvense* $\pm =$ Lodgepole Pine Clubmoss $\pm =$ Black Spruce - Moss $>$ Black Spruce - *Equisetum sylvaticum* $>$ Lodgepole Pine - Kinnikinnick - Lichen $>$ Tamarack - Swamp Birch - *Menyanthes* $>$ Black Spruce - *Sphagnum fuscum* $\pm =$ Black Spruce - *Salix myrtillifolia* - *Aulacomnium*.

AVERAGE SITE INDEX (100 yrs)

Based on the average of the single largest tree of each species for community type. Individual occurrences of species are given in the Appendix.

Association #		Species	No. of Measurements	Avg. Site Index (ft.)	(m)
7	Black Spruce - *Salix myrtillifolia* - *Aulacomnium*	Black Spruce	5	24	7.3
9	Tamarack - Swamp Birch - *Menyanthes*	Tamarack	4	37	11.3
4	Lodgepole Pine - Kinnikinnick - Lichen	Lodgepole Pine	4	68	20.7
		Aspen	2	70	21.3
		White Spruce	2	73	22.3
6	Black Spruce - *Equisetum sylvaticum*	Black Spruce	5	50	15.2
		Tamarack	3	41	12.5
3	Lodgepole Pine - Clubmoss	Lodgepole Pine	5	79	24.1
		Aspen	4	78	23.8
10	Tamarack - Black Spruce - *Equisetum arvense*	Black Spruce	5	70	21.3
		Tamarack	3	68	20.7
		White Spruce	3	72	21.9
5	Black Spruce - Moss	Black Spruce	13	52	15.9
		Lodgepole Pine	9	63	19.2
		White Spruce	5	69	21.0
		Tamarack	3	65	19.8
1	Aspen - White Spruce	Aspen	14	95	29.0
		White Spruce	8	89	27.1
		Balsam Poplar	2	104	31.7
		Lodgepole Pine	2	86	26.2
2	Floodplain (Young Terrace) - White Spruce	White Spruce	8	98	29.9
		Balsam Poplar	2	90	27.4
11	Floodplain Balsam - Poplar	Balsam Poplar	6	121	36.9

Table 65

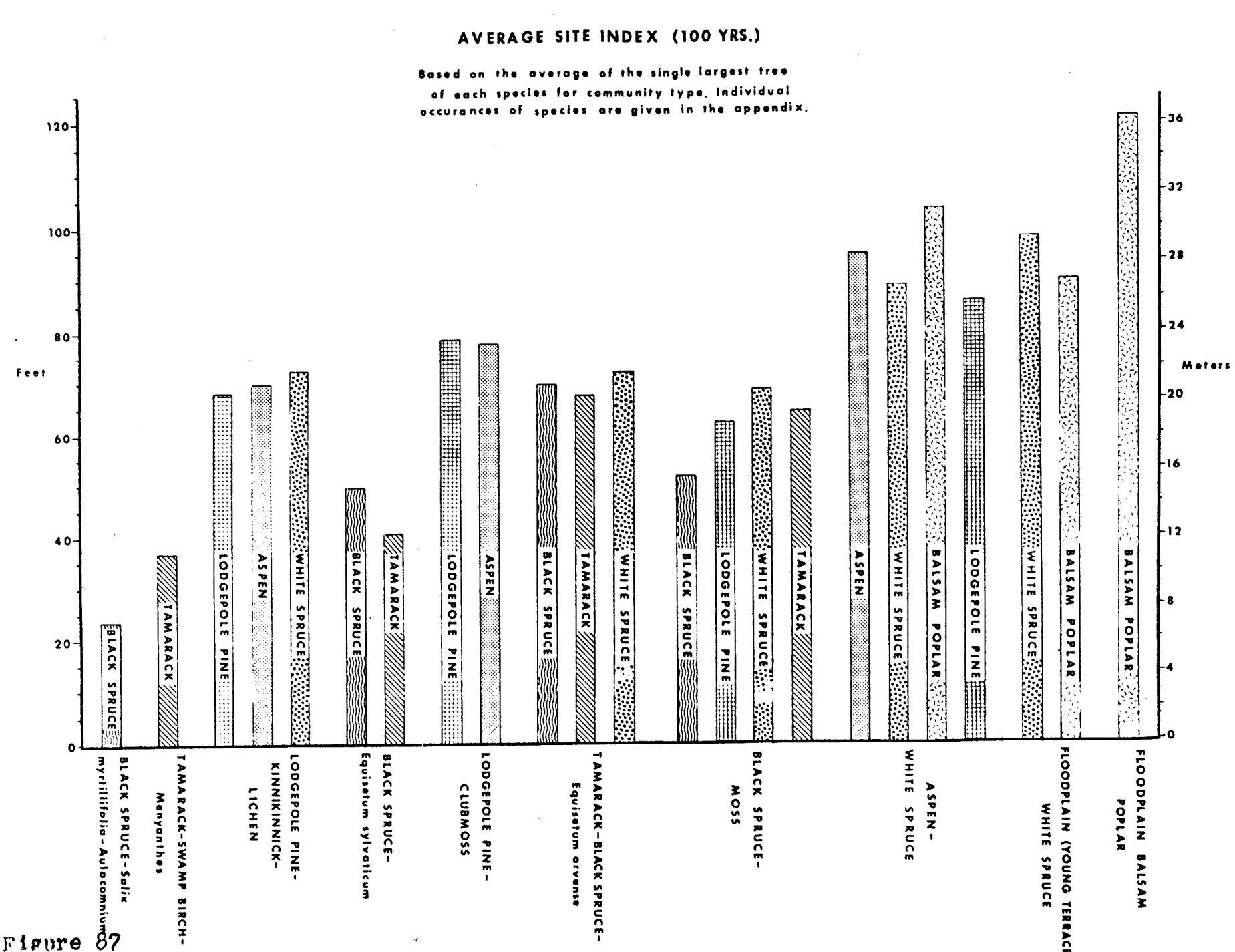

AVERAGE SITE INDEX (100 YRS.)
Based on the average of the single largest tree of each species for community type. Individual occurances of species are given in the appendix.
Feet
Meters
0
20
40
60
80
100
120
0
4
8
12
16
20
24
28
32
36
BLACK SPRUCE
BLACK SPRUCE-Salix myrtillifolia-Autocommium
TAMARACK
TAMARACK-SWAMP BIRCH-Menyanthes
LODGEPOLE PINE
ASPEN
WHITE SPRUCE
LODGEPOLE PINE-KINNIKINNICK-LICHEN
BLACK SPRUCE
TAMARACK
BLACK SPRUCE-Equisetum sylvaticum
LODGEPOLE PINE
ASPEN
LODGEPOLE PINE-CLUBMOSS
BLACK SPRUCE
TAMARACK
WHITE SPRUCE
TAMARACK-BLACK SPRUCE-Equisetum arvense
BLACK SPRUCE
LODGEPOLE PINE
WHITE SPRUCE
BLACK SPRUCE-MOSS
ASPEN
WHITE SPRUCE
BALSAM POPLAR
LODGEPOLE PINE
ASPEN-WHITE SPRUCE
WHITE SPRUCE
BALSAM POPLAR
FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE
BALSAM POPLAR
FLOODPLAIN BALSAM POPLAR

Figure 87

Average Total Gross Volume, Basal Area, and # of Trees by Species
for trees greater than 3.1" (7.9cm) dbh
(Avg. Age is for Dominant and Co-Dominant trees)

		White Spruce	Black Spruce	Lodgepole Pine	Tamarack	Subalpine Fir	Trembling Aspen	Balsam Poplar	Birch	All Species Total Range	All Species Total Avg.
Black Spruce-Sphagnum fuscum 5 Plots Avg. Age 80 Yrs Assoc. # 8	Ft^3/ Acre		69.7		19.1					0 - 503.1	88.8
	# trees/ Acre		60.0		6.7					0 - 370.0	66.7
	B.A. in Ft^2/ Acre		4.8		1.1					0 - 33.2	5.9
	M^3/ Hectare		4.8		1.3					0 - 34.7	6.1
	# trees/ Hectare		148.2		16.5					0 - 913.9	164.7
	B.A. in M^2/ Hectare		1.1*		.2*					0 - 7.6	1.4*
Black Spruce-Salix myrtillifolia-Tulacomnium 6 Plots Avg. Age 80 yrs Assoc. # 7	Ft^3/ Acre	41.0	58.5					10.2		0 - 335.1	109.7
	# trees/ Acre	18.3	51.7					10.0		0 - 180.0	80.0
	B.A. in Ft^2/ Acre	2.1	4.0					.7		0 - 18.7	6.8
	M^3/ Hectare	2.8	4.0					.7		0 - 23.1	7.5
	# trees/ Hectare	45.3	127.6					24.7		0 - 444.6	197.6
	B.A. in M^2/ Hectare	.5	.9					.0		0 - 4.3	1.4
Floodplain Alder 4 Plots Avg. Age 30 yrs Assoc. # 12	Ft^3/ Acre							547.2		0 - 2188.8	547.2
	# trees/ Acre							165.0		0 - 660.0	165.0
	B.A. in Ft^2/ Acre							26.7		0 - 106.6	26.7
	M^3/ Hectare							37.8		0 - 151.0	37.8
	# trees/ Hectare							407.6		0 - 1630.2	407.6
	B.A. in M^2/ Hectare							6.1		0 - 24.5	6.1
Tamarack-Swamp Birch-Menyanthes 4 Plots Avg. Age 150 yrs Assoc. # 9	Ft^3/ Acre		8.1		626.8					333.8 - 840.0	634.9
	# trees/ Acre		7.5		305.0					290.0 - 450.0	312.5
	B.A. in Ft^2/ Acre		.7		38.3					24.2 - 53.5	38.9
	M^3/ Hectare		.6		43.2					23.0 - 58.0	43.8
	# trees/ Hectare		18.5		753.3					716.3 - 1111.5	771.9
	B.A. in M^2/ Hectare		.1		8.8					5.6 - 12.3	8.9

Table 66 *Figures are rounded off from computer printouts (Appendix H) to the nearest decimal and therefore may not exactly add across horizontally.

		White Spruce	Black Spruce	Lodgepole Pine	Tamarack	Subalpine Fir	Trembling Aspen	Balsam Poplar	Birch	All Species Total Range	All Species Total Avg.
Lodgepole Pine-Kinnikinnick-Lichen 4 Plots * includes *Pinus banksiana* Avg. Age 70 yrs Assoc. # 4	Ft^3/ Acre	152.0	83.7	1226.7*			845.7			1565.1 - 3878.1	2308.2
	# trees/ Acre	30.0	55.0	155.0			80.0			280.0 - 350.0	320.0
	B.A. in Ft^2/ Acre	6.4	5.3	45.8			25.5			60.7 - 119.4	83.1
	M^3/ Hectare	10.5	5.8	84.6*			58.4			108.0 - 267.6	159.3
	# trees/ Hectare	74.1	135.8	382.8			197.6			691.6 - 864.5	790.4
	B.A. in M^2/ Hectare	1.5	1.2	10.5			5.9			14.0 - 27.5	19.1
Black Spruce *Equisetum sylvaticum* 5 Plots Avg. Age 110 yrs Assoc. # 6	Ft^3/ Acre		2524.1	31.7	109.7				90.7	655.8 - 6114.6	2756.2
	# trees/ Acre		1054.0	4.0	48.0				20.0	530.0 - 1930.0	1126.0
	B.A. in Ft^2/ Acre		131.0	1.2	6.7				4.1	44.7 - 239.0	143.1
	M^3/ Hectare		174.2	2.2	7.6				6.3	45.2 - 421.9	190.2
	# trees/ Hectare		2603.4	9.9	118.6				49.4	1309.1 - 4767.1	2781.2
	B.A. in M^2/ Hectare		30.1	.3	1.6				.9	10.3 - 55.0	32.9
Lodgepole Pine-Clubmoss 5 Plots Avg. Age 80 yrs Assoc. # 3	Ft^3/ Acre	26.5	7.8	2683.1			728.8		79.3	2018.1 - 5936.0	3525.4
	# trees/ Acre	8.0	6.0	576.0			38.0		16.0	470.0 - 870.0	644.0
	B.A. in Ft^2/ Acre	1.2	.5	111.4			20.4		3.6	105.1 - 196.7	137.2
	M^3/ Hectare	1.8	.5	185.1			50.3		5.5	139.2 - 409.6	243.2
	# trees / Hectare	19.8	14.8	1422.7			93.9		39.5	1160.9 - 2148.9	1590.7
	B.A. in M^2/ Hectare	.3	.1	25.6			4.7		.8	24.2 - 45.2	31.6
Tamarack-Black Spruce-*Equisetum arvense* 5 Plots Avg. Age 100 yrs Assoc. # 10	Ft^3/ Acre	838.7	2826.7		452.0			73.6	96.3	1706.7 - 6889.3	4287.3
	# trees/ Acre	120.0	832.0		48.0			4.0	58.0	570.0 - 1720.0	1062.0
	B.A. in Ft^2/ Acre	30.3	135.0		18.4			2.3	5.9	96.2 - 283.5	191.9
	M^3/ Hectare	57.9	195.0		31.2			5.1	6.6	117.8 - 475.4	295.8
	# trees/ Hectare	296.4	2055.0		118.6			9.9	143.3	1407.9 - 4248.4	2623.1
	B.A. in M^2/ Hectare	7.0	31.0		4.2			.5	1.4	27.1 - 65.2	44.1

Table 66 (continued)

		White Spruce	Black Spruce	Lodgepole Pine	Tamarack	Subalpine Fir	Trembling Aspen	Balsam Poplar	Birch	All Species Total Range	All Species Total Avg.
Black Spruce-Moss	Ft^3/ Acre	417.9	2317.4	1280.4	44.3	21.0	149.4	83.7	38.1	2712.5 - 6598.0	4352.2
13 Plots	# trees / Acre	48.5	881.5	286.1	15.4	11.5	18.5	4.6	20.8	560.0 - 2110.0	1286.9
Avg. Age 100 yrs	B.A. in Ft^2/ Acre	14.8	121.5	53.1	2.5	1.2	5.0	2.6	2.2	142.9 - 249.3	202.8
	M^3/ Hectare	28.8	159.9	88.3	3.1	1.4	10.3	5.8	2.6	187.2 - 455.2	300.3
	# trees / Hectare	119.7	2177.4	706.8	38.0	28.5	45.6	11.4	51.3	1383.2 - 5211.7	3178.7
Assoc. # 5	B.A. in M^2/ Hectare	3.4	27.9	12.2	.6	.3	1.2	.6	.5	32.9 - 57.3	46.7
Aspen-White Spruce	Ft^3/ Acre	2301.9	97.8	198.7			3912.4	110.0	253.4	3167.4 - 10415.0	6874.2
16 Plots	# trees / Acre	297.5	48.1	11.9			216.9	7.5	28.7	240.0 - 1190.0	610.6
Avg. Age 110 yrs	B.A. in Ft^2/ Acre	84.0	5.6	6.2			111.9	3.4	9.4	110.7 - 314.7	220.5
	M^3/ Hectare	158.8	6.7	13.7			270.0	7.6	17.5	218.6 - 718.6	474.3
	# trees / Hectare	734.8	118.9	29.3			535.7	18.5	71.0	592.8 - 2939.3	1508.2
Assoc. # 1	B.A. in M^2/ Hectare	19.3	1.3	1.4			25.7	.8	2.2	25.4 - 72.4	50.7
Floodplain (Young Terrace) White Spruce	Ft^3/ Acre	9050.5				18.0	105.4	31.8	218.8	5441.4 - 15590.0	9424.4
7 Plots	# trees / Acre	374.3				1.4	4.3	1.4	22.9	140.0 - 680.0	404.3
Avg. Age 160 yrs	B.A. in Ft^2/ Acre	239.5				.6	2.8	1.0	6.9	196.1 - 329.8	250.8
	M^3/ Hectare	624.5				1.2	7.3	2.2	15.1	375.5 - 1075.5	650.3
	# trees / Hectare	924.5				3.5	10.6	3.5	56.5	345.8 - 1679.6	998.6
Assoc. # 2	B.A. in M^2/ Hectare	55.1				.1	.6	.2	1.6	45.1 - 75.8	57.7
Floodplain Balsam Poplar	Ft^3/ Acre	596.3						10046.3		1949.0 - 17558.9	10642.6
7 Plots	# trees / Acre	111.4						292.9		170.0 - 780.0	404.3
Avg. Age 110 yrs	B.A. in Ft^2/ Acre	24.0						254.1		99.5 - 394.8	278.2
	M^3/ Hectare	41.1						693.2		133.9 - 1211.6	734.3
	# trees / Hectare	275.2						723.4		419.9 - 1926.6	998.6
Assoc. # 11	B.A. in M^2/ Hectare	5.5						58.4		22.9 - 90.8	64.0

Table 66

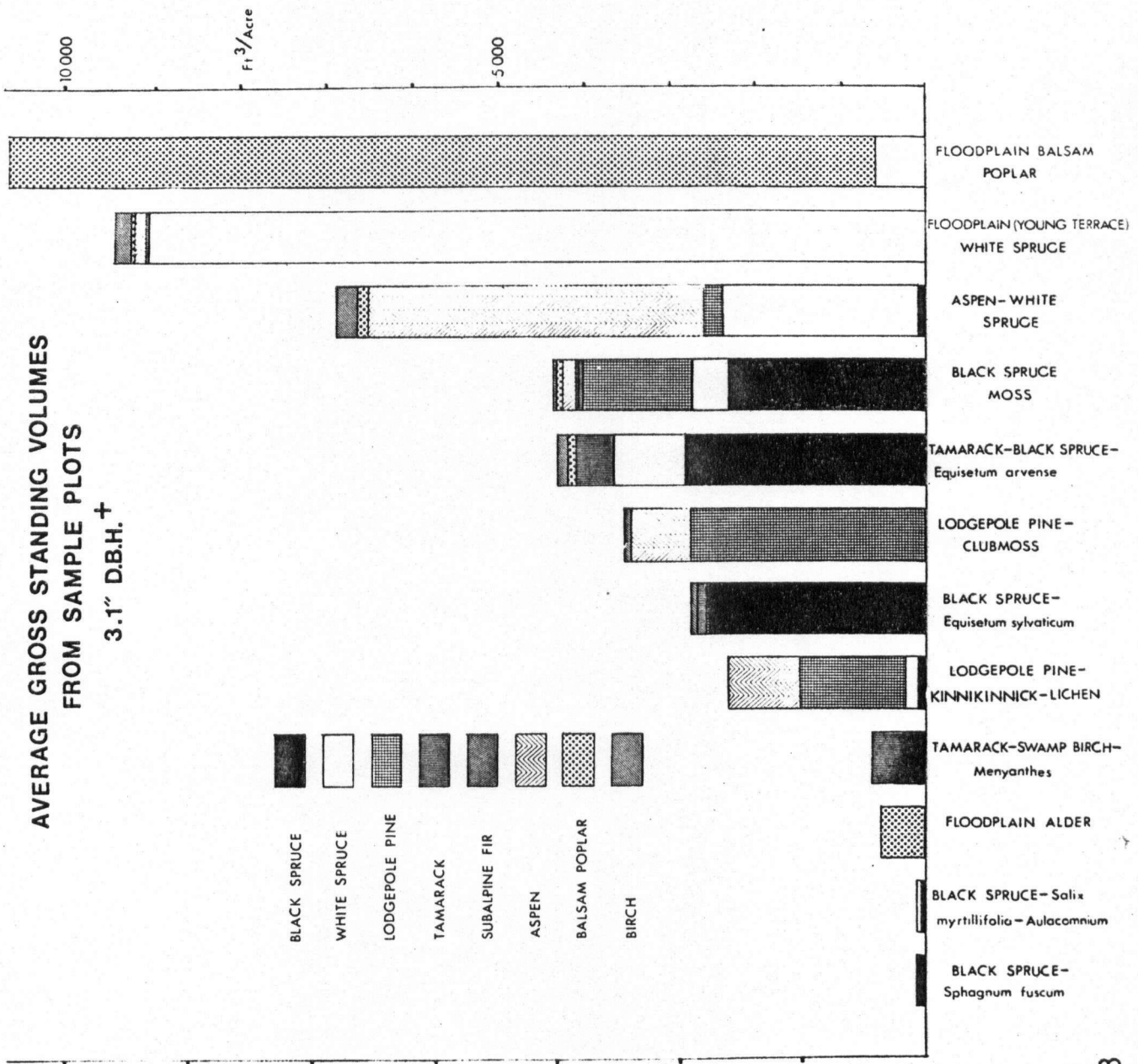

AVERAGE GROSS STANDING VOLUMES
FROM SAMPLE PLOTS
3.1" D.B.H.+
10 000
Ft³/Acre
5 000
700
M³/Hectare
500
BLACK SPRUCE
WHITE SPRUCE
LODGEPOLE PINE
TAMARACK
SUBALPINE FIR
ASPEN
BALSAM POPLAR
BIRCH
FLOODPLAIN BALSAM POPLAR
FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE
ASPEN-WHITE SPRUCE
BLACK SPRUCE MOSS
TAMARACK-BLACK SPRUCE-Equisetum arvense
LODGEPOLE PINE-CLUBMOSS
BLACK SPRUCE-Equisetum sylvaticum
LODGEPOLE PINE-KINNIKINNICK-LICHEN
TAMARACK-SWAMP BIRCH-Menyanthes
FLOODPLAIN ALDER
BLACK SPRUCE-Salix myrtillifolia-Aulacomnium
BLACK SPRUCE-Sphagnum fuscum

Figure 88

Chapter VII

SUCCESSION

Although successional schemes for boreal forests have often been severely criticized by some students of the boreal forests, certain trends are very obvious. The successional pattern of alluvial sites, as presented in the following discussion, for example, is treated by the author as fact. The directional trend in upland forests, although not as obvious, can be constructed by examining vegetation patterns and development trends in soils.

Much of the criticism directed towards discussions of succession in boreal forests stems from the fact that fire (as pointed out by Kayll, 1968) is an integral part of the boreal environment. True climax forest communities are generally not present due to repeated burnings and therefore, the climax vegetation of sites can only be hypothesized. For this reason, discussion of successional development of vegetation should not be done without considering soils.

If one considers the ecosystem as a whole, the development of routes that ecosystems have taken in the past,

regardless of whether or not they have been burned, can be deduced by examining soils of various ages. For example, only Cumulic Regosols are found on recent alluvial deposits. Degraded Eutric Brunisols (on fine textured parent materials) or Degraded Dystric Brunisols (on coarse textured materials) can be found on older river terraces as is reported by Jeffrey (1964) for the lower Liard River. Even older terraces support Orthic Gray Luvisols which would have developed basically from Degraded Eutric Brunisols. It is also reasonable to assume that as these soils went through their development, the entire ecosystem, including its vegetation, would also go through a corresponding successional development.

Likewise, if one follows soil development from the edges of lakes which are slowly being filled in by organic matter, the directional trends of organic ecosystems can be deduced and placed into a reasonable scheme. A summary of the probable directional development of upland ecosystems, along with a detailed discussion on the development of alluvial ecosystems, follows.

Floodplain Succession

The development of vegetation on the alluvial deposits along the Fort Nelson, Muskwa, and Prophet Rivers produce a

textbook example of succession. These rivers have cut a trench approximately 100 meters deep through the Fort Nelson lowlands. The valley bottoms contain recent alluvial deposits where the meandering rivers continuously rearrange the alluvium into shifting floodplain terraces. Fresh alluvium is continually being added on the downstream edge of the floodplain terraces

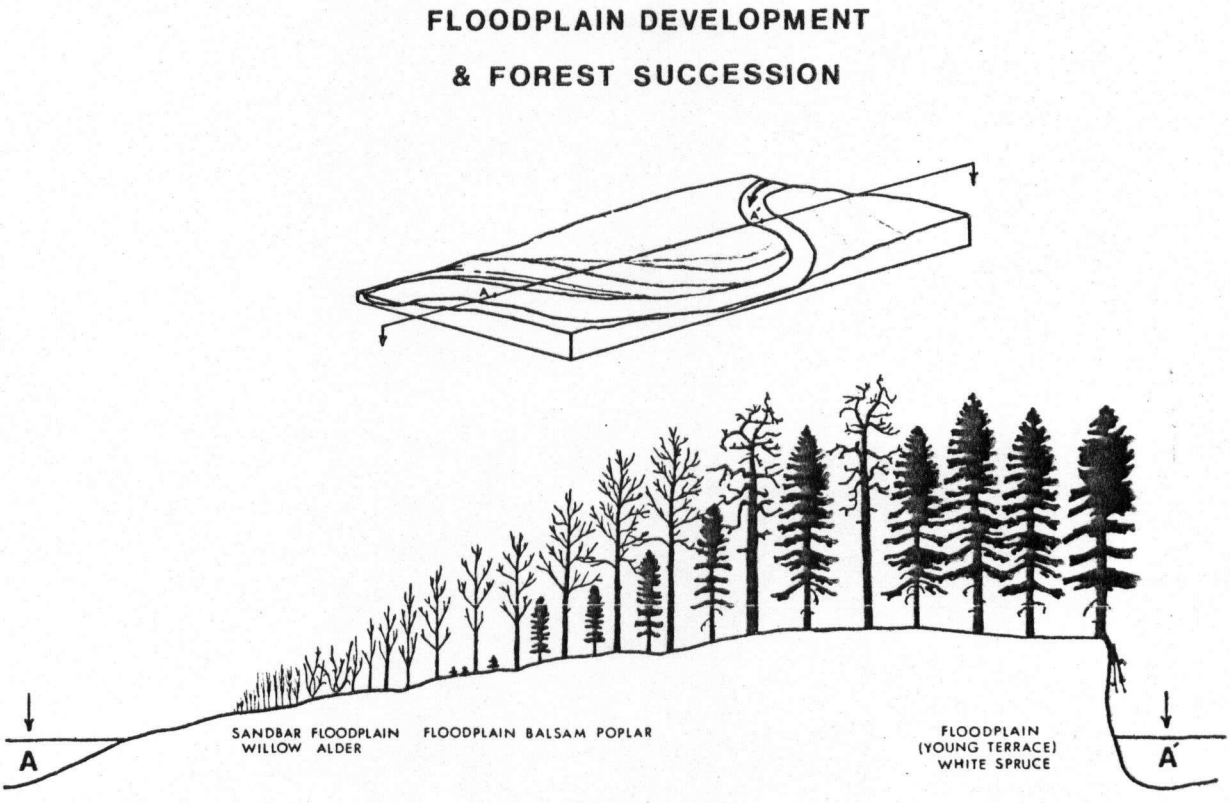
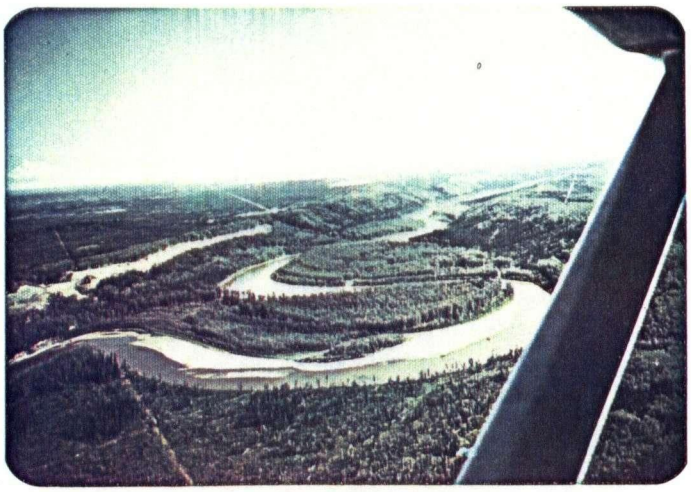


Figure 89 Floodplain Development and Forest Succession

while the upstream edge is continually being eroded away by the rivers. This effectively results in the downstream movement of these terraces. (See Fig. 89)



Figs. 90 & 91 Above, note the position of the white spruce and balsam poplar communities on the Fort Nelson River. Below, the same pattern is evident. The floodplain (young terrace) in the foreground has been logged.



Flooding Fort Nelson River







Figs. 92 , 93 & 94 Log jam of trees eroded from the floodplains of the Fort Nelson River during the 1971 flood.

In the Fort Nelson area, the vegetation to first colonize a recent point-bar deposit is usually Salix interior (sandbar willow). In these sandbar willow ecosystems, herb development is minimal, generally with only evergreen Equisetum hyemale being present.

As rivers add alluvium to the sandbar willow ecosystems, these ecosystems become elevated above the river. The deposition of alluvium has three important effects on these sites: the internal drainage of the soils increases with height above the river; the period of time the sites are under water during flooding is reduced with height above the river and the yearly amount of sediments added to the surface decreases with the height above the river. These effects allow Alnus tenuifolia and later, Populus balsamifera to invade sites originally occupied only by Salix interior. This willow is extremely shade intolerant and therefore, is quickly eliminated when overtopped by alder or balsam poplar.

The Populus balsamifera, which becomes established on the developing terraces, initially forms very dense stands. It is usually only after competition has thinned out the stands of balsam poplar that Picea glauca can become well established in the understory. Additionally, the herb and shrub layers can only develop after stand canopies have thinned out and only

after the effects of flooding and siltation become less severe. Mosses do not tolerate flooding or smothering by sediments and are therefore, essentially absent from the early floodplain terrace ecosystems except where they occur as epiphytes on trees or on elevated dead wood where sedimentation is minimal. Only in the white spruce ecosystems of the older and higher portions of the floodplains do well developed moss layers occur. In the mature Floodplain White Spruce ecosystems, species diversity in terms of numbers of species present, reaches a maximum with all vegetation layers being well occupied or exploited. In the initial communities on these sites (the Sandbar Willow and the Floodplain Alder ecosystems) 14 species of vascular plants occur in the sample plots of the first community type and 7 in the second. Forty species of vascular plants occur in the Floodplain Balsam Poplar ecosystem with the number increasing to 63 in the mature alluvial spruce communities.

Soil development is minimal on these floodplain terraces due to their young age. All soils examined, with the exception of one Rego Gleysol, were classified as Cumulic Regosols. On the lower portions of the terraces, flooding and sedimentation of fresh alluvium occurs so frequently that an LFH horizon does not have time to develop and therefore, recognizable buried organic layers are absent in the soil

profiles. These buried organic horizons are characteristic of the older and higher portions of the floodplain landforms which are changing into the alluvial terrace.

The texture of the alluvium is variable, basically depending upon the velocity of the river at the time of sedimentation, with the coarser sediment load being deposited at the higher water velocities. This results in a trend in which the point-bar deposits, in the area of this study, are coarse (loamy sands and sandy loams). The higher portions of the alluvial terraces tend to be finer (loams and silty loams). This deposition pattern agrees with observations made on river velocity patterns during normal high water and during peak floods on the Muskwa and Fort Nelson Rivers.

The evolution and development of these floodplain ecosystems is somewhat similar to what has been described by Raup (1935, 1946), Lacate et al. (1958 and 1965), Jeffrey (1961b), and Horton (1965) for the lower Peace River and by Jeffrey (1964) for conditions on the lower Liard. One basic difference, between the Fort Nelson alluvial terraces and those described by the above authors, is that the Fort Nelson alluvial terraces are all young or transitions between floodplains and terraces. However, on the Liard and Peace Rivers older post glacial terraces are common. On these older terraces, fire plays a

dominant role in stand establishment whereas on the recent terraces of the Fort Nelson, Muskwa, and Prophet Rivers in the Fort Nelson area, fire is less frequent. In this area, recent fires, which have burned hundreds of square miles of upland sites, burned only to the edge of the flat valley bottoms, leaving the alluvial sites unburned. The lack of fires on these alluvial sites could be due to the fact that seepage sites are frequently present at the base of the steep slopes leading down to the river. These could effectively act as barriers to the spread of fires. Additionally, forest fires travel more slowly down slopes which would make the relatively narrow valley bottoms less subject to fires. The meandering of the rivers across the valley bottoms also acts as a fire barrier and limits the extent of any burn. Another factor which may explain the rare occurrence of fire on these sites is the large amount of exposed mineral soil (silt from flooding) and lack of fuel on the forest floor. In addition, the definite progression of tree ages, from young trees near the sandbar willow ecosystems to older trees on the upstream edges of terraces, demonstrate the path of natural succession of these ecosystems. The actual time span, for the initiation of a point-bar to its final destruction through river erosion, is generally less than 400 years for the terraces studied in the Fort Nelson River basin (including its tributaries).

This time span can be judged by examining the patterns of plant community distribution and the ages of the trees in these communities. Since in the Fort Nelson area, balsam poplar usually does not survive past an age of 200 years, [this agrees with Horten's findings for the lower Peace in Lacate et al. (1965)], and since most of the white spruce stands were somewhat even-aged and less than 250 years old, the indication is that the spruce sites are less than 450 years old. Generally, however, white spruce is well established by the time balsam poplar stands are 120 years old, therefore making the age of the older parts of the terrace less than 400 years. The order of magnitude of this time sequence was independently supported by examining 1947 aerial photographs of the terraces and comparing them with 1967 aerial photographs. Measurements, from the photographs of one area of active erosion below the Fort Nelson airport, showed that the Muskwa River was eroding away the upstream edge of an alluvial terrace at a rate averaging approximately five meters a year, which would be sufficiently rapid to destroy most of the terraces of the area within a 400 year period.

This pattern holds only for the major rivers in the area near Fort Nelson, since further to the west, at the junction of Kledo Creek and the Muskwa River (plot 39), the spruce community arose from fire as did the 3 plots along the

Tetsa River (21, 22, and 25). Additionally, closer to the Rocky Mountains, stream velocity and depositional and erosional patterns differ which produces different histories for alluvial sites.

SUCCESSIONAL TRENDS FROM ALLUVIAL DEPOSITS

[without seepage after the Alluvial (Young Terrace) White Spruce]

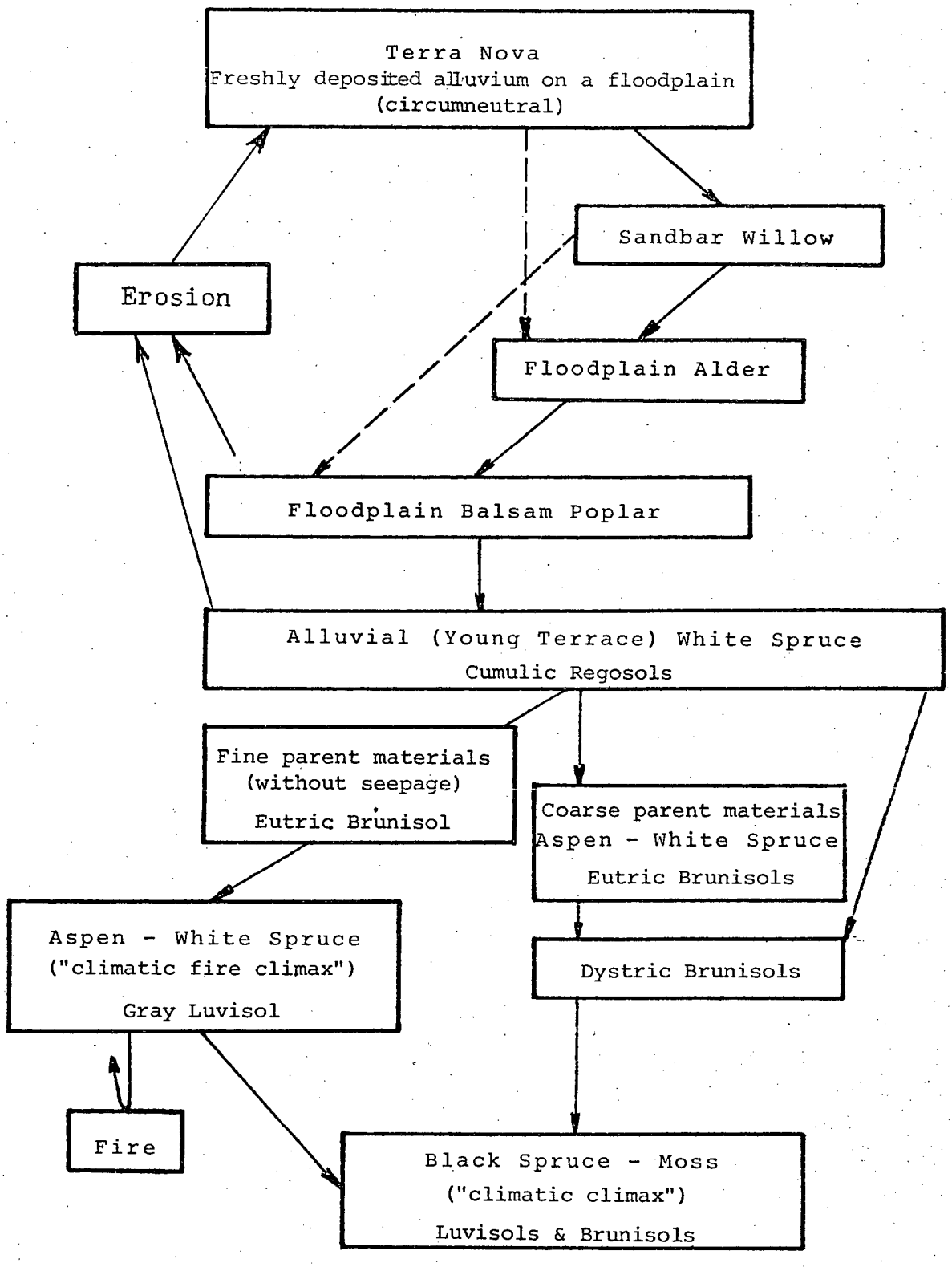


Figure 95

SUCCESSIONAL TRENDS FROM FLUVIO - GLACIAL DEPOSITS

(without seepage)

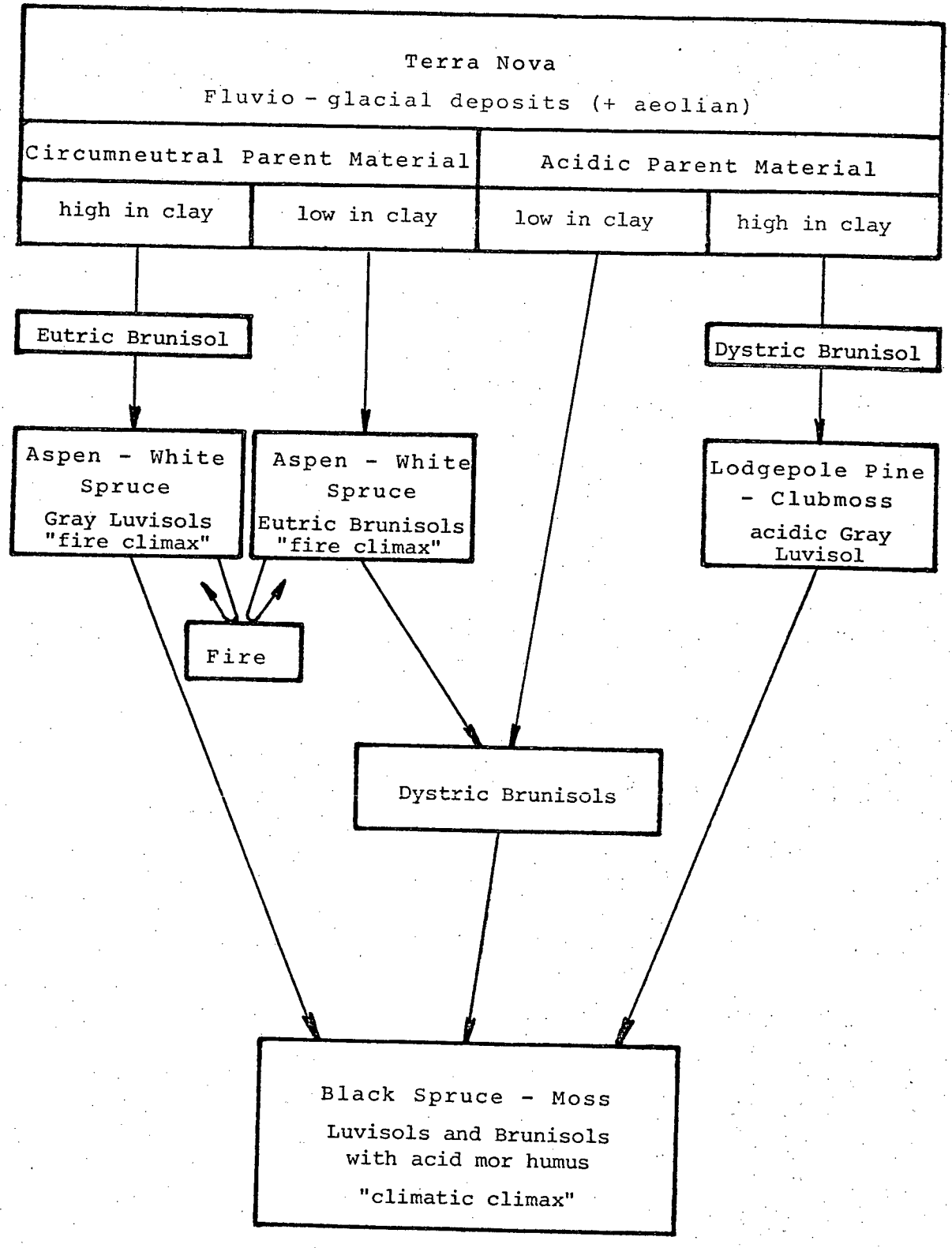


Figure 96

SUCCESSIONAL TRENDS FROM LAKES

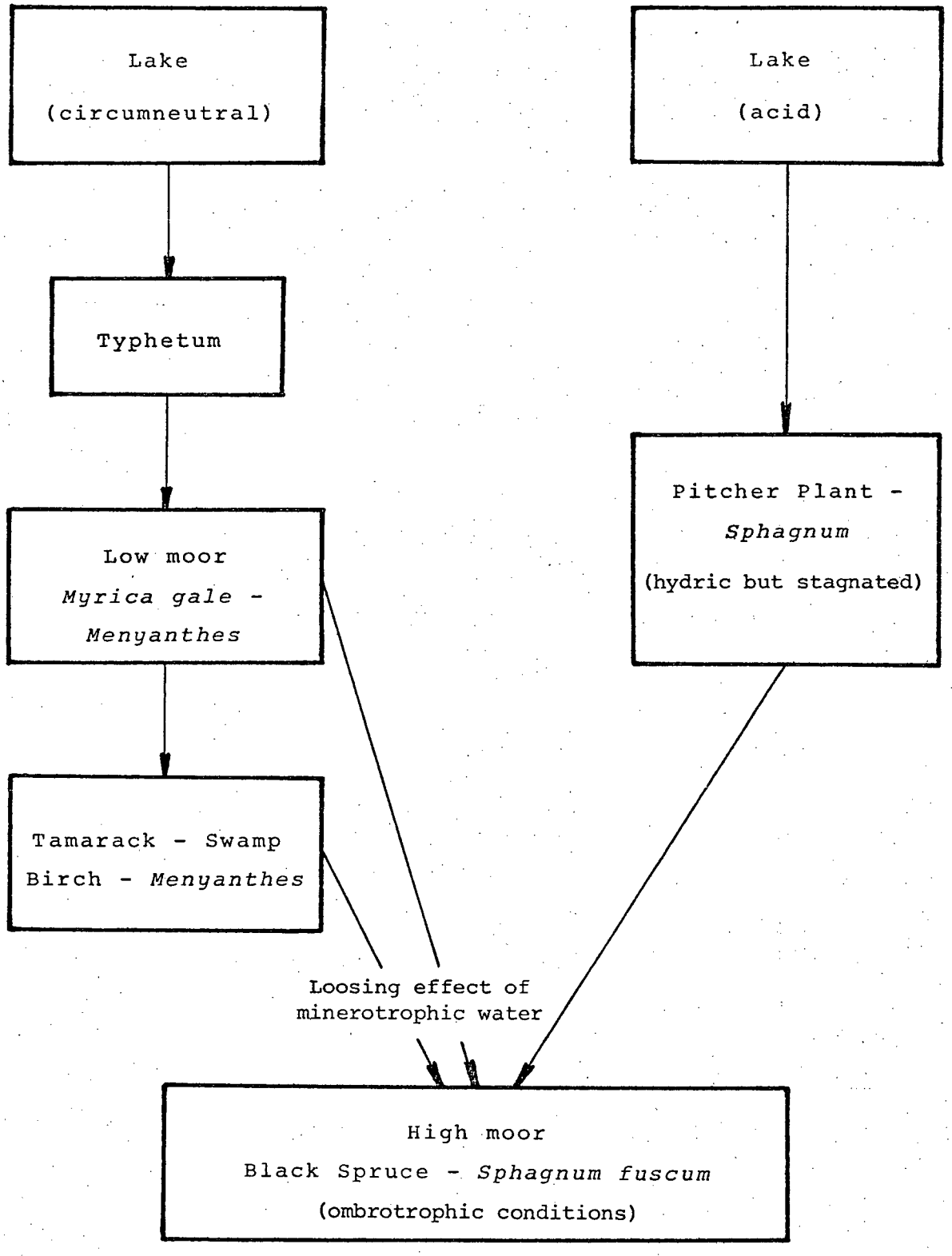


Figure 97

SUCCESSIONAL TRENDS WHERE SEEPAGE WATER IS PRESENT

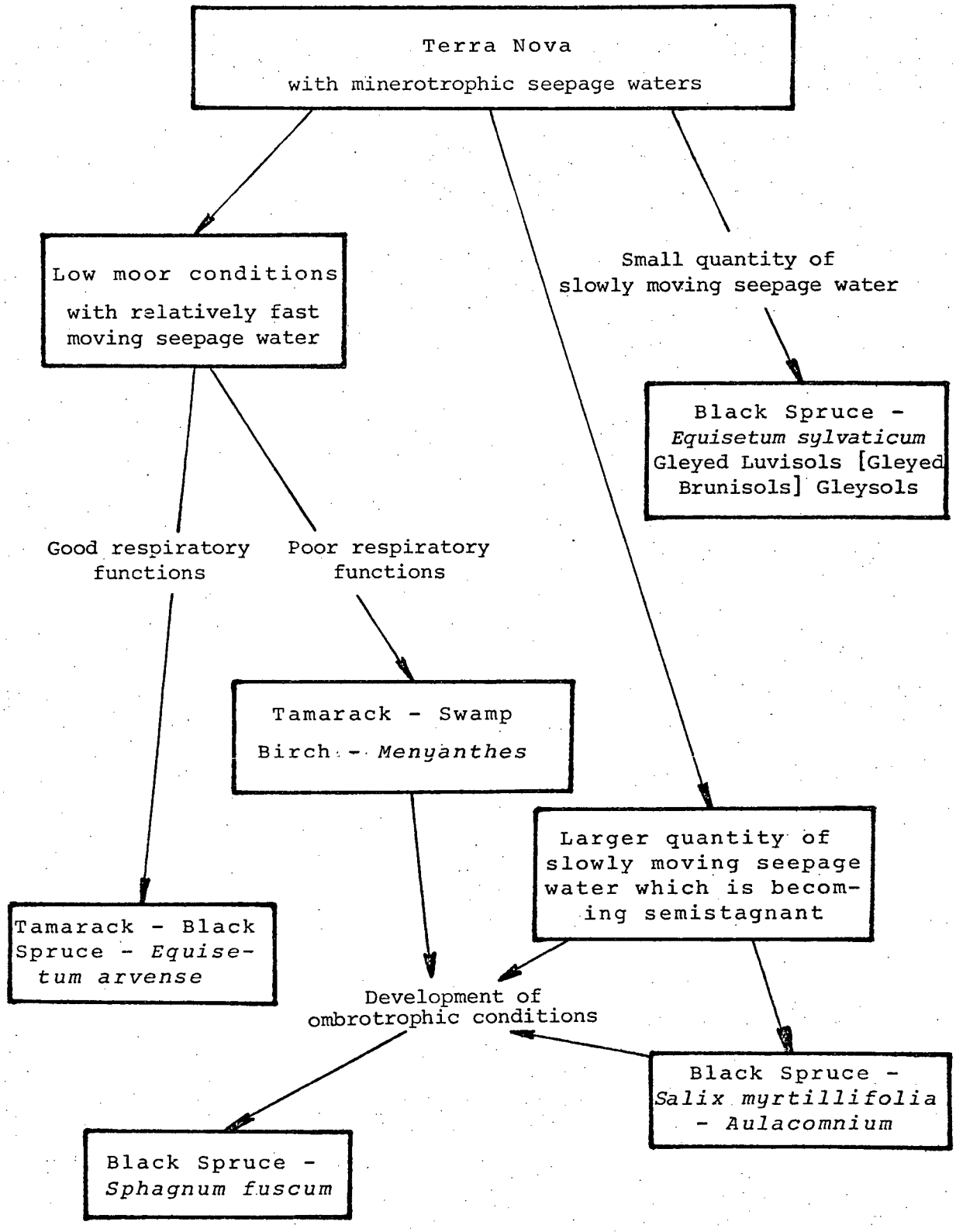


Figure 98

SUMMARY AND CONCLUSIONS

The prime objective of this study is to produce an ecological classification of forested ecosystems of the Boreal White and Black Spruce Biogeoclimatic Zone of Northeastern British Columbia. The classification is derived from quantitative and qualitative data on vegetation and environmental factors of the boreal zone. Methods utilized are those of the Krajina school of ecosystem classification, as developed and utilized at the University of British Columbia. No such study has been carried out previously for the boreal zone in British Columbia. The main results are summarized as follows.

(1) The study was centered in the Fort Nelson area of Northeastern British Columbia on the Fort Nelson Lowland. This is an area of gentle topography, which is covered mostly by morainal deposits derived from the underlying sedimentary rocks. The climate is a microthermal continental boreal climate (Dfc after Köppen), which is sufficiently severe to allow permafrost to develop frequently.

(2) A total of 95 phytogeocoenotic plots were established in this study. Vegetation is classified into

associations according to the Zürich-Montpellier school of phytosociology. Each association may contain more than one soil type and therefore, may consist of one to several basic ecosystem types.

(3) The vegetation is classified into 6 orders, 10 alliances, and 15 associations. Accompanying soils are classified into 17 subgroups according to the Canadian system of soil classification.

A) The order Piceetalia glaucae, which consist of one alliance and three associations, in the study area, basically occur under mesotrophic to eutrophic nutrient conditions and under submesic to subhygric moisture regimes.

i. Aspen - White Spruce: This association covers extensive areas of the Fort Nelson Lowland, on moderately well drained sites and is considered as the "Climatic fire climax" of the region. It occurs under mesotrophic (occasionally submesotrophic) to subeutrophic nutrient conditions and on submesic (occasionally subxeric) to mesic hygrotopes. In terms of forest productivity, this association is surpassed only by alluvial communities in this area. It occurs on Orthic Gray Luvisols and Degraded Eutric and Dystric Brunisols (gleyed versions may be present but are not considered here). Three variations of this association are recognized: var. populosum

tremuloidis (aspen variant), var. betulosum papyriferae (birch variant), and var. piceosum glaucae (white spruce variant).

ii. Floodplain (Young Terrace) White Spruce: This association is common on young alluvial terraces of all the major rivers of the region where it forms an edaphic climax. Soils are circumneutral, with high base status (subeutrophic to eutrophic), with the moisture regime varying from hydric (during floods) to mesic. These alluvial sites probably have the highest forest productivity of the entire Canadian boreal forest. Soils are Cumulic Regosols (with one Rego Gleysol).

iii. Lodgepole Pine - Clubmoss: This association occurs on neutral to mildly shedding topographic positions. Texture of the soil parent material is fine, with heavy clay being common in the profiles. This factor allows only the surface of the soil to dry out, even if the community occurs in shedding positions. The resulting vegetation, therefore, shows characteristics of both xeric and subhygric moisture regimes. Soils are Orthic Gray Luvisols, which have developed from acidic parent material and are judged to be nutritionally submesotrophic to mesotrophic.

B) The order Piceetalia marianae contain 4 alliances and 5 plant associations. Except for one

association, which is under the influence of minerotrophic ground waters, all the plant associations are judged to be nutritionally mesotrophic or poorer. The five plant associations are as follows.

i. Lodgepole Pine - Kinnikinnick - Lichen: Similar plant associations, occupying xeric to subxeric moisture regimes, are found in other zones. Nutritionally, this association is judged to vary from oligotrophic to submesic. Soils are Degraded Dystric Brunisols, developed from coarse parent material.

ii. Black Spruce - Moss: The Black Spruce - Moss association is considered to be the climatic climax community of the study area. This association occurs over a wide range of soils, wherever a thick acid mor humus has developed on the soil surface. Soil moisture regimes vary from submesic to subhygric, while nutrient regimes vary from oligotrophic to mesic. Soils are Orthic Gray Luvisols, Orthic Eutric Brunisols, Degraded Dystric Brunisols, Humic Eluviated Gleysols, Rego Humic Gleysols, and one tentatively identified as an Orthic Humo-Ferric Podzol. All these soils produce related ecosystems.

iii. Black Spruce - Equisetum sylvaticum: This association occurs where slowly moving (almost stagnant) minerotrophic water is present in the soil. Two distinct environmental variations are recognized; one occurring

on Gleyed Orthic Gray Luvisols and the other occurring on soils with considerable peat development (Peaty Phases of Rego Humic Gleysols and Terric Sphagno-Fibrisols). Nutritionally, these ecosystems are from submesotrophic to mesotrophic, with hygric (to subhydric) moisture regimes.

iv. Black Spruce - Salix myrtillifolia - Aulacomnium When projected on the edatopic grid, this bog association occurs on hygric hygrotopes and mesotrophic to subeutrophic trophotopes. It is under the influence of minerotrophic water, which is reflected in both the vegetation and the soils. Soils are classified as Rego Gleysols and Cryic Mesisols.

v. Black Spruce - Sphagnum fuscum: The Black Spruce - Sphagnum fuscum is the typical high moor bog of the study area and covers extensive areas. Permafrost is consistently present in the soil, being insulated by peat. All soils examined are Cryic Sphagno-Fibrisols. Nutritionally, the Black Spruce - Sphagnum fuscum is oligotrophic (to submesotrophic) and occurs under a hygric moisture regime.

C) The Laricetalia laricinae are represented in the Fort Nelson area by one alliance, with two plant associations.

i. Tamarack - Swamp Birch - Menyanthes: This association is infrequent in the study area. It can be

classified as a treed fen or a transition bog, which represents an advanced stage of succession away from a treeless fen. The presence of minerotrophic waters (in this case resulting in a subeutrophic trophotope) are reflected in soil development, as well as in vegetational characteristics. Soils are Typic Mesisols, with hygric to subhydric moisture regimes.

ii. Tamarack - Black Spruce - Equisetum arvense: The Tamarack - Black Spruce - Equisetum arvense association is under the strong influence of rich minerotrophic water. This association is frequently encountered adjacent to small stream channels, where water movement is sufficient to prevent stagnation. The nutrient regime is estimated to be subeutrophic and the moisture regime to be from subhygric to hygric. Soils are Peaty Phases of Rego Humic Gleysols, Terric Mesisols, and Terric Humisols. This is the only association examined, where organic decomposition in the soil was sufficiently rapid to produce a humisol.

D) The Populetalia balsamiferae are confined to floodplains along the major rivers of the study area. This order is represented by two alliances and three plant associations. The plant associations are as follows.

i. Floodplain Balsam Poplar: Generally, this ecosystem develops on fairly recent alluvial deposits.

The Floodplain Balsam Poplar is successional to the Floodplain (Young Terrace) White Spruce association. Soils are all Cumulic Regosols, with eutrophic nutrient regimes. Hygrotopes will vary with the level of the river water.

ii. and iii. Floodplain Alder and Sandbar Willow: Since both of these ecosystems develop on recent point-bar deposits and go through rapid succession towards the Floodplain Balsam Poplar, they are summarized together. Soils are eutrophic Cumulic Regosols, with variable moisture regimes, which are usually never drier than hygric.

E) The Spiraeo - Myricetalia galis are represented by only one plant association, the Myrica gale - Menyanthes. This ecosystem is a treeless fen whose soil is a Hydric Fenno-Fibrisol. Nutrient regimes are subeutrophic to eutrophic and moisture regimes are subhydric.

F) The Sphagno (magellanici) - Scheuchzerietalia palustris are again represented by only one association in this study; the Pitcher Plant - Sphagnum association. The Pitcher Plant - Sphagnum develops under oligotrophic to submesotrophic nutrient and subhydric moisture regimes. Soils are Hydric Sphagno-Fibrisols.

(4) The projection of the ecosystem units onto the edatopic grid is a useful technique for showing relationships among the ecosystem units.

(5) Ash analysis was carried out on 92 organic layers from the various ecosystems. Results show that the organic matter contained an average of 2.4% Ca, which is indicative of the important role played by Ca in these ecosystems. The average value of the Ca content of the plant associations appear to be good indicators of the positions that the ecosystems occupy on the edatopic grid. Mg was the only other element to follow the pattern of Ca.

(6) Mor humus of the Black Spruce - Moss association was compared with the moder humus of the Aspen - White Spruce association. The mor humus exhibits a low pH, low total % N, a wide C/N ratio, low exchangeable cations, and a low base saturation when compared to the moder humus. It is assumed that leachates, from mor humus, percolating down through the soil, will tend to degrade the soil through podzolization.

(7) It is confirmed that especially aspen, in the Aspen - White Spruce association, is largely responsible for cycling large amounts of Ca, which maintains conditions unfavourable for the development of mor humus.

(8) Forest fire is a dominating factor in stand

establishment in the boreal environment and promotes the establishment of aspen. It is thought that periodic forest fires (in the order of magnitude of one every 70 - 120 years) have helped to maintain the fine textured soils of upland sites in a highly productive state.

(9) Without fire, directional trends of ecosystem succession, point towards the development of mor humus with black spruce stands (the theoretical climatic climax).

(10) The microthermal climate limits biological activity, especially in subhygric and wetter sites. This tends to result in the buildup of undecomposed organic matter (bog development), except in the nutritionally rich sites.

(11) The generally fine textured soils retard water movement to the point where seepage waters often act in a similar fashion to stagnant water.

(12) Due to Ca and Mg rich parent materials from which most of the soils are derived in this region, white spruce (Picea glauca) is frequently established here, especially after forest fire. Only under semi-stagnant and stagnant water conditions which promote acid mor humus

development, the climatic climax tree of this zone, black spruce (Picea mariana), becomes more rapidly established, even in secondary forests.

The ecosystem classification, produced in this study, identifies basic ecological units which are required for proper forest management. The projection of these units, onto the edatopic grid, which is part of the ecosystem classification, allows the functional assessment of ecosystems. The classification provides the basic ecological framework which is necessary for assessing management techniques. It also provides scientific denominators for communication between various resource managers for the boreal forest of the Fort Nelson area.

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APPENDIX A

Checklist of Plants

This checklist includes all the species appearing in the vegetation synthesis tables.

Vascular plants are arranged according to families and bryophytes and lichens are arranged alphabetically. Nomenclature of vascular plants is after Fernald (1950), Moss (1959), Dougle (1966), Taylor (1966), Hulten (1968), Argus (1973), and Hitchcock and Cronquist (1973).

Nomenclature of bryophytes is after Frye and Clarke (1937-1947), Nyholm (1956-1969), Schofield (1968a, 1968b), Schuster (1966,1969), Lawton (1971), and Crum, Steere and Anderson (1973).

Nomenclature of lichens is after Thompson (1967), Otto and Ahti (1967), Hale (1969), and Bird (1970).

Collections were made from the Trutch Mountain area (near Mile 180 of the Alaska Highway) to the Tetsa River area (Mile 375). Collections were also made from the Petitot River and Maxhamish Lake areas north and east of Fort Nelson. All these plants are from the BWBS zone.

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VASCULAR PLANTS

The plants with an asterisk (*) are newly reported for British Columbia.

PTERIDOPHYTA:

EQUISETACEAE

Equisetum arvense L.
Equisetum fluviatile L.
Equisetum hyemale L.
Equisetum laevigatum A.Br.
Equisetum palustre L.
Equisetum pratense Ehrh.
Equisetum scirpoides Michx.
Equisetum sylvaticum L.

LYCOPODIACEAE

Lycopodium annotinum L.
Lycopodium complanatum L.
Lycopodium obscurum L.

POLYPODIACEAE

Gymnocarpium dryopteris (L.) Newm.
Matteuccia struthiopteris (L.) Todaro

GYMNOSPERMAE:

PINACEAE

Abies lasiocarpa (Hook.) Nutt.
Larix laricina (Du Roi) K.Koch
Picea glauca (Moench) Voss
Picea mariana (Mill.) B.S.P.
Pinus banksiana Lamb.
Pinus contorta Dougl.

ANGIOSPERMAE:

APOCYNACEAE

Apocynum androsaemifolium L.

ARACEAE

Calla palustris L.

ARALIACEAE

Aralia nudicaulis L.
Oplopanax horridus (Sm.) Miq.[1]

BALSAMINACEAE

Impatiens noli-tangere L.

BETULACEAE

Alnus crispa (Ait.) Pursh ssp.*crispa*
Alnus crispa (Ait.) Pursh ssp.*sinuata* (Regel) Hult.
Alnus tenuifolia Nutt.
Betula glandulifera (Reg.) Butler
(= *Betula pumila* L. var. *glandulifera* Regel)
Betula glandulosa Michx.
Betula papyrifera Marsh.
Betula resinifera Britt.

BORAGINACEAE

Mertensia paniculata (Ait.) G.Don
Lappula echinata Gilib.

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[1] As for the gender of the species see International code of botanical nomenclature, 1966, p. 63: "Modern compounds ending in .... -panax .... should be masculine."

CALLITRICHACEAE

Callitriche palustris L.

CAPRIFOLIACEAE

Linnaea borealis L. var. *americana* (Forbes) Rehd.
Lonicera dioica L. var. *glaucescens* (Rydb.) Butters
Symphoricarpos occidentalis Hook.
Viburnum edule (Michx.) Raf.

CARYOPHYLLACEAE

Stellaria calycantha (Ledeb.) Bong.
Stellaria crassifolia Ehrh.
Stellaria longifolia Muhl.
Stellaria longipes Goldie

CHENOPODIACEAE

Chenopodium album L.
Chenopodium capitatum (L.) Aschers.

COMPOSITAE

Achillea millefolium L.
* *Achillea sibirica* Ledeb.
Artemisia tilesii Ledeb.
Aster ciliolatus Lindl.
Bidens cernua L.
Crepis tectorum L.
Erigeron acris L.
Erigeron philadelphicus L.
Hieracium canadense Michx.
Matricaria matricarioides (Less.) Porter
Petasites frigidus (L.) Fries
Petasites hyperboreus Rydb.
Petasites palmatus (Ait.) Gray
Petasites sagittatus (Banks) Gray
Senecio lugens Richards.
Solidago canadensis L. var. *salebrosa* (Piper) M.E.Jones

CORNACEAE

Cornus canadensis L.
Cornus stolonifera Michx.

CRUCIFERAE

Capsella bursa-pastoris (L.) Medic.
Cardamine pratensis L.
Rorippa islandica (Oeder) Borbas

CYPERACEAE

Carex aenea Fern.
Carex aquatilis Wahlenb.
Carex aurea Nutt.

(CYPERACEAE - cont.)

Carex brunnescens (Pers.) Poir
Carex canescens L.
Carex capillaris L.
Carex concinna R. Br.
Carex crawfordii Fern.
Carex deweyana Schwein.
Carex diandra Schrank
Carex dioica L.
Carex disperma Dewey
* *Carex heleonastes* L.f.
Carex interior Bailey
Carex laeviculmis Meinsh.
Carex leptalea Wahlenb.
Carex limosa L.
Carex loliacea L.
Carex media R. Br.
Carex microglochin Wahlenb.
Carex pauciflora Lightf.
Carex paupercula Michx.
Carex raymondii Calder
Carex rostrata Stokes
Carex tenuiflora Wahlenb.
Carex vaginata Tausch
Eriophorum brachyantherum Trautv.
Eriphorum chamissonis C.A. Mey.
Eriphorum gracile Koch
Eriphorum scheuchzeri Hoppe
Eriophorum vaginatum L.
Eriphorum viridi-carinatum (Engelm.) Fern.
Rhynchospora alba (L.) Vahl.
Scirpus microcarpus Presl
Scirpus validus Vahl.

DROSERACEAE

Drosera anglica Huds.
Drosera rotundifolia L.

ELAEAGNACEAE

Shepherdia canadensis (L.) Nutt.

EMPETRACEAE

Empetrum nigrum L.

ERICACEAE

Andromeda polifolia L.
Arctostaphylos rubra (Rehder & Wils.) Fern.
Arctostaphylos uva-ursi (L.) Spreng.
Chamaedaphne calyculata (L.) Moench
Ledum groenlandicum Oeder
Oxycoccus palustris Pers.
Oxycoccus microcarpus Turcz.
Vaccinium caespitosum Michx.

(ERICACEAE - cont.)

Vaccinium membranaceum Dougl.
Vaccinium myrtilloides Michx.
Vaccinium uliginosum L.
Vaccinium vitis-idaea L. var. *minus* Lodd.

FUMARIACEAE

Corydalis aurea Willd.
Corydalis sempervirens (L.) Pers.

GENTIANACEAE

Gentiana amarella L. subsp. *acuta* (Michx.) Hult.
Menyanthes trifoliata L.

GERANIACEAE

Geranium bicknellii Britt.

GRAMINAE

Agropyron caninum (L.) Beauv.
Agrostis scabra Willd.
Alopecurus aequalis Sobol.
Arctagrostis latifolia (R. Br.) Griseb.
Beckmannia syzigachne (Steud.) Fern.
Bromus inermis Leyss.
Calamagrostis canadensis (Michx.) Beauv.
Calamagrostis neglecta (Ehrh.) Gaertn.
Cinna latifolia (Trev.) Griseb.
Elymus innovatus Beal.
Festuca altaica Trin.
Glyceria pulchella (Nash) K.Schum.
Glyceria striata (Lam.) Hitchc.
Hordeum jubatum L.
Oryzopsis asperifolia Michx.
Oryzopsis pungens (Torr.) Hitchc.
Phalaris arundinacea L.
Phleum alpinum L.
Poa palustris L.
Puccinellia nuttalliana (Schult.) Hitchc.
Trisetum spicatum (L.) Richt.

GROSSULARIACEAE

Ribes glandulosum Grauer
Ribes hudsonianum Richards.
Ribes lacustre (Pers.) Poir.
Ribes oxyacanthoides L.
Ribes triste Pall.

HALORAGIDACEAE

Myriophyllum spicatum L.
Myriophyllum verticillatum L.

HIPPURIDACEAE

Hippuris vulgaris L.

JUNCACEAE

Juncus alpinus Vill.
Juncus bufonius L.
Juncus castaneus Sm.
Juncus filiformis L.
Luzula parviflora (Ehrh.) Desv.
Luzula rufescens Fisch.
Luzula wahlenbergii Rupr.

JUNCAGINACEAE

Scheuchzeria palustris L. var. *americana* Fern.
Triglochin maritima L.
Triglochin palustris L.

LABIATAE

Lycopus uniflorus Michx.
Moldavica parviflora (Nutt.) Britt.
Scutellaria galericulata L.

LEGUMINOSAE

Astragalus canadensis L.
Astragalus tenellus Pursh
Lathyrus ochroleucus Hook.
Medicago sativa L.
Melilotus alba Desr. in Lam.
Melilotus officinalis (L.) Lam.
Trifolium hybridum L.
Vicia americana Muhl.

LEMNACEAE

Lemna minor L.
Lemna trisulca L.
Spirodela polyrhiza (L.) Schleiden

LENTIBULARIACEAE

Utricularia intermedia Hayne
Utricularia minor L.
Utricularia vulgaris L. subsp. *macrorrhiza* (Le Conte) Clausen

LILIACEAE

Maianthemum canadense Desf.
Smilacina stellata (L.) Desf.
Smilacina trifolia (L.) Desf.

MYRICACEAE

Myrica gale L.

NAJADACEAE

Potamogeton friesii Rupr.
Potamogeton richardsonii (Bennett) Rydb.

NYMPHAEACEAE

Nuphar variegatum Engelm.

ONAGRACEAE

Circaea alpina L.
Epilobium angustifolium L.
Epilobium leptophyllum Raf.
Epilobium palustre L.
Epilobium adenocaulon Haussk.

ORCHIDACEAE

Calypso bulbosa (L.) Oakes
Corallorhiza trifida Châtelain
Goodyera repens (L.) R. Br.
Habenaria dilatata (Pursh) Hook.
Habenaria hyperborea (L.) R. Br.
Habenaria obtusata (Banks) Richards.
Habenaria orbiculata (Pursh) Torr.
Listera borealis Morong
Listera cordata (L.) R. Br.
Orchis rotundifolia Banks
Spiranthes romanzoffiana Cham. & Schl.

PLANTAGINACEAE

Plantago major L.

POLYGONACEAE

Polygonum amphibium L.
Rumex occidentalis Wats. var. *fenestratus* (Greene) Le Page

POLEMONIACEAE

Collomia linearis Nutt.
Polemonium acutiflorum Willd.

PRIMULACEAE

Dodecatheon pulchellum (Raf.) Merr. subsp. *pauciflorum* (Greene) Hult.
Trientalis europaea L. var. *arctica* (Fisch.) Ledeb.

PYROLACEAE

Moneses uniflora (L.) A. Gray
Pyrola asarifolia Michx.
Pyrola chlorantha Sw.
Pyrola secunda L.
Pyrola virens Schweigg.

RANUNCULACEAE

Aconitum delphinifolium DC.
Actaea rubra (Ait.) Willd.
Delphinium glaucum S. Wats.
Ranunculus gmelinii DC.
* *Ranunculus lapponicus* L.
Ranunculus macounii Britt.
Thalictrum sparsiflorum Turcz.

ROSACEAE

Amelanchier alnifolia Nutt.
Fragaria bracteata Heller
Fragaria virginiana Duchesne
Geum allepicum Jacq. var. *strictum* (Ait.) Fern.
Geum macrophyllum Willd.
Potentilla norvegica L.
Potentilla palustris (L.) Scop.
Prunus pensylvanica L.f.
Prunus virginiana L.
Rosa acicularis Lindl.
Rosa woodsii Lindl.
Rubus acaulis Michx.
Rubus chamaemorus L.
Rubus pubescens Raf.
Rubus idaeus L. var. *strigosus* (Michx.) Maxim.
Sorbus scopulina Greene
Spiraea betulifolia Pall. var. *lucida* (Dougl.) C.L. Hitchc.

RUBIACEAE

Galium boreale L.
Galium labradoricum Wieg.
* *Galium palustre* L.
Galium trifidum L.
Galium triflorum Michx.

SALICACEAE

Populus balsamifera L.
Populus tremuloides Michx.
* *Salix athabascensis* Raup
Salix arbusculoides Anderss.
Salix barclayi Anderss.
Salix bebbiana Sarg.
Salix discolor Muhl.
Salix drummondiana Barratt
Salix glauca L. var. *glauca*
Salix glauca L. var. *acutifolia* (Hook.) Schneid.
Salix glauca L. var. *villosa* (Hook.) Anderss.
Salix interior Rowlee

(SALICACEAE - cont.)

Salix lasiandra Benth.
Salix maccalliana Rowlee
Salix monticola Bebb. ex Coult.
Salix myrtillifolia Anderss.
Salix novae-angliae Anderss. (= *S. myrtillifolia* Anderss. var. *pseudomyrsinites* Ball ex Hult.)
Salix pedicellaris Pursh var. *hypoglauca* Fernald
Salix planifolia Pursh
Salix pyrifolia Anderss.
Salix rigida Muhl. [= *S. mackenzieana* (Hook.) Barratt]
Salix scouleriana Barratt

SANTALACEAE

Geocaulon lividum (Richards.) Fern.

SARRACENIACEAE

Sarracenia purpurea L.

SAXIFRAGACEAE

Mitella nuda L.
* *Parnassia montanensis* Fern. & Rydb.
Parnassia palustris L. var. *neogaea* Fern.

SCROPHULARIACEAE

* *Castilleja raupii* Pennell
Pedicularis labradorica Wirsing
* *Pedicularis macrodonta* Richards.
Pedicularis parviflora J.E. Sm.

SPARGANIACEAE

Sparganium angustifolium Michx.
Sparganium eurycarpum Engelm.
Sparganium minimum (Hartm.) Fries

TYPHACEAE

Typha latifolia L.

UMBELLIFERAE

* *Cicuta mackenzieana* Raup
Sium suave Walt.

URTICACEAE

Urtica gracilis Ait.

VIOLACEAE

Viola epipsila Ledeb. subsp. *repens* (Turcz.) Becker
Viola renifolia A. Gray

BRYOPHYTA

MUSC I

Amblystegium serpens (Hedw.) B.S.G.

Atrichum undulatum (Hedw.) P. Beauv.

Aulacomnium palustre (Hedw.) Schwaegr.

Brachythecium albicans (Hedw.) B.S.G.

Brachythecium asperrimum (C. Muell.) Sull.

Brachythecium collinum (Schleich. Ex. C. Muell.) B.S.G.

Brachythecium curtum (Lindb.) Limpr.

Brachythecium reflexum (Starke) B.S.G.

Brachythecium salebrosum (Web. & Mohr) B.S.G.

Brachythecium velutinum (Hedw.) B.S.G.

Bryum pseudotriquetrum (Hedw.) Gaertn.

Calliergidium pseudostramineum (C. Muell.) Grout

Calliergon cordifolium (Hedw.) Kindb.

Calliergon giganteum (Schimp.) Kindb.

Calliergon richardsonii (Mitt) Kindb. In Warnst

Calliergon sarmentosum (Wahlenb.) Kindb.

Calliergon stramineum (Brid.) Kindb.

Campylium chrysophyllum (Brid.) J. Lange.

Campylium hispidulum (Brid.) Mitt.

Campylium stellatum (Hedw.) C. Jens.

Ceratodon purpureus (Hedw.) Brid.

Cinclidium stygium Sw.

Climacium dendroides (Hedw.) Web. & Mohr

Cratoneuron williamsii Grout

Dicranum acutifolium (Lindb. & Arn.) C. Jens

Dicranum bonjeanii De. Not. Ex. Lisa

Dicranum elongatum Schwaegr.

Dicranum fragilifolium Lindb.

Dicranum fuscescens Turn.

Dicranum howellii Ren. & Card

Dicranum montanum Hedw.

Dicranum muehlenbeckii B.S.G.

Dicranum polysetum Sw.

Dicranum tauricum Sapehin.

Dicranum undulatum Brid.

Distichium capillaceum (Hedw.) B.S.G.

Ditrichum heteromallum (Hedw.) Britt.

Drepanocladus aduncus (Hedw.) Warnst.

Drepanocladus capillifolius (Warnst.) Warnst.

Drepanocladus exannulatus (B.S.G.) Warnst.

Drepanocladus revolvens (Sw.) Warnst.

Drepanocladus sendtneri (Schimp.) Warnst.

Drepanocladus tundrae (Arn.) Loeske

Drepanocladus uncinatus (Hedw.) Warnst.

Drepanocladus vernicosus (Mitt.) Warnst.

Eurhynchium praelongum (Hedw.) B.S.G.

Eurhynchium pulchellum (Hedw.) Jenn.

Herzogiella turfacea (Lindb.) Iwats.

Homalothecium aeneum (Mitt.) Lawt.

Homalothecium fulgescens (Mitt. Ex C. Muell.) Lawt.

Hylocomium splendens (Hedw.) B.S.G.

Hypnum lindbergii Mitt.

Leptobryum pyriforme (B.S.G.) Wils.

Meesia triquetra (Richt.) Angstr.

Meesia uliginosa Hedw.

Mnium blyttii B.S.G.

Mnium marginatum (Wita.) P. Beauv.

Mnium spinulosum B.S.G.

Oncophorus wahlenbergii Brid.

Orthotrichum speciosum Nees In Sturn

Paludella squarrosa (Hedw.) Brid.

Philonotis fontana (Hedw.) Brid.

Plagiomnium ciliare (C. Muell.) Koponen

Plagiomnium cuspidatum (Hedw.) Koponen

Plagiomnium drummondii (Bruch & Schimp.) Koponen

Plagiomnium medium (B.S.G.) Koponen

Plagiomnium rostratum (Schrad.) Koponen

Plagiothecium denticulatum (Hedw.) B.S.G.

Plagiothecium laetum B.S.G.

Plagiothecium piliferum (Sw. Ex C. J. Hartm.) B.S.G.

Platydictya jungermannioides (Brid.) Crum

Pleurozium schreberi (Brid.) Mitt.

Pohlia cruda (Hedw.) Lindb.

Pohlia elongata Hedw.

Pohlia nutans (Hedw.) Lindb.

Pohlia sphagnicola (B.S.G.) Lindb. & Arnell

Polytrichum commune Hedw.

Polytrichum juniperinum Hedw.

Polytrichum strictum Menz. Ex Brid.

Ptilium crista-castrensis (Hedw.) De Not.

Pylaisia polyantha (Hedw.) B.S.G.

Rhizomnium pseudopunctatum (Bruch & Schimp.) Koponen

Rhytidiadelphus triquetrus (Hedw.) Warnst.

Sphagnum annulatum Warnst.

Sphagnum capillaceum (Weiss) Schrank

Sphagnum cuspidatum Ehrh. Ex Hoffm.

Sphagnum fuscum (Schimp.) Klinggr.

Sphagnum girgensohnii Russ.

Sphagnum magellanicum Brid.

Sphagnum pulchrum (Lindb. Ex Braithw.) Warnst.

Sphagnum recurvum P. Beauv.

Sphagnum riparium Angstr.

Sphagnum rubellum Wils.

Sphagnum subfulvum Sjors

Sphagnum subnitens Russ. & Warnst. Ex Warnst.

Sphagnum warnstorfii Russ.

Splachnum ampullaceum Hedw.

Tetraphis geniculata Girg. Ex Milde

Tetraphis pellucida Hedw.

Timmia megapolitana Hedw.

Tomenthypnum nitens (Hedw.) Loeske

Tortula mucronifolia Schwaegr.

Thuidium recognitum (Hedw.) Lindb.

BRYOPHYTA

HEPATICAE

Barbilophozia barbata (Schnid) Dvm.

Barbilophozia hatcheri (Evs.) Loeske

Barbilophozia lycopodioides (Wallr.) Loeske

Blepharostoma trichophyllum (L.) Dum.

Calypogeia sphagnicola (Arn X Pers.) Warnst & Loeske

Cephalozia affinis Lindb.

Cephalozia connivens (Dicks.) Spr.

Cephalozia macrostachya Lindb.

Cephalozia pleniceps (Aust.) Lindb.

Cephalozia loitlesbergeri Schiffn.

Cephaloziella divaricata (Franc) Schiffn.

Cephaloziella subdentata Warnst.

Cladopodiella fluitans (Nees) Spr.

Crossocalyx hellerianus Warnst.

Geocalyx graveolens (Schrad.) Nees

Jamesoniella autumnalis (De Cand.) Steph.

Leiocolea rutheana (Limpr.) K. Mull.

Lepidozia reptans (L.) Dumort.

Lophocolea heterophylla (Schrad.) Dum.

Lophocolea minor Nees

Lophozia alpestris (Schleich.) Evans

Lophozia ascendens (Warnst.) Schuster

Lophozia elongata (Dicks.) Dum

Lophozia excisa (Dicks.) Dum.

Lophozia incisa (Schrad.) Dum.

Lophozia longidens (Lindb.) Macoun

Lophozia marchica (Nees) Steph.

Lophozia obtusa (Lindb.) Evans

Lophozia porphyroleuca (Nees) Schiffn

Lophozia ventricosa (Dicks.) Dum.

Marchantia aquatica Nees

Marchantia polymorpha L.

Mylia anomala (Hook) S.T. Gray

Obtusifolium obtusum (Lindb.) S. Arn.

Orthocaulis kunzeanus (Hubener) Buch

Plagiochila aspleniodes (L.) Dumort.

Ptilidium ciliare (L.) Hampe

Ptilidium pulcherrimum (Weber) Hompe

Riccardia sinuata (Dicks) Trevis

Scapania paludosa (K. Mull.) K. Mull.

Scapania umbrosa (Schrad.) Dum.

Tritomaria exsectiformis (Breidl.) Schiffn.

Tritomaria scitula (Tayl.) Joerg.

LICHENS

Actinogyra muhlenbergii (Ach.) Schol.

Alectoria sarmentosa (Ach.) Ach.

Cetraria cucullata (Bell.) Ach.

Cetraria ericetorum Opiz

Cetraria islandica (L.) Ach.

Cetraria juniperina (L.) Ach.

Cetraria nivalis (L.) Ach.

Cetraria pinastri (Scop.) S. Gray

Cetraria viridis Schwein

Cladina aberrans (Abb.) Hale. & W. Culb.

Cladina alpestris (L.) Harm.

Cladina arbuscula (Walbr.) Hale & W. Culb.

Cladina mitis (Sandst.) Hale & W. Culb.

Cladina pseudoevansii (Asah.) Hale & W. Culb.

Cladina rangiferina (L.) Harm.

Cladonia amaurocraea (Florke) Schaer.

Cladonia bacillaris (Ach.) Nyl.

Cladonia botrytes (Hag.) Willd.

Cladonia chlorophaea (Floerke Ex Somm.) Spreng.

Cladonia coccifera (L.) Willd.

Cladonia coniocraea (Florke) Spreng

Cladonia cornuta (L.) Hoffm.

Cladonia crispata (Ach.) Flot

Cladonia deformis (L.) Hoffm.

Cladonia digitata (L.) Hoffm.

Cladonia fimbriata (L.) Fr.

Cladonia gonecha (Ach.) Asah.

Cladonia gracilis (L.) Willd.

Cladonia grayi Merr.

Cladonia multiformis Merr.

Cladonia nemoxyna (Ach.) Nyl.

Cladonia ochrochlora Florke

Cladonia pleurota (Florke) Schaer.

Cladonia squamosa (Scop.) Hoffm.

Cladonia subulata (L.) Wigg.

Cladonia uncialis (L.) Wigg.

Hypogymnia physodes (L.) Nyl.

Icmadophila ericetorum (L.) Zahlbr.

Leptogium saturninum (Dicks.) Nyl.

Nephroma arcticum (L.) Torss.

Nephroma bellum (Spreng.) Tuck.

Nephroma helveticum (Ach.) Ach.

Nephroma parile (Ach.) Ach.

Nephroma resupinatum (L.) Ach.

Parmelia sulcata Tayl.

Peltigera aphthosa (L.) Willd.

Peltigera canina (L.) Willd.

Peltigera evansiana Gyel.

Peltigera horizontalis (Huds.) Baumg.

Peltigera leucophlebia (Nyl.) Gyelnik

Peltigera malacea (Ach.) Funck

Peltigera membranacea (Ach.) Nyl.

Peltigera polydactyla (Neck.) Hoffm.

Peltigera spuria (Ach.) D.C.

Stereocaulon tomentosum Fr.

APPENDIX B

Rock Fragments in Soil

Representative samples of coarse fragments, taken from the soil samples, were identified by Gordon Richards, Department of Geology, University of British Columbia. The main types of rock were characterized by Richards as follows:

Sandstone

Non-calcareous (all samples). Generally fine-grained, well-laminated with 5-15% dark coloured fragments. Quartz content generally high (40-70%) thus a well sorted sandstone. Feldspars are usually somewhat altered to clays. Mafics are usually somewhat altered. Angular, sub-angular to subround, mostly subangular. There is not too much variation of individual samples from the above description.

Orthoquartzite

Over 90% and usually over 97% pure quartz, with mafic fragments somewhat altered. Quartz grains fine to

medium grained (up to 1 1/2mm), clear glassy quartz. Subround in general. May be closely associated with sandstone above (?)

Granite

Medium to coarse grained Biotite Granite. 10-35% Quartz. 5% Biotite (rarely hornblende). Other intrusives ie. Diorite, Granodiorite present but not numerous. Subround.

Carbonates

Many pieces of very variable textured limestone and dolomite. Textureless to fine-grained crystalline. Colours brown, grey, white. Some samples with vugs. Some samples with unidentifiable shell fragments. Round to subround.

Chert

Dense, hard usually buff brown but also black and pale grey. Round to subangular, variable.

Quartz

Pure massive clear quartz. Subround.

APPENDIX

ROCK FRAGMENTS IN SOIL

Identified by Gordon Richards - Dept. of Geology U.B.C.

Plot No.	Fragment	Shape	Alteration
2	Dark brown sandstone	Subangular	Unaltered
	Black chert (?)	Angular	Unaltered
3	Light grey chert	Round	Unaltered
	Pale purple fine grained orthoquartzite (intrusive)	Subround	Unaltered
	Quartz-feldspar-biotite porphyry	Subround	Slight
6	White quartzite	Angular	Slight
	Fine grained sandstone	Subround	Slight
	Dense maroon argillite (?)	Subround	Unaltered
9	Light brown limestone	Subround	Unaltered
	Light brown chert	Subangular	Unaltered
	Grey quartz diorite (?)	Subangular	Unaltered
	Light brown dolomite	Round	Unaltered
	Pink orthoquartzite	Subround	Iron oxide specks
	Granite gneiss (?)	Subangular	Unaltered
	Quartz	Round	Unaltered
	Orthoquartzite	Subround	Unaltered
	Buff limestone with Paleozoic brachiopods	Subangular	Unaltered
	Quartzite	Subangular	Unaltered
	Pink orthoquartzite	Subround	Unaltered
	Pink medium grained orthoquartzite	Subangular	Unaltered
10	White limestone	Subangular	Unaltered
	Light brown well-laminated limestone	Subangular	Unaltered
	Grey sandstone	Angular	Unaltered
	Pink fine-grained orthoquartzite	Subround	Unaltered
	Light brown dolomite with calcite	Subround	Unaltered
13	Laminated sandstone and white mica	Angular	Well altered

Plot No.	Fragment	Shape	Alteration
15	Pink biotite granite gneiss	Subround	Unaltered
	Light brown chert	Subround	Unaltered
	Pink granite	Subangular	Slight
	Fine-grained grey gneissic diorite (?)	Subangular	Moderate
	Medium-grained granite	Subangular	Moderate
	Coarse-grained granite	Subangular	Unaltered
	Gabbro	Subangular	Unaltered
	Light-grey limestone	Subround	Slight 1 mm deep
16	Aphanitic buff-grey limestone	Subangular	Unaltered
17	Orangy-brown orthoquartzite	Subround	Unaltered
	Dark black dense (chert ?)	Subangular	Unaltered
	Brown dense (argillite ?)	Subangular	Unaltered
	Medium-grained biotite acid intrusive	Subround	Slight
	Granite gneiss	Subround	Unaltered
	Light-grey well-laminated sandstone and white mica	Subround	Partly altered
18	quartz-mica schist (?)	Round	Slight
	Quartz	Subround	Unaltered
	Fine-grained quartz-phlogophite gneiss and ½% sulphides	Subround	Slight
	Dolomite 5% vugs lined with calcite	Subround	Slight
	Poorly banded clean sandstone	Round	Slight
	Dolomite-limestone 1% vugs	Round	Unaltered
	Medium-grained granodiorite (?)	Subround	Well altered
19	Pink orthoquartzite	Subangular	Unaltered
	Limestone	Rounded	Unaltered
	Aphanitic limestone	Subround	Slight
	Limestone coral Thamnopura 80% chance Devonian age otherwise Silurian	Subround	Unaltered
	Quartz-white mica schist	Round	Unaltered
	Coarse-grained biotite granite	Round	Unaltered
	Quartz	Subround	Unaltered
	Light grey aphanitic limestone	Subround	Unaltered

Plot No.	Fragment	Shape	Alteration
20	Fine-grained sandstone	Angular	Slight
	Granite gneiss	Subround	Unaltered
	Pink orthoquartzite	Subround	Moderate
	Quartz	Subround	Unaltered
	Granite gneiss	Subround	Moderate
	Light-grey laminated sandstone	Angular	Slight
	Light brown limestone-dolomite	Subangular	Unaltered
	Slightly calcareous dense, black, hard, (cherty mudstone ?) ½% pyrite	Subround	Unaltered
	Light-grey banded limestone	Subangular	Unaltered
23	Fine-grained sandstone	Angular	Well altered
	Well-laminated fine-grained sandstone	Angular	Well altered
	Poorly-laminated fine-grained sandstone	Subround	Partly altered
	Medium-grained granite	Subround	Unaltered
	Fine-grained sandstone	Subangular	Well altered
24	Medium-grained orthoquartzite with pebble	Subangular	Unaltered
	Well-laminated sandstone	Subangular	Well altered
	Poorly-laminated fine-grained sandstone	Subangular	Well altered
	Sandstone (some white mica)	Subangular	Partly altered
	Sandstone (some white mica)	Subangular	Well altered
	Fine-grained laminated sandstone	Subangular	Slight
	Sandstone	Subangular	Slight
	Laminated quartz rich sandstone with 20-30% black horn blende (?) with quartz pebbles 1-2% white mica	Subangular	Slight
26	Medium-grained granite	Subangular	Slight
	Fine-grained well-laminated sandstone	Subangular	Well altered
27	Buff quartzite	Subround	Unaltered
	Biotite "granite"	Subround	Slight
29	Fine-grained sandstone 5% white mica	Subround	Partly altered
	Porous fine-grained sandstone	Angular	Well altered
	Fine-grained sandstone	Angular	Partly altered
	Fine-grained sandstone	Subangular	Partly altered

Plot No.	Fragment	Shape	Alteration
29	Buff-pink orthoquartzite	Subangular	Unaltered
	Sandstone	Angular	Slight
	Medium-grained orthoquartzite	Subangular	Partly altered
	Fine-grained orthoquartzite	Subround	Slight
	Light chocolate-brown sandstone (white mica)	Subangular	Well altered
	Light-grey sandstone	Subangular	Partly Altered
30	Sandstone (white mica)	Subangular	Partly altered
	Brown, banded, fine-grained sandstone	Subround	Unaltered
	Sandstone (much qtz) (white mica)	Subround	Partly altered
	Sandstone (clean)	Subround	Slight
	Well laminated sandstone	Subround	Moderate
32	Granite	Subround	Unaltered
	Light brown limestone	Subround	Unaltered
	Medium-grained granite	Subround	Unaltered
	Dolomite	Subangular	Unaltered
	Maroon orthoquartzite	Subangular	Unaltered
	Quartz	Subangular	Unaltered
	Very fine-grained dolomite	Subangular	Unaltered
	Fine-grained pink orthoquartzite	Subround	Unaltered
	Dense hard light brown chert	Subround	Unaltered
35	Fine-grained grey quartzite	Subround	Unaltered
	Pink medium-grained granite	Angular	Unaltered
	Dark brown sandstone	Angular	Moderate
	Fine-grained green-brown sandstone	Subangular	Slight
	Pink orthoquartzite	Subangular	Unaltered
	Light-grey fine-grained sandstone	Subangular	Slight
	Medium-grained acid igneous	Subround	Slight
	Medium-grained pink granite gneiss	Subangular	Unaltered
	Dark black fine-grained "sandstone"	Subround	Slight
36	White fine-grained orthoquartzite	Subround	Unaltered
	Granite gneiss	Subround	Unaltered
	Siltstone	Subangular	Slight

Plot No.	Fragment	Shape	Alteration
36	Sandstone	Subangular	Slight
	Light-grey laminated sandstone	Angular	Slight
	Quartz	Subangular	Unaltered
	Grey-brown laminated sandstone	Subangular	Partly altered
37	Sandstone (white mica)	Subangular	Partly altered
	Sandstone (white mica)	Subangular	Partly altered
	Fine-grained laminated sandstone	Subangular	Very altered
38	Orthoquartzite	Subround	Fe-oxide specks
	Hornfels with granite	Subround	Unaltered
	Quartz	Subround	Unaltered
	Brown chert	Subround	Unaltered
	Medium-grained granite	Subround	Unaltered
	Brown finely-laminated limestone	Subround	Unaltered
	Soft porous fragmental limestone	Angular	Very Altered
40	Granite	Subangular	Unaltered
	Medium-grained granite	Subangular	Slight
45	Biotite granite gneiss	Subround	Slight
	Light-grey sandstone	Subangular	Slight
	Fine-grained crystalline limestone-dolomite	Subround	Unaltered
	Biotite granite gneiss	Subangular	Slight
51	Fine-grained laminated sandstone	Angular	Well altered
72	Light-grey laminated sandstone	Subround	Partly altered
Steam-boat area	Grey sandstone dark Greywache	Angular	Slight

APPENDIX C

1

Elemental Analysis of Surface Organic Horizons, Concentration in ppm of Organic Matter in Original Sample

Lodgepole Pine - Kinnikinnick - Lichen

	Ca	Mg	Na	K	Fe	Al	Mn
Plot 59	10921	1699	70	1262	8251	4186	910
81	19023	2378	127	1902	8878	6975	3900
82	6671	834	62	1156	1112	2113	1512
92	4126	825	139	1642	2476	3111	1659
Average	10185	1434	99	1490	5179	4096	1995
Range	4126-19023	825-2378	62-139	1156-1902	1112-8878	2113-6975	910-3900

Aspen - White Spruce

	Ca	Mg	Na	K	Fe	Al	Mn
Plot 38	34413	3777	117	3190	14185	5028	881
3	29728	2064	83	2147	3551	2231	248
4	19227	2218	107	2810	17353	9466	1962
8	38248	2285	60	1510	993	1450	914
13	30573	3006	89	1482	7047	4156	684
14	22514	3081	132	1766	4503	2951	379
20	22181	2090	82	2986	2901	2133	418
37	14046	1457	94	1966	4682	3933	697
40	20231	2596	75	1954	6184	5023	748
15	19391	1406	66	1522	1745	1580	1134
16	14257	1342	81	1837	3187	2751	486
19	12593	1322	96	2254	11585	4408	4533
26	25800	3679	118	2551	11849	6297	1108
32	5875	641	77	1314	1709	1570	171
33	13243	1677	72	1324	3090	1854	600
Average	21488	2176	90	2041	6304	3531	998
Range	5875-38248	641-3777	60-132	1314-3190	993-17353	1450-6297	171-4533

APPENDIX C

2

Black Spruce - Equisetum sylvaticum

	Ca	Mg	Na	K	Fe	Al	Mn
Plot 52	17408	1985	79	1427	3412	1546	1929
29	3289	822	57	1243	2566	2480	99
30	8832	1731	54	1088	4663	3886	876
47	7030	1023	91	486	1662	1789	38
51	16433	1786	77	929	7574	2186	86
Average	10598	1469	72	1035	3975	2377	606
Range	3289-17408	822-1985	57-91	486-1427	1662-4663	1546-3886	38-1929

Tamarack - Black Spruce - Equisetum arvense

	Ca	Mg	Na	K	Fe	Al	Mn
Plot 31	40076	2479	125	294	18179	1124	273
48	51869	3127	163	765	9344	7321	2884
56	17169	1771	39	1127	966	644	279
57	7015	935	48	655	117	246	70
58	12706	1753	81	885	351	438	61
Average	25767	2013	91	745	5791	1955	713
Range	7015-51869	935-3127	39-163	294-1127	117-18179	246-7321	61-2884

Tamarack - Swamp Birch - Menyanthes

	Ca	Mg	Na	K	Fe	Al	Mn
Plot 53	39353	2589	279	311	33140	1036	2693
76	20649	2628	248	1151	10387	388	1014
77	37887	3789	209	1132	13178	231	1021
78	25616	2383	52	298	715	679	119
Average	30876	2847	197	723	14355	583	1212
Range	20649-39353	2383-3789	52-279	298-1151	715-33140	231-1036	119-2693

Myrica gale - Menyanthes

	Ca	Mg	Na	K	Fe	Al	Mn
Plot 60	14367	1437	269	311	1165	318	155
61	15012	1351	280	340	9307	260	280
Average	14689	1394	274	325	5231	289	217
Range	14367-15012	1351-1437	269-280	311-340	1165-9307	260-318	155-280

Black Spruce - Salix myrtillifolia - Aulacomnium

	Ca	Mg	Na	K	Fe	Al	Mn
Plot 44	10657	1421	91	595	710	524	53
45	12340	987	62	1079	1481	1156	7
88	69047	4568	51	393	4143	4047	329
89	13501	2636	37	874	514	373	64
90	30477	3195	79	991	441	1058	169
91	45593	4297	88	975	2201	2725	597
Average	30269	2851	68	818	1582	1647	203
Range	10657-69047	987-4568	37-91	393-1079	441-4143	373-2725	7-597

Black Spruce - Sphagnum fuscum

	Ca	Mg	Na	K	Fe	Al	Mn
Plot 27	6645	562	48	726	1125	797	20
46	2551	638	291	867	893	740	51
Average	4598	600	169	796	1009	768	35
Range	2551-6645	562-638	48-291	726-867	893-1125	740-797	20-51

APPENDIX C

4

Lodgepole Pine - Clubmoss

	Ca	Mg	Na	K	Fe	Al	Mn
Plot 35	8281	1087	85	2029	5797	5993	1977
55	15083	2204	63	2761	10094	5059	1822
41	12625	2967	130	3548	18811	14771	3043
42	16581	3491	106	2269	9425	6868	2356
43	17131	2463	104	2827	7780	5175	1970
Average	13940	2442	98	2687	10381	7573	2234
Range	8281-17131	1087-3491	63-130	2029-3548	5797-18811	5059-14771	1822-2356

Black Spruce - Moss

	Ca	Mg	Na	K	Fe	Al	Mn
Plot 1	5073	326	56	167	1812	2312	7
5	6211	660	58	776	1320	1048	241
6	3158	368	125	1221	2211	2000	568
9	5919	592	50	497	355	687	59
17	5024	457	78	849	1827	1197	137
23	2912	915	53	715	2163	3586	33
36	4906	491	48	892	1784	1525	27
54	12600	3045	78	1501	10815	4861	252
10	24930	2451	88	938	5916	4902	431
18	4555	759	64	1367	1974	1685	562
24	2970	535	44	784	1069	1188	48
79	5302	1022	71	1765	12649	6362	204
Average	6963	968	68	956	3658	2613	214
Range	2912-24930	326-3045	44-125	167-1765	355-12649	687-6362	27-568

Floodplain (Young Terrace) White Spruce

	Ca	Mg	Na	K	Fe	Al	Mn
Plot 80	32159	2688	67	893	3456	1546	576
39	23578	1572	101	1115	2143	1543	286
25	26207	2406	66	1177	3351	2475	911
21	31526	4586	80	1318	4356	2407	378
Average	28367	2813	78	1126	3326	1993	538
Range	23578-32159	1572-4586	66-101	893-1318	2143-4356	1543-2475	286-911

ELEMENTS IN PPM OF O.M. IN ORIGINAL SAMPLE PAGE 1

(8X,F2.C,F6.0,F5.0,F4.0,F5.0,2F6.0,F4.0)

Ash Analysis

NUMBER OF OBSERVATIONS 92

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	ASH	C.2052170+02	0.132892E+02	0.200000E+01	C.650CC0E+C2	64.76
X 2	CA	C.2403530+05	0.197133E+05	0.230900E+04	C.933710E+05	82.02
X 3	MG	0.221277D+04	0.142961E+04	0.368CCCE+C3	C.612500E+C4	64.61
X 4	NA	C.9652170+02	0.552197E+02	0.350C00E+C2	C.291C00E+03	57.21
X 5	K	C.1C6014D+04	0.790575E+03	C.1210CCE+C3	C.354800E+04	74.58
X 6	FE	0.707396D+04	0.741497E+04	0.1170CCE+C3	C.447250E+C5	104.82
X 7	AL	C.3231820+04	0.3360758E+C4	0.231000E+03	0.165120E+05	104.96
X 8	MN	0.6575330+03	0.815508E+03	C.7C0CCE+C1	C.453300E+04	124.03

ELEMENTS IN PPM OF O.M. IN ORIGINAL SAMPLE PAGE

COVARIANCE MATRIX - CORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1 ASH							
C.1667100+05							
ROW X 2 CA							
0.1372240+08	C.3336390+11						
ROW X 3 MG							
0.1124020+07	C.2233920+10	0.1859E5D+09					
ROW X 4 NA							
C.6668560+04	C.4356130+07	0.5184230+06	0.277479C+06				
ROW X 5 K							
C.3431420+06	-C.3586790+C5	-0.3631500+05	-0.742038C+C5	C.568876D+08			
ROW X 6 FE							
0.5225970+07	0.514-01D+10	0.2583430+09	C.1109280+CE	C.2103020+08	C.500334D+10		
ROW X 7 AL							
C.3478500+C7	0.2427270+1C	0.2158160+09	C.1750880+07	C.9815640+08	0.1C9567D+1C	C.1C2781D+1C	
ROW X 8 MN							
C.5377400+06	C.2020750+09	0.2339940+08	0.9145500+06	C.3001C9D+0E	C.1735C3D+C9	0.1132280+09	0.6051990+08

ELEMENTS IN PPM OF O.M. IN ORIGINAL SAMPLE

CORRELATION MATRIX

ROW X 1 ASH							
1.CCCCC							
ROW X 2 CA							
0.57561	1.CC00C						
ROW X 3 MG							
0.65015	0.87106	1.00000					
ROW X 4 NA							
0.09987	0.04438	0.07217	1.CCCCC				
ROW X 5 K							
0.35888	-C.25281	-0.00035	-C.01868	1.00000			
ROW X 6 FE							
0.56280	0.38672	0.26781	0.29771	0.03942	1.00000		
ROW X 7 AL							
0.85588	0.40261	0.49362	C.10368	0.40593	C.48316	1.00000	
ROW X 8 MN							
0.54526	0.13813	C.22055	C.22317	0.51147	C.31603	0.45399	1.00000

(10X,F6.0,F5.0,F4.0,F5.0,2F6.0,F4.0)

Ash Analysis

NUMBER OF OBSERVATIONS 91

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	CA	C.597945D+02	0.168477E+02	0.161000E+02	0.859000E+02	28.18
X 2	MG	0.653516D+01	0.251448E+01	0.150000E+01	0.163000E+02	38.48
X 3	NA	C.438462D+CC	0.590062E+00	0.100000E+00	C.480000E+01	134.56
X 4	K	C.433516D+01	C.355545E+01	C.200000E+00	C.144000E+02	82.00
X 5	FE	C.177385D+02	0.109088E+02	0.120000E+01	C.482000E+02	61.50
X 6	AL	C.928132D+01	0.723270E+01	0.400000E+00	0.345000E+02	77.93
X 7	MN	0.187802D+01	0.240055E+01	0.0	C.123000E+02	127.82

ELEMENTS IN % YIELD OF ELEMENTS

COVARIANCE MATRIX - CORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1	CA						
C.255462D+05							
ROW X 2	MG						
C.582489D+03	0.569127D+03						
ROW X 3	NA						
-C.215341D+03	C.463169D+02	0.313354D+02					
ROW X 4	K						
-C.302704D+04	C.203757D+03	0.904169D+02	0.113745D+04				
ROW X 5	FE						
-C.122158D+05	-C.121006D+04	0.111953D+02	-C.475437D+02	C.1C71C4D+05			
ROW X 6	AL						
-C.894915D+04	-C.972109D+02	0.340E53D+02	C.132729D+04	C.237783D+04	C.470806D+04		
ROW X 7	MN						
-C.170276D+04	-C.926658D+02	0.326691D+01	C.312480D+03	C.373206D+03	0.585832D+03	C.516636D+C3	

ELEMENTS IN % YIELD OF ELEMENTS

CORRELATION MATRIX

ROW X 1	CA					
1.00000						
ROW X 2	MG					
0.15276	1.00000					
ROW X 3	NA					
-0.24180	0.34683	1.00000				
ROW X 4	K					
-0.56155	0.25330	0.47892	1.00000			
ROW X 5	FE					
-0.73651	-0.49012	0.01932	-C.01362	1.00000		
ROW X 6	AL					
-0.81601	-0.05939	0.08869	C.57356	0.33485	1.00000	
ROW X 7	MN					
-0.48780	-0.17057	0.02578	C.40484	0.15835	C.37490	1.00000

ELEMENTS IN PPM OF OVEN DRIED MATERIAL

(10X,F6.0,F5.0,F4.0,F5.0,2F6.0,F4.0)

Ash Analysis

NUMBER OF OBSERVATIONS 91

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	CA	0.177090D+05	0.125551E+05	0.226200E+04	0.515970E+05	70.95
X 2	MG	0.164659D+04	0.879515E+03	0.338000E+03	0.385100E+04	53.35
X 3	NA	0.762083E+02	0.492465E+02	0.290000E+02	0.280000E+03	64.31
X 4	K	0.798143D+03	0.547694E+03	0.113000E+03	0.245300E+04	68.62
X 5	FE	0.503934D+04	0.509377E+04	0.109000E+03	0.321440E+05	101.07
X 6	AL	0.216514D+04	0.169902E+04	0.164000E+03	0.750500E+04	78.44
X 7	MN	0.460626D+03	0.523556E+03	0.600000E+01	0.207800E+04	113.66

ELEMENTS IN PPM OF OVEN DRIED MATERIAL

COVARIANCE MATRIX - CORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1	CA					
0.142093D+11						
ROW X 2	MG					
0.826518D+09	0.694610D+08					
ROW X 3	NA					
-0.624194D+07	-0.416911D+06	0.209495D+06				
ROW X 4	K					
-0.239658D+09	-0.578518D+07	-0.265597D+06	0.269972D+08			
ROW X 5	FE					
0.180154D+10	0.404332D+08	0.359138D+07	-0.438303D+08	0.233519D+10		
ROW X 6	AL					
0.383400D+09	0.210268D+08	-0.196092D+07	0.245596D+08	0.201903D+09	0.259759D+09	
ROW X 7	MN					
0.421472D+08	0.503383D+07	0.189172D+06	0.103507D+08	0.526317D+08	0.313966D+08	0.246700D+08

ELEMENTS IN PPM OF OVEN DRIED MATERIAL

CORRELATION MATRIX

ROW X 1	CA					
1.00000						
ROW X 2	MG					
0.83195	1.00000					
ROW X 3	NA					
-0.11441	-0.10929	1.00000				
ROW X 4	K					
-0.38654	-0.13359	-0.11185	1.00000			
ROW X 5	FE					
0.31275	0.10052	0.16237	-0.17456	1.00000		
ROW X 6	AL					
0.16393	0.23097	-0.25767	0.29325	0.25922	1.00000	
ROW X 7	MN					
0.07119	0.12160	0.08321	0.40107	0.21928	0.39219	1.00000

DECK 1

(10X,F6.0,F5.0,F4.0,F5.0)

Exchangeable Cations

NUMBER OF OBSERVATIONS 91

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	CA	0.430495D+02	0.214210E+02	0.750000E+01	0.887500E+02	49.76
X 2	MG	0.913303D+01	0.440701E+01	0.175000E+01	0.197500E+02	48.25
X 3	NA	0.214336D+00	0.183116E+00	0.0	0.870000E+00	85.41
X 4	K	0.137659D+01	0.125585E+01	0.0	0.562000E+01	91.23

DECK 1

COVARIANCE MATRIX - CORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1	CA			
0.412975D+05				
ROW X 2	MG			
0.879265D+04	0.174795D+04			
ROW X 3	NA			
-0.832379D+01	-0.309255D+01	0.301764D+01		
ROW X 4	K			
-0.955805D+03	-0.843440D+02	-0.626004D+01	0.141944D+03	

DECK 1

CORRELATION MATRIX

ROW X 1	CA		
1.00000			
ROW X 2	MG		
0.79949	1.00000		
ROW X 3	NA		
-0.01935	-0.04256	1.00000	
ROW X 4	K		
-0.36477	-0.17967	-0.30247	1.00000

(4F12.3)

NUMBER OF OBSERVATIONS 91

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	K1	0.137659D+01	0.125585E+01	0.0	0.562000E+01	91.23
X 2	K2	0.105356D+04	0.792500E+03	0.121000E+03	0.354800E+04	75.22
X 3	K3	0.798143D+03	0.547694E+03	0.113000E+03	0.245900E+04	68.62
X 4	K4	0.433516D+01	0.355504E+01	0.200000E+00	0.144000E+02	82.00

COVARIANCE MATRIX = CORRECTED SUMS OF SQUARES AND PRODUCTS

ROW				
X 1	K1			
0.141944D+03				
X 2	K2			
0.715309D+05	0.565251D+08			
X 3	K3			
0.549383D+05	0.371707D+08	0.269972D+08		
X 4	K4			
0.277589D+03	0.126958D+06	0.109800D+06	0.113745D+04	

CORRELATION MATRIX

ROW				
X 1	K1			
1.00000				
X 2	K2			
0.79857	1.00000			
X 3	K3			
0.88748	0.95153	1.00000		
X 4	K4			
0.69084	0.50070	0.62658	1.00000	

K_1 - exchangeable K

K_2 - K in ppm of organic matter in original sample

K_3 - K in ppm of oven dried material

K_4 - K in % yield of elements

(4F12.3)

NUMBER OF OBSERVATIONS 01

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	MG1	0.913308D+01	0.440701E+01	0.175000E+01	0.197500E+02	48.25
X 2	MG2	0.2226960+04	0.143101E+04	0.368000E+03	0.612900E+04	64.26
X 3	MG3	0.1646590+04	0.878515E+03	0.338000E+03	0.385100E+04	53.35
X 4	MG4	0.6535160+01	0.251468E+01	0.150000E+01	0.163000E+02	38.48

COVARIANCE MATRIX = CORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1	MG1			
0.174795D+04				
ROW X 2	MG2			
0.473550D+06	0.184300D+09			
ROW X 3	MG3			
0.330427D+06	0.105851D+09	0.694610D+08		
ROW X 4	MG4			
0.164616D+03	-0.460940D+04	0.192306D+05	0.569127D+03	

CORRELATION MATRIX

ROW X 1	MG1		
1.00000			
ROW X 2	MG2		
0.83433	1.00000		
ROW X 3	MG3		
0.94829	0.93554	1.00000	
ROW X 4	MG4		
0.16504	-0.01423	0.09672	1.00000

Mg_1 - Exchangeable Mg

Mg_2 - Mg in ppm of organic matter in original sample

Mg_3 - Mg in ppm of oven dried material

Mg_4 - Mg in % yield of elements

(4F12,3)

NUMBER OF OBSERVATIONS 91

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	NA1	0.214396D+00	0.183110E+00	0.0	0.870000E+00	85.41
X 2	NA2	0.968681D+02	0.554251E+02	0.350000E+02	0.291000E+03	57.22
X 3	NA3	0.762088D+02	0.482465E+02	0.290000E+02	0.280000E+03	63.31
X 4	NA4	0.438462D+00	0.590060E+00	0.100000E+00	0.480000E+01	134.58

COVARIANCE MATRIX = CORRECTED SUMS OF SQUARES AND PRODUCTS

ROW				
X 1	NA1			
0.301764D+01				
X 2	NA2			
0.721003D+03	0.276474D+06			
X 3	NA3			
0.692056D+03	0.224921D+06	0.209495D+06		
X 4	NA4			
0.493361D+01	0.146876D+04	0.166057D+04	0.313354D+02	

CORRELATION MATRIX

ROW				
X 1	NA1			
1.00000				
X 2	NA2			
0.78936	1.00000			
X 3	NA3			
0.87040	0.93458	1.00000		
X 4	NA4			
0.50736	0.49901	0.64812	1.00000	

Na_1 - Exchangeable Na

Na_2 - Na in ppm of organic matter in original sample

Na_3 - Na in ppm of oven dried material

Na_4 - Na in % yield of elements

(4F12,3)

NUMBER OF OBSERVATIONS 91

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	CA1	0.430495D+02	0.214210E+02	0.750000E+01	0.887500E+02	49.76
X 2	CA2	0.241869D+05	0.197689E+05	0.230900E+04	0.833710E+05	81.73
X 3	CA3	0.177090D+05	0.125651E+05	0.226200E+04	0.515970E+05	70.95
X 4	CA4	0.597945D+02	0.168477E+02	0.161000E+02	0.859000E+02	28.18

COVARIANCE MATRIX = CORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1 CA1			
0.412975D+05			
ROW X 2 CA2			
0.331252D+08	0.351727D+11		
ROW X 3 CA3			
0.226227D+08	0.213758D+11	0.142093D+11	
ROW X 4 CA4			
0.219945D+05	0.156629D+08	0.120757D+08	0.255462D+05

CORRELATION MATRIX

ROW X 1 CA1			
1.00000			
ROW X 2 CA2			
0.86915	1.00000		
ROW X 3 CA3			
0.93389	0.95617	1.00000	
ROW X 4 CA4			
0.67716	0.52253	0.63381	1.00000

Ca_1 - Exchangeable Ca

Ca_2 - Ca in ppm of organic matter in original sample

Ca_3 - Ca in ppm of oven dried material

Ca_4 - Ca in % yield of elements

APPENDIX E

Cluster Analysis

The following dendrograms are the results of a clustering (U.B.C. C Group, Hierarchical Grouping Analysis) which determines the extent to which natural groups exist among a number of items. [documented by Lloyd and Gerbrandt (1974)].

The dendrogram on page 363 uses the results of ash analysis as keys, with each key having equal weight. The keys are Ca, Mg, Na, K, Fe, Al, Mn. These keys are from the elemental analysis of surface organic horizons. The second dendrogram on page 364 uses pH, C/N, and base saturation from surface organic layers as keys.

The clustering using 7 elemental keys (page 363) produced four large groups which only partly conformed to the ecosystem classification developed in this study. Of the four groups distinguished from the clustering, one (group a) is composed mainly of samples from plots which occupy the eutrophic side of the edatopic grid. A second group

(b) is mainly composed of samples from ecosystems on the oligotrophic side of the edatopic grid. The remaining two groups (c and d) are composed mainly of samples from mesotrophic or richer ecosystems.

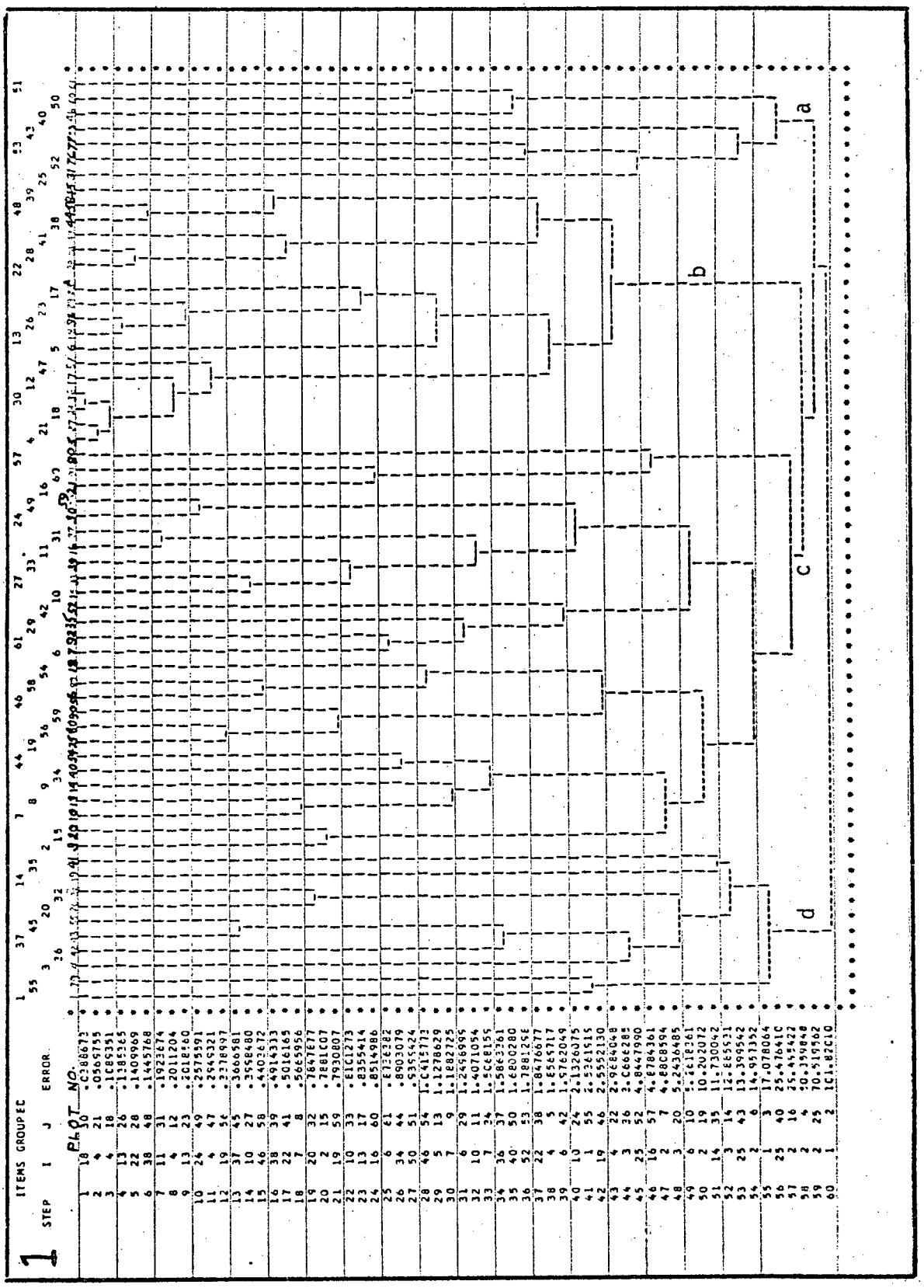
The second dendrogram (page 364) which uses pH, C/N, and base saturation as keys illustrates three main groups. The first group (a) is composed mainly of samples from oligotrophic ecosystems and from mor humus. This group characteristically has a low pH, wide C/N ratio and low base saturation. The remaining two groups (b and c) are from ecosystems of higher nutrient status.

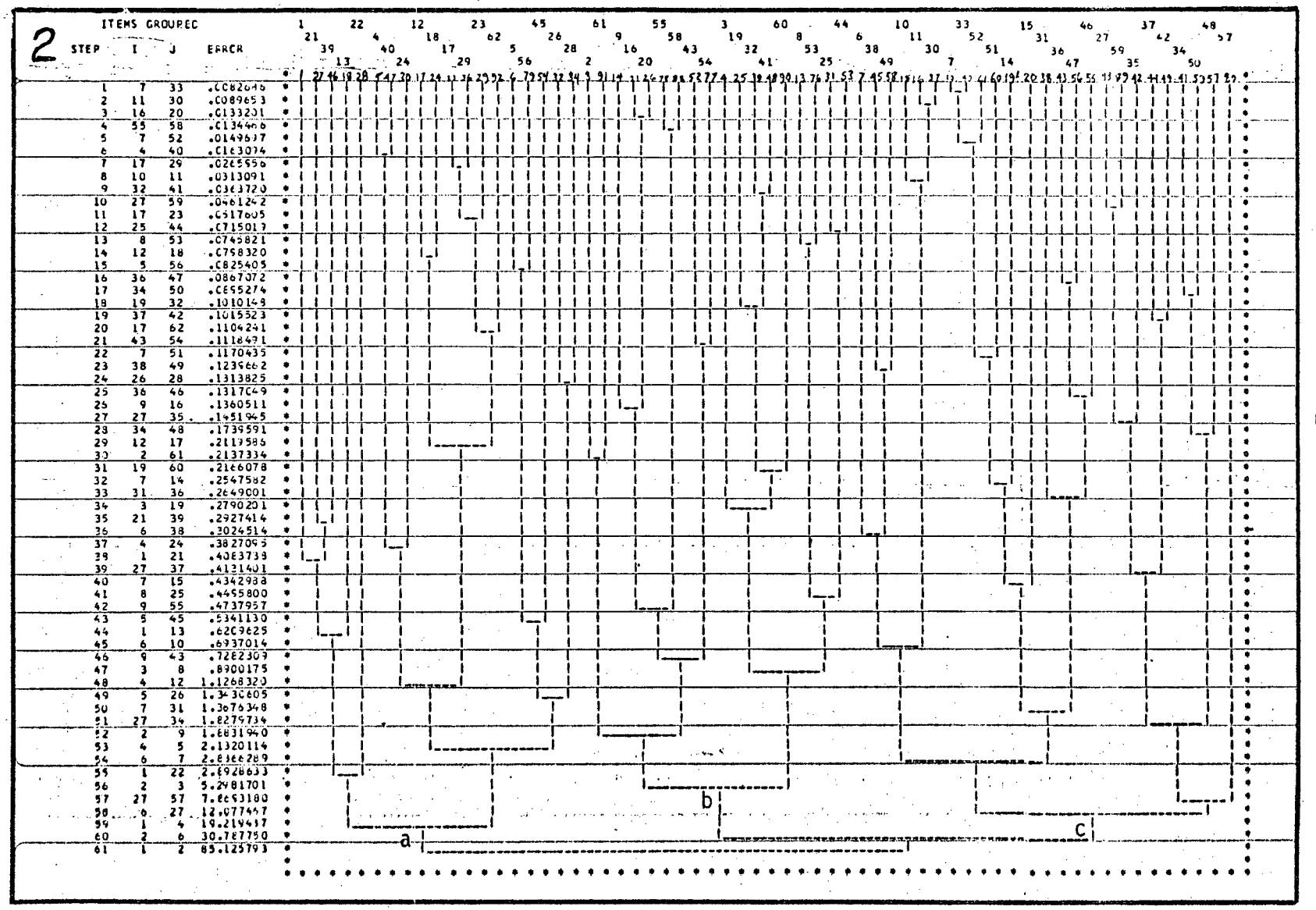
Although the clustering of data from organic matter analysis does not produce groups which closely conform to the ecosystem classification, the technique did organize information which indicated trends in the data set.

The clustering, based on the results of bog water analysis (page 408 and 409), produced groups which conformed closely to the ecosystem classification. This indicates that the measurements taken on the bog waters accurately reflect the actual nutrient status of the ecosystems.

APPENDIX E

1




2
ITEMS GROUPED
STEP I J ERROR
1 7 33 .0082046
2 11 30 .0089653
3 16 20 .0133201
4 55 58 .0134466
5 7 52 .0149637
6 4 40 .0163034
7 17 29 .0265556
8 10 11 .0313091
9 32 41 .0363720
10 27 59 .0461242
11 17 23 .0517605
12 25 44 .0715017
13 8 53 .0746821
14 12 18 .0758320
15 5 56 .0825405
16 36 47 .0867072
17 34 50 .0895274
18 19 32 .1010149
19 37 42 .1015523
20 17 62 .1104241
21 43 54 .1118491
22 7 51 .1170435
23 38 49 .1239662
24 26 28 .1313825
25 36 46 .1317049
26 9 16 .1360511
27 27 35 .1451945
28 34 48 .1739591
29 12 17 .2119586
30 2 61 .2137334
31 19 60 .2166078
32 7 14 .2547582
33 31 36 .2649001
34 3 19 .2790201
35 21 39 .2927414
36 6 38 .3024514
37 4 24 .3827095
38 1 21 .4083738
39 27 37 .4131401
40 7 15 .4342988
41 8 25 .4455800
42 9 55 .4737957
43 5 45 .5341130
44 1 13 .6209625
45 6 10 .6937014
46 9 43 .7282309
47 3 8 .8900175
48 4 12 1.1268320
49 5 26 1.3430605
50 7 31 1.3678348
51 27 34 1.8279734
52 2 9 1.8831940
53 4 5 2.1320114
54 6 7 2.8366289
55 1 22 2.8928633
56 2 3 5.2981701
57 27 57 7.8693180
58 0 27 12.077447
59 1 4 19.219417
60 2 6 30.787750
61 1 2 85.125793
a
b
c

APPENDIX F

Site Index at 100 years from the single largest tree of each species on a plot (suppressed trees ignored)

Black Spruce - Salix Myrtillifolia - Aulacomnium

Plot No.	44	88	89	90	91	Avg.
Picea mariana	9	10	7	5	5	7
Picea glauca		14				14
Populus balsamifera		11				11

Tamarack - Swamp Birch - Menyanthes

Plot No.	53	76	77	78	Avg.
Larix laricina	12	10	13	11	11

Lodgepole Pine - Kinnikinnick - Lichen

Plot No.	59	81	82	92	Avg.
Lodgepole Pine	22	19	21	22	21

Black Spruce - Equisetum sylvaticum

Plot No.	52	29	30	47	51	Avg.
Picea mariana	13	20	20	12	12	15
Larix laricina	15			11	11	13
Pinus contorta			19			19

Lodgepole Pine - Clubmoss

Plot No.	35	55	41	42	43	Avg.
Pinus contorta	26	26	22	20	25	24
Populus tremuloides	27	27		17	24	24

Tamarack - Black Spruce - Equisetum arvense

Plot No.	31	48	56	57	58	Avg.
Picea mariana	24	24	22	16	20	21
Larix laricina	19	23			21	21
Picea glauca		26	24	16		22
Populus balsamifera		20				20

Black Spruce - Moss

Plot No.	1	5	6	9	17	23	36	54	10	18	24	79	49	Avg.
Picea mariana	18	20	17	18	13	13	12	13	20	19	12	13	18	16
Pinus contorta	23	21	25			13	17			27	15	12	19	19
Populus tremuloides		23												23
Picea glauca				19	14				28	23			21	21
Abies lasiocarpa						10								10
Larix laricina					18			18	24					20

Aspen - White Spruce

Plot No.	2	3	4	8	13	14	20	37	40	15	16	19	26	32	33	38	Avg.
Populus tremuloides	35	31	31	35	27	24	24	30	30	24	30	33	26	27			29
Populus balsamifera	33	31															32
Picea glauca					28					24	29	27	25	29	30	25	27
Pinus contorta											28	24					26

Floodplain (Young Terrace) White Spruce

Plot No.	21	22	25	39	71	75	80	83	Avg.
Picea glauca	24	27	26	30	32	40	30	30	30
Populus balsamifera	21							34	27
Abies lasiocarpa		24							24
Populus tremuloides			28						28

For the Tetsa River plots, the avg. S.I. for Picea glauca is 26 m, while for the other plots (Muskwa and Fort Nelson Rivers) it is 32 meters at 100 years. The Tetsa River plots border on the Spruce Birch Willow Biogeoclimatic Zone and are under a more severe climate than the other alluvial plots.

Floodplain Balsam Poplar

Plot No.	64	65	73	74	84	85	Avg.
Populus balsamifera	37	37	38	38	34	37	37

Picea glauca

SPECIES 8

NUMBER OF OBSERVATIONS 60

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	DBH	0,118200D+02	0,578762E+01	0,320000E+01	0,321000E+02	48,96
X 2	DBH*DBH	0,172790D+03	0,187664E+03	0,102400E+02	0,103041E+04	108,61
X 3	HT	0,781000D+02	0,273929E+02	0,230000E+02	0,151000E+03	35,07
X 4	HT-4,5	0,736000D+02	0,273929E+02	0,185000E+02	0,146500E+03	37,22

SPECIES 8

COVARIANCE MATRIX = UNCORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1	DBH			
0,138232D+05				
ROW X 2	DBH*DBH			
0,246061D+06	0,517074D+07			
ROW X 3	HT			
0,853781D+05	0,141311D+07	0,547248D+06		
ROW X 4	HT-4,5			
0,811229D+05	0,135091D+07	0,519132D+06	0,492636D+06	

SPECIES 8

CORRELATION MATRIX

ROW X 1	DBH		
1,00000			
ROW X 2	DBH*DBH		
0,96348	1,00000		
ROW X 3	HT		
0,92033	0,82125	1,00000	
ROW X 4	HT-4,5		
0,92033	0,82125	1,00000	1,00000

SPECIES 8

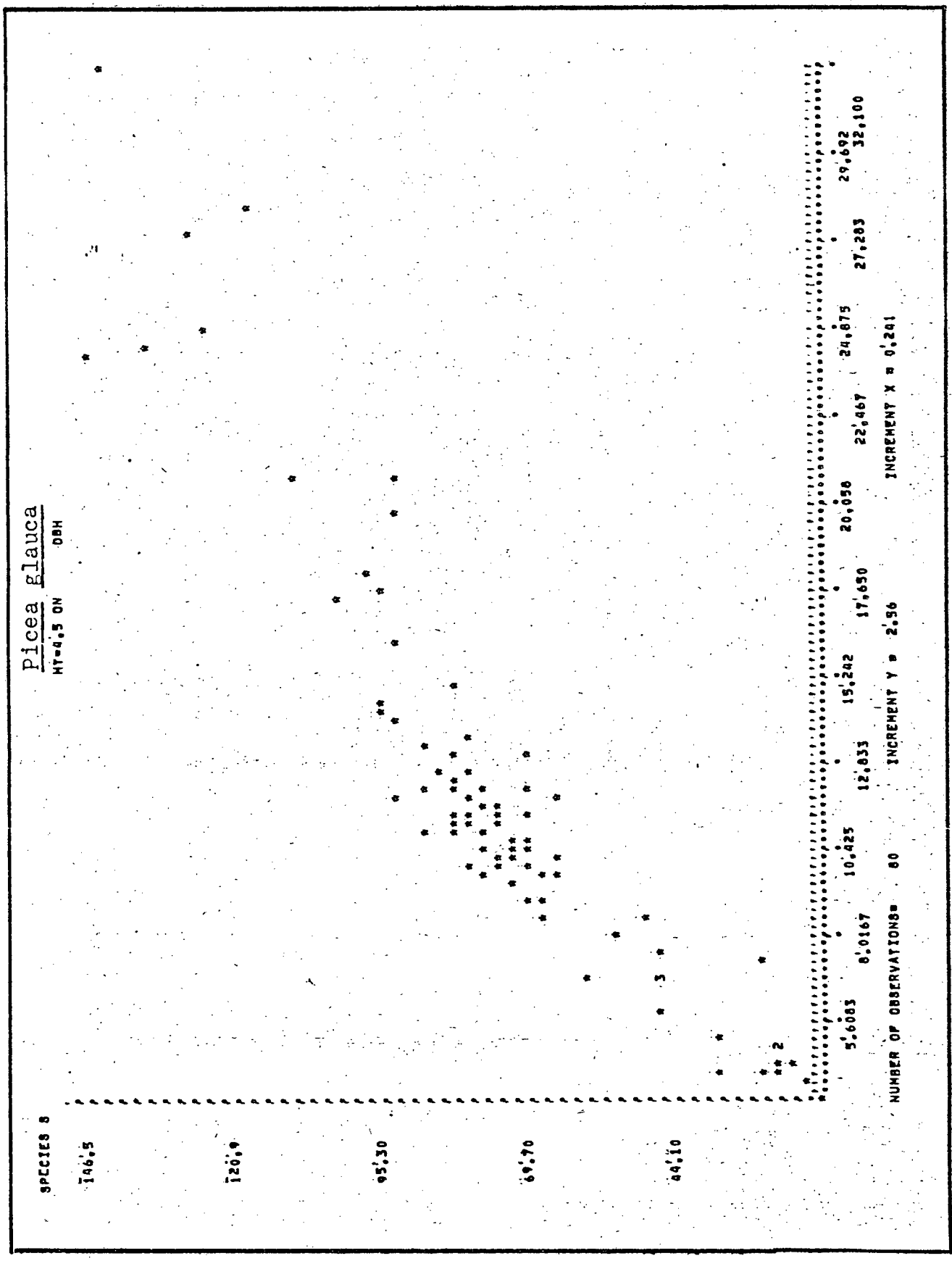
REGRESSION ANALYSIS, THE DEPENDENT VARIABLE IS HT-4,5

INDEPENDENT VARIABLE	REGRESSION COEFFICIENT	STAND. REGR. COEFFICIENT	STANDARD ERROR	VARIANCE RATIO(F)
DBH	0,796505D+01	0,168287E+01	0,184142E+00	1670,995
DBH*DBH	-0,117774D+00	-0,806855E+00	0,952095E-02	153,017

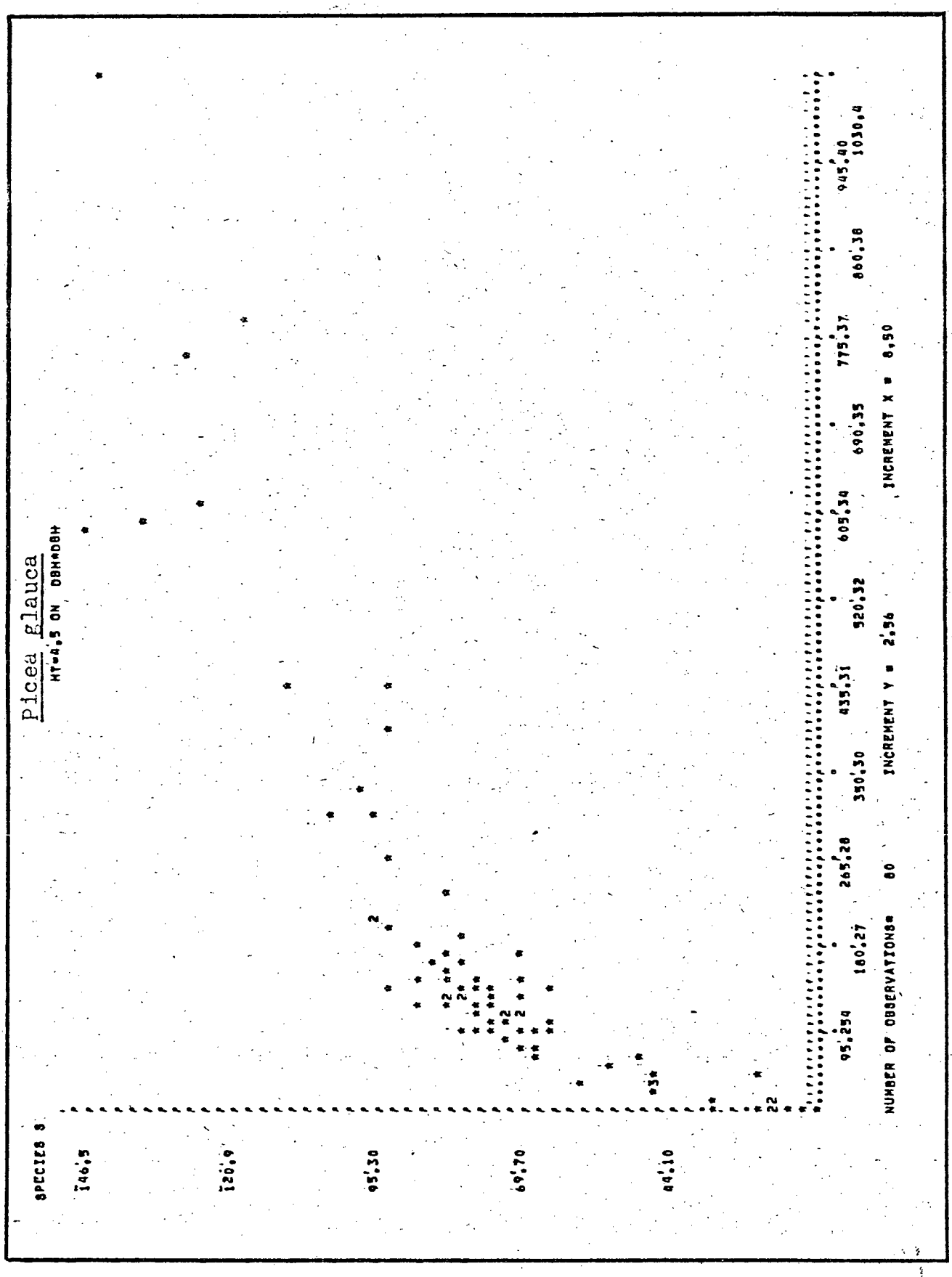
INTERCEPT	=	0,0
STANDARD ERROR OF ESTIMATE	=	0,846619E+01
RESIDUAL VARIANCE	=	0,716763E+02
MULTIPLE CORRELATION COEFFICIENT	=	0,95168
R SQUARED	=	0,90569
VARIANCE RATIO (F)	=	374,522 WITH 2 AND 78 DEGREES OF FREEDOM

APPENDIX G

2


Picea glauca
HT=4.5 ON DBH
SPECIES 8
146.5
120.9
95.30
69.70
44.10
5.6083
8.0167
10.425
12.833
15.242
17.650
20.058
22.467
24.875
27.283
29.692
32.100
NUMBER OF OBSERVATIONS= 80
INCREMENT Y = 2.56
INCREMENT X = 0.241

3


Picea glauca
HT=4,5 ON DBH=DBH
SPECIES 8
146,5
120,9
95,30
69,70
44,10
95,250
180,27
265,28
350,30
435,31
520,32
605,34
690,35
775,37
860,38
945,40
1030,4
NUMBER OF OBSERVATIONS= 80
INCREMENT Y = 2,56
INCREMENT X = 8,50

Picea mariana

SPECIES M

NUMBER OF OBSERVATIONS 85

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	DBH	0,593765D+01	0,213853E+01	0,200000E+01	0,107000E+02	36,02
X 2	DBH*DBH	0,397752D+02	0,265934E+02	0,400000E+01	0,114490E+03	66,86
X 3	HT	0,440471D+02	0,180118E+02	0,120000E+02	0,760000E+02	40,89
X 4	HT-4,5	0,395471D+02	0,180118E+02	0,750000E+01	0,715000E+02	45,55

SPECIES M

COVARIANCE MATRIX = UNCORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1 DBH			
0,338089D+04			
ROW X 2 DBH*DBH			
0,247586D+05	0,193881D+06		
ROW X 3 HT			
0,252191D+05	0,184439D+06	0,192164D+06	
ROW X 4 HT-4,5			
0,229479D+05	0,169225D+06	0,175316D+06	0,160189D+06

SPECIES M

CORRELATION MATRIX

ROW X 1 DBH			
1,00000			
ROW X 2 DBH*DBH			
0,98051	1,00000		
ROW X 3 HT			
0,92365	0,88281	1,00000	
ROW X 4 HT-4,5			
0,92365	0,88281	1,00000	1,00000

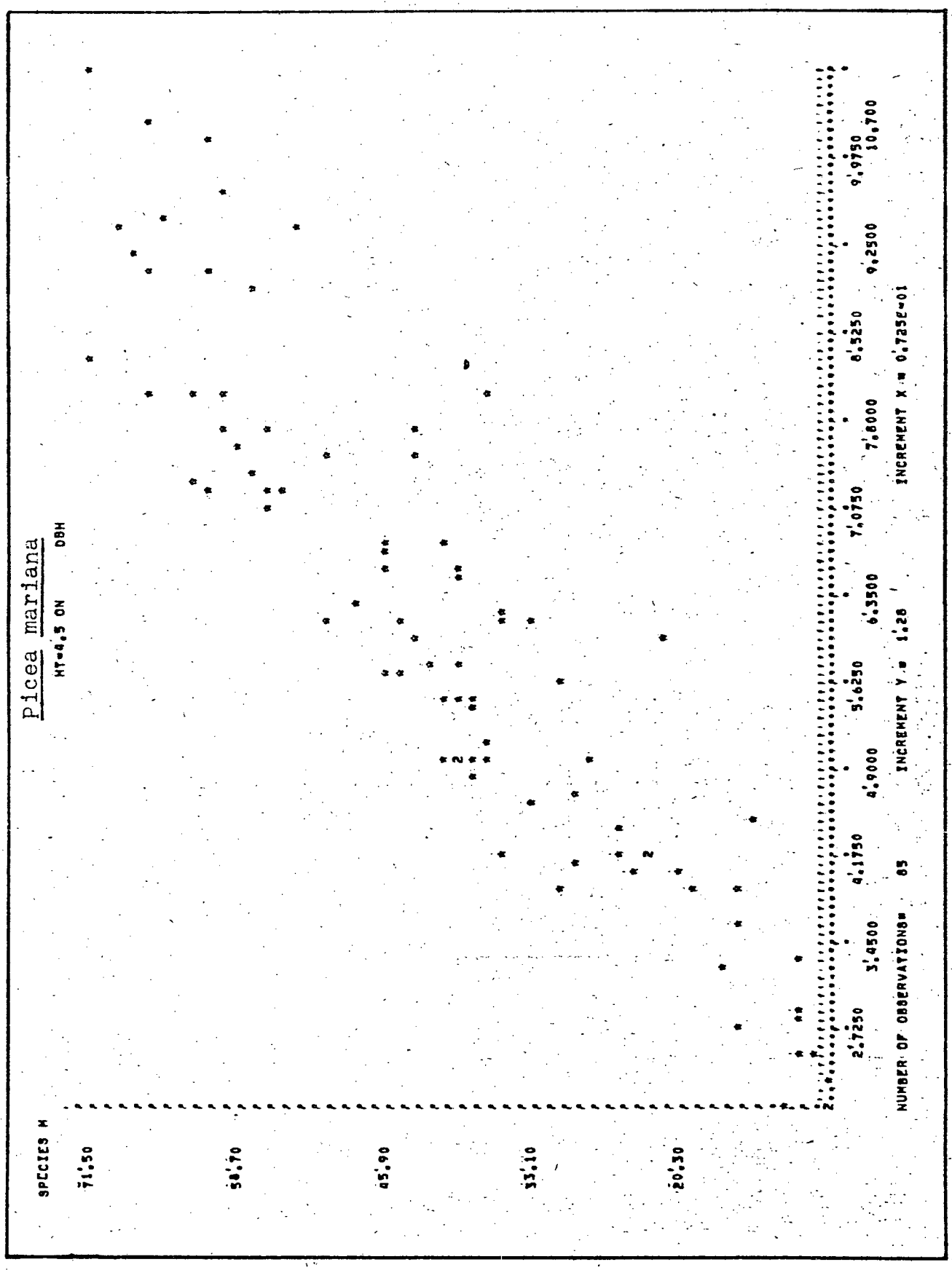
SPECIES M

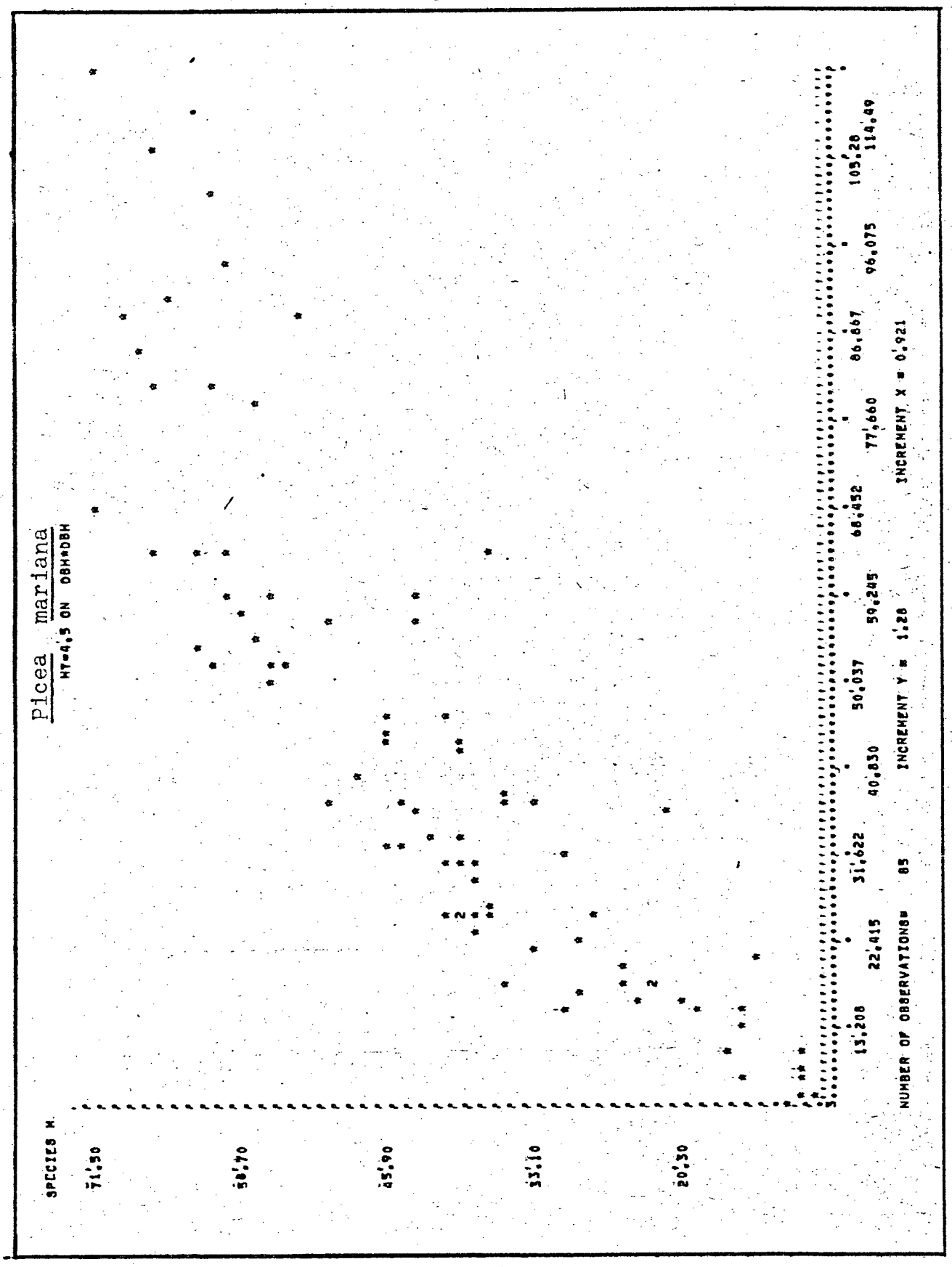
REGRESSION ANALYSIS, THE DEPENDENT VARIABLE IS HT-4,5

INDEPENDENT VARIABLE	REGRESSION COEFFICIENT	STAND. REGR. COEFFICIENT	STANDARD ERROR	VARIANCE RATIO(F)
DBH	0,610329D+01	0,724640E+00	0,487211E+00	156,926
DBH*DBH	0,934382D-01	0,137956E+00	0,643376E-01	2,109

INTERCEPT = 0,0
STANDARD ERROR OF ESTIMATE = 0,721380E+01
RESIDUAL VARIANCE = 0,520369E+02
MULTIPLE CORRELATION COEFFICIENT = 0,91734
R SQUARED = 0,84151
VARIANCE RATIO (F) = 220,341 WITH 2 AND 83 DEGREES OF FREEDOM

5


Picea mariana
HT=4,5 ON DBH
SPECIES M
71,50
58,70
45,90
33,10
20,30
2,7250
3,9500
4,1750
4,9000
5,6250
6,3500
7,0750
7,8000
8,5250
9,2500
9,9750
10,700
NUMBER OF OBSERVATIONS= 85
INCREMENT Y = 1,28
INCREMENT X = 0,725E-01


Picea mariana
HT=4,5 ON DBH=DBH
SPECIES M.
71,50
58,70
45,90
33,10
20,30
13,208
22,415
31,622
40,830
50,037
59,245
68,452
77,660
86,867
96,075
105,28
114,49
NUMBER OF OBSERVATIONS= 85
INCREMENT Y = 1,28
INCREMENT X = 0,921

Pinus contorta (including P. banksiana)

SPECIES P

NUMBER OF OBSERVATIONS 52

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	DBH	0,911923D+01	0,263595E+01	0,370000E+01	0,154000E+02	28,91
X 2	DBH*DBH	0,899750D+02	0,522079E+02	0,136900E+02	0,237160E+03	58,02
X 3	HT	0,628846D+02	0,149189E+02	0,290000E+02	0,930000E+02	23,72
X 4	HT-4,5	0,583846D+02	0,149189E+02	0,245000E+02	0,885000E+02	25,55

SPECIES P

COVARIANCE MATRIX = UNCORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1	DBH			
0,467870D+04				
ROW X 2	DBH*DBH			
0,495877D+05	0,559975D+06			
ROW X 3	HT			
0,314776D+05	0,326254D+06	0,216984D+06		
ROW X 4	HT-4,5			
0,293437D+05	0,305199D+06	0,202269D+06	0,188607D+06	

SPECIES P

CORRELATION MATRIX

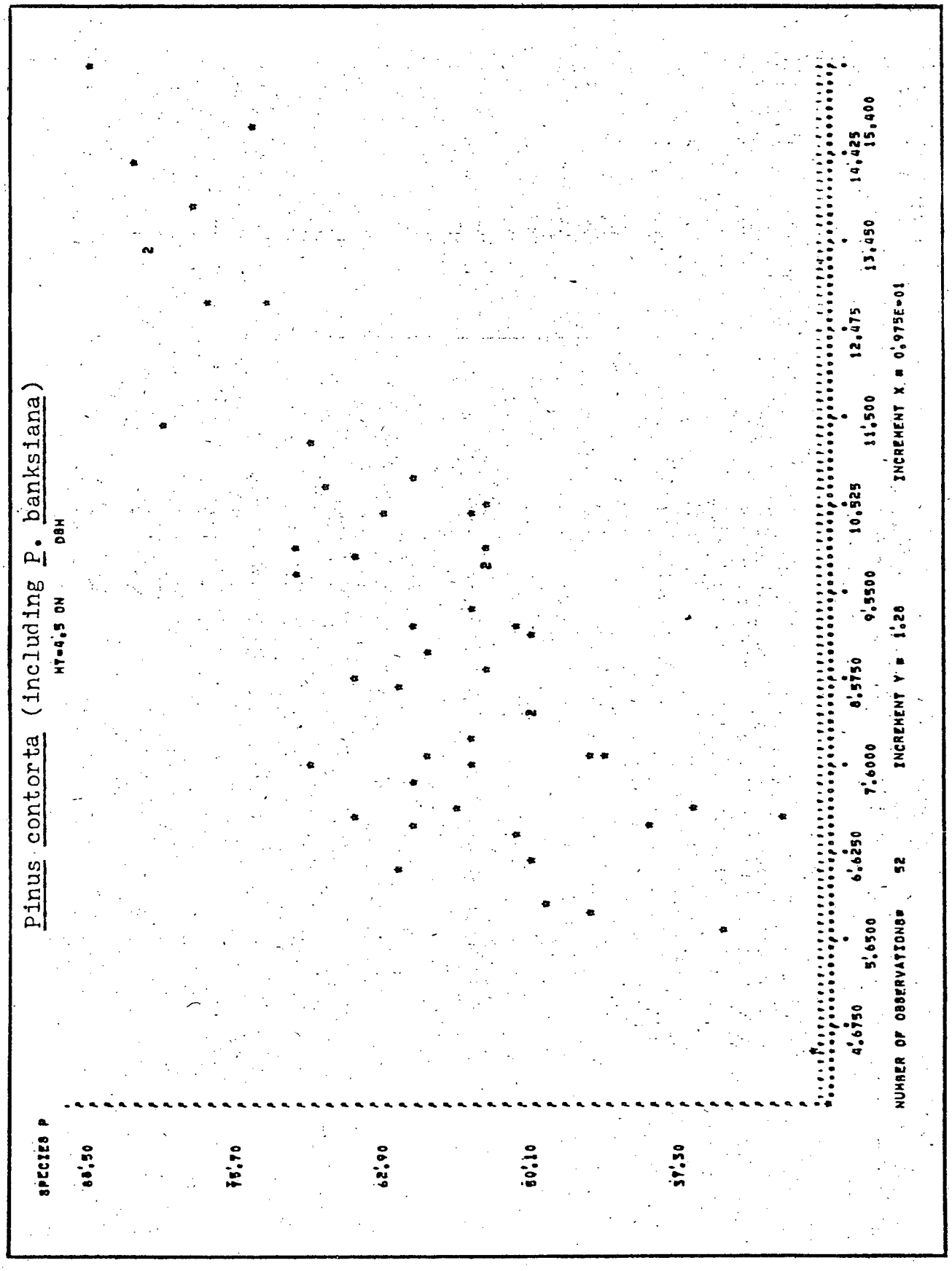
ROW X 1	DBH		
1,00000			
ROW X 2	DBH*DBH		
0,98619	1,00000		
ROW X 3	HT		
0,82654	0,80647	1,00000	
ROW X 4	HT-4,5		
0,82654	0,80647	1,00000	1,00000

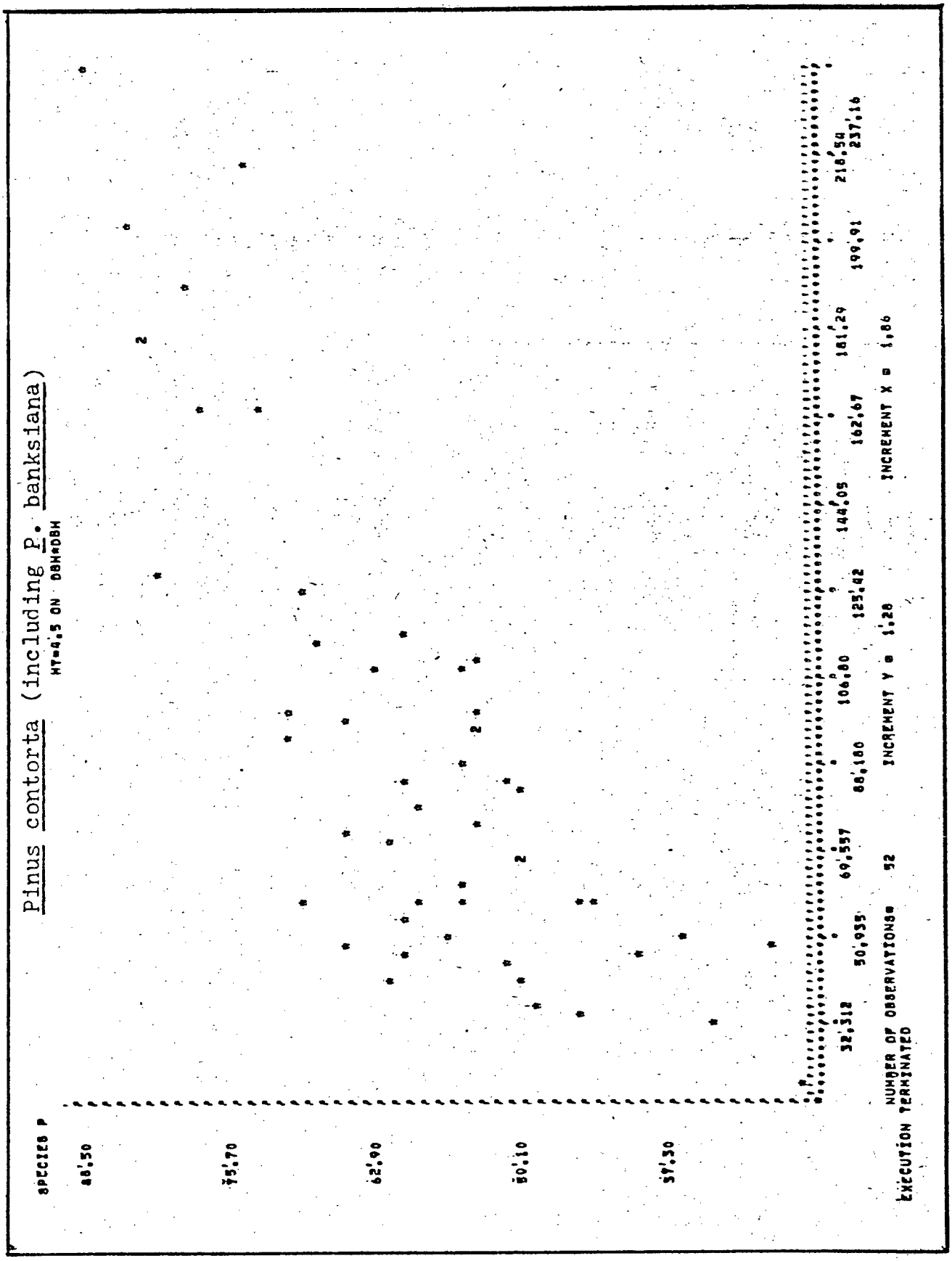
SPECIES P

REGRESSION ANALYSIS, THE DEPENDENT VARIABLE IS HT-4,5

INDEPENDENT VARIABLE	REGRESSION COEFFICIENT	STAND, REGR, COEFFICIENT	STANDARD ERROR	VARIANCE RATIO(F)
DBH	0,805884D+01	0,142387E+01	0,499834E+00	259,952
DBH*DBH	-0,168614D+00	-0,590054E+00	0,456882E-01	13,620

INTERCEPT	=	0,0
STANDARD ERROR OF ESTIMATE	=	0,847569E+01
RESIDUAL VARIANCE	=	0,718373E+02
MULTIPLE CORRELATION COEFFICIENT	=	0,82679
R SQUARED	=	0,68357
VARIANCE RATIO (F)	=	54,008 WITH 2 AND 50 DEGREES OF FREEDOM


Pinus contorta (including P. banksiana)
HT=0.5 ON DBH
SPECIES P
68.50
65.70
62.90
60.10
57.30
4.6750
5.6500
6.6250
7.6000
8.5750
9.5500
10.525
11.500
12.475
13.450
14.425
15.400
NUMBER OF OBSERVATIONS= 52
INCREMENT Y = 1.28
INCREMENT X = 0.975E-01


Pinus contorta (including P. banksiana)
HT=4.5 ON DBH*DBH
SPECIES P
88.50
75.70
62.90
50.10
37.30
32.312
50.955
69.557
88.180
106.80
125.42
144.05
162.67
181.29
199.91
218.54
237.16
NUMBER OF OBSERVATIONS= 52
INCREMENT Y = 1.20
INCREMENT X = 1.86
EXECUTION TERMINATED

Larix laricina

SPECIES L

NUMBER OF OBSERVATIONS 26

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	DBH	0,690385D+01	0,245755E+01	0,390000E+01	0,143000E+02	35,60
X 2	DBH*DBH	0,534704D+02	0,426379E+02	0,152100E+02	0,204490E+03	79,74
X 3	HT	0,496538D+02	0,148619E+02	0,310000E+02	0,790000E+02	29,93
X 4	HT=4,5	0,451538D+02	0,148619E+02	0,265000E+02	0,745000E+02	32,91

SPECIES L

COVARIANCE MATRIX = UNCORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1	DBH			
0,139023D+04				
ROW X 2	DBH*DBH			
0,121719D+05	0,119786D+06			
ROW X 3	HT			
0,967370D+04	0,817145D+05	0,696250D+05		
ROW X 4	HT=4,5			
0,886595D+04	0,754585D+05	0,638155D+05	0,585325D+05	

SPECIES L

CORRELATION MATRIX

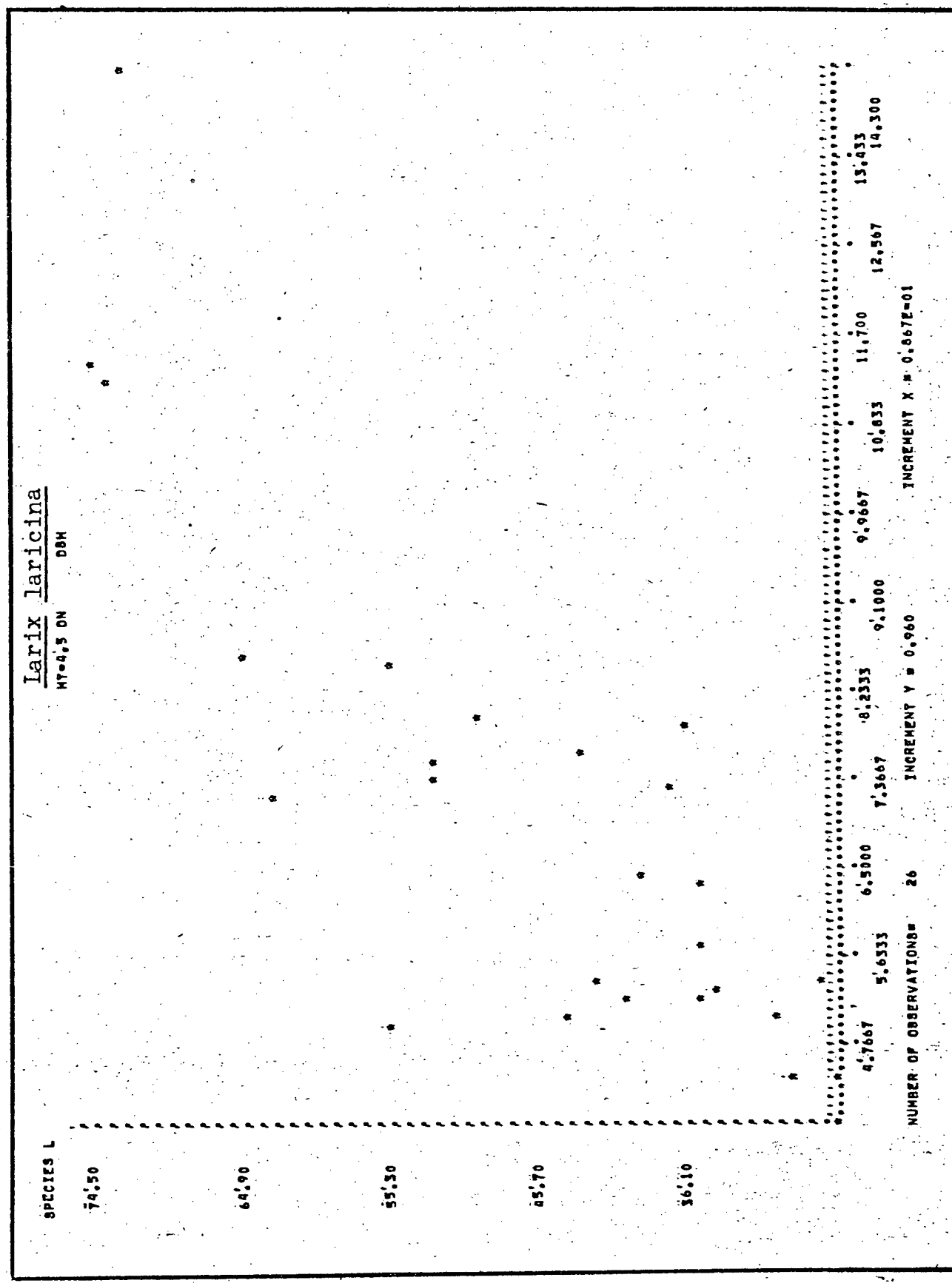
ROW X 1	DBH		
1,00000			
ROW X 2	DBH*DBH		
0,98259	1,00000		
ROW X 3	HT		
0,83324	0,80067	1,00000	
ROW X 4	HT=4,5		
0,83324	0,80067	1,00000	1,00000

SPECIES L

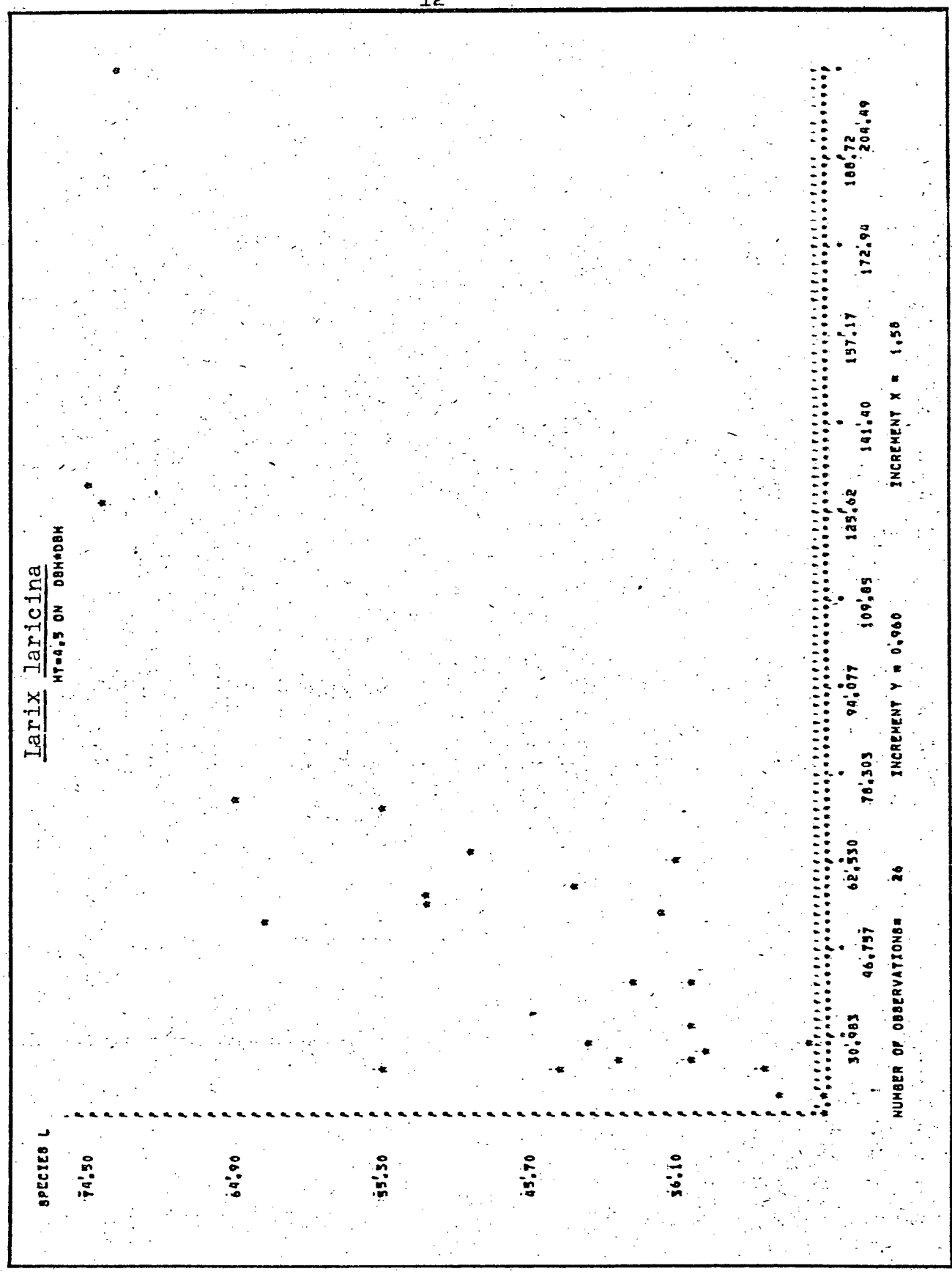
REGRESSION ANALYSIS, THE DEPENDENT VARIABLE IS HT=4,5

INDEPENDENT VARIABLE	REGRESSION COEFFICIENT	STAND. REGR. COEFFICIENT	STANDARD ERROR	VARIANCE RATIO(F)
DBH	0,781223D+01	0,129183E+01	0,666738E+00	137,290
DBH*DBH	-0,163889D+00	-0,470189E+00	0,718282E-01	5,206

INTERCEPT	=	0,0
STANDARD ERROR OF ESTIMATE	=	0,825750E+01
RESIDUAL VARIANCE	=	0,681863E+02
MULTIPLE CORRELATION COEFFICIENT	=	0,83883
R SQUARED	=	0,70364
VARIANCE RATIO (F)	=	28,491 WITH 2 AND 24 DEGREES OF FREEDOM


Larix laricina
HT=4,5 DN DBH
SPECIES L
74,50
64,90
55,30
45,70
36,10
4,7667
5,6333
6,5000
7,3667
8,2333
9,1000
9,9667
10,833
11,700
12,567
13,433
14,300
NUMBER OF OBSERVATIONS= 26
INCREMENT Y = 0,960
INCREMENT X = 0,867E-01

12


Larix laricina
HT=4.5 ON DBH=DBH
SPECIES L
74.50
64.90
55.30
45.70
36.10
30.983
46.757
62.530
78.303
94.077
109.85
125.62
141.40
157.17
172.94
188.72
204.49
NUMBER OF OBSERVATIONS= 26
INCREMENT Y = 0.960
INCREMENT X = 1.58

Populus tremuloides

SPECIES A

NUMBER OF OBSERVATIONS 49

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	DBH	0,121898D+02	0,316788E+01	0,530000E+01	0,200000E+02	25,99
X 2	DBH*DBH	0,158422D+03	0,822889E+02	0,280900E+02	0,400000E+03	51,94
X 3	HT	0,882653D+02	0,160958E+02	0,480000E+02	0,118000E+03	18,24
X 4	HT-4,5	0,837653D+02	0,160958E+02	0,435000E+02	0,113500E+03	19,22

SPECIES A

COVARIANCE MATRIX = UNCORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1	DBH			
0,776267D+04				
ROW X 2	DBH*DBH			
0,106980D+06	0,155481D+07			
ROW X 3	HT			
0,539841D+05	0,716349D+06	0,394183D+06		
ROW X 4	HT-4,5			
0,512962D+05	0,681417D+06	0,374721D+06	0,356250D+06	

SPECIES A

CORRELATION MATRIX

ROW X 1	DBH		
1,00000			
ROW X 2	DBH*DBH		
0,98735	1,00000		
ROW X 3	HT		
0,51613	0,49036	1,00000	
ROW X 4	HT-4,5		
0,51613	0,49036	1,00000	1,00000

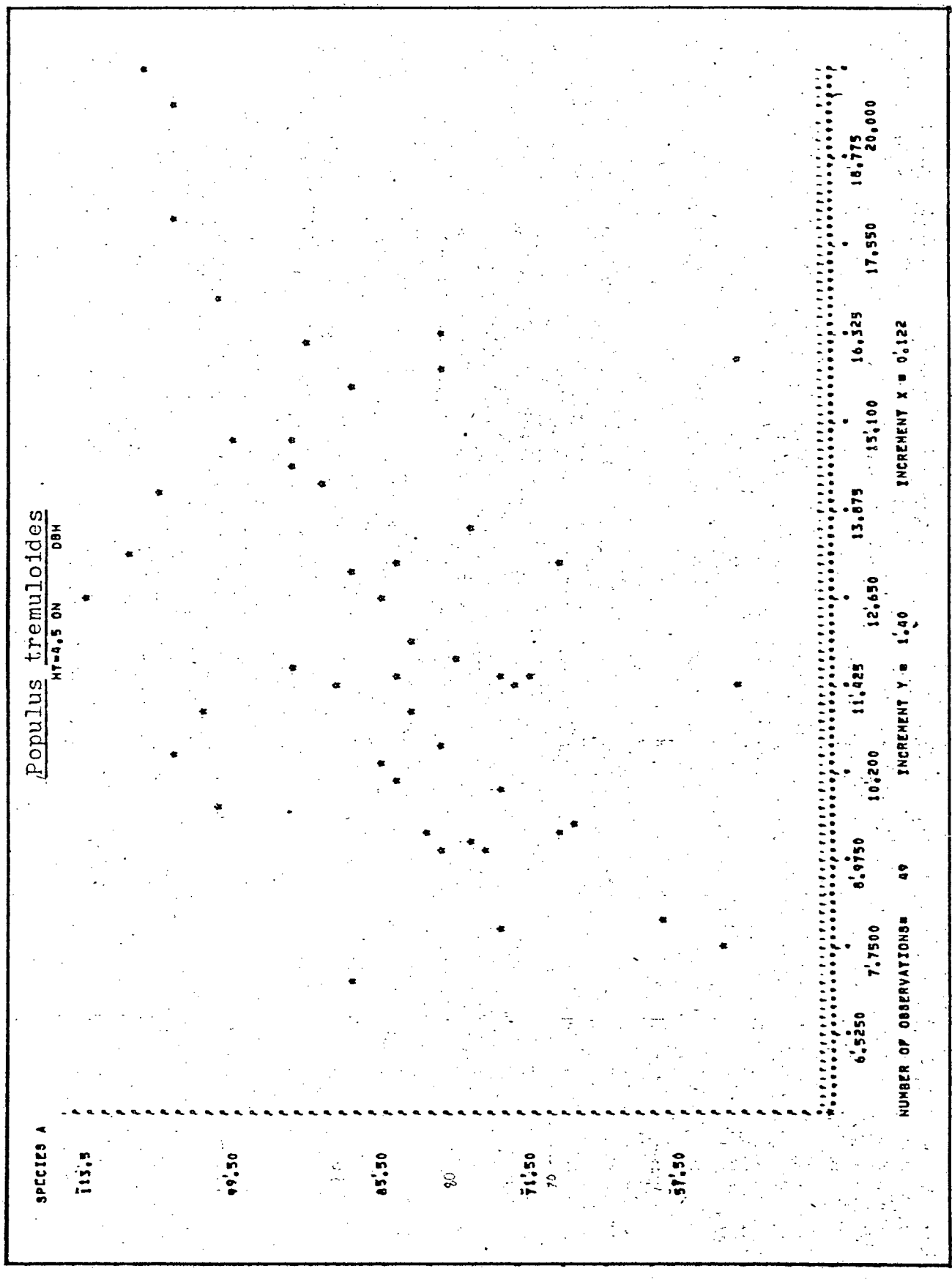
SPECIES A

REGRESSION ANALYSIS, THE DEPENDENT VARIABLE IS HT-4,5

INDEPENDENT VARIABLE	REGRESSION COEFFICIENT	STAND. REGR. COEFFICIENT	STANDARD ERROR	VARIANCE RATIO(F)
DBH	0,109767D+02	0,216037E+01	0,697716E+00	247,504
DBH*DBH	-0,316993D+00	-0,162061E+01	0,492999E-01	41,344

INTERCEPT	=	0,0
STANDARD ERROR OF ESTIMATE	=	0,139662E+02
RESIDUAL VARIANCE	=	0,195613E+03
MULTIPLE CORRELATION COEFFICIENT	=	0,51059
R SQUARED	=	0,26070
VARIANCE RATIO (F)	=	8,287 WITH 2 AND 47 DEGREES OF FREEDOM

14


Populus tremuloides
HT=4.5 ON DBH
SPECIES A
115.5
99.50
85.50
80
71.50
70
57.50
6.5250
7.7500
8.9750
10.200
11.425
12.650
13.875
15.100
16.325
17.550
18.775
20.000
NUMBER OF OBSERVATIONS= 49
INCREMENT Y = 1.40
INCREMENT X = 0.122

15

Populus tremuloides
HT=4.5 ON DBH&BH
SPECIES A
113.5
99.50
85.50
71.50
57.50
59.082
90.075
121.07
152.06
183.05
214.04
245.04
276.03
307.02
338.01
369.01
400.00
NUMBER OF OBSERVATIONS= 49
INCREMENT Y = 1.40
INCREMENT X = 3.10

Populus balsamifera

SPECIES C

NUMBER OF OBSERVATIONS 29

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	DBH	0,161517D+02	0,577788E+01	0,370000E+01	0,254000E+02	35,77
X 2	DBH*DBH	0,293111D+03	0,174072E+03	0,136900E+02	0,645160E+03	59,39
X 3	HT	0,104069D+03	0,281766E+02	0,230000E+02	0,136000E+03	27,07
X 4	HT-4,5	0,995690D+02	0,281766E+02	0,185000E+02	0,131500E+03	28,30

SPECIES C

COVARIANCE MATRIX = UNCORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1 DBH
0,850022D+04
ROW X 2 DBH*DBH
0,164982D+06 0,333994D+07
ROW X 3 HT
0,528843D+05 0,100126D+07 0,336310D+06
ROW X 4 HT-4,5
0,507765D+05 0,963009D+06 0,322729D+06 0,309735D+06

SPECIES C

CORRELATION MATRIX

ROW X 1 DBH
1,00000
ROW X 2 DBH*DBH
0,98320 1,00000
ROW X 3 HT
0,90785 0,84940 1,00000
ROW X 4 HT-4,5
0,90785 0,84940 1,00000 1,00000

SPECIES C

REGRESSION ANALYSIS, THE DEPENDENT VARIABLE IS HT-4,5

INDEPENDENT VARIABLE	REGRESSION COEFFICIENT	STAND, REGR, COEFFICIENT	STANDARD ERROR	VARIANCE RATIO(F)
DBH	0,914516D+01	0,187530E+01	0,537917E+00	289,036
DBH*DBH	-0,163408D+00	-0,100952E+01	0,271370E-01	36,260

INTERCEPT = 0,0
STANDARD ERROR OF ESTIMATE = 0,100734E+02
RESIDUAL VARIANCE = 0,101473E+03
MULTIPLE CORRELATION COEFFICIENT = 0,93635
R SQUARED = 0,87675
VARIANCE RATIO (F) = 96,036 WITH 2 AND 27 DEGREES OF FREEDOM

Populus balsamifera
SPECIES C
HT=4.5 ON DBH
131.5
108.9
86.30
63.70
41.10
5.5063
7.3167
9.1250
10.933
12.742
14.550
16.358
18.167
19.975
21.783
23.592
25.400
NUMBER OF OBSERVATIONS= 29
INCREMENT Y = 2.26
INCREMENT X = 0.181

Populus balsamifera
SPECIES C
HT=4.5 ON DBH*DBH
131.5
108.9
86.30
63.70
41.10
66.312
116.93
171.56
224.18
276.80
329.42
382.05
434.67
487.29
539.91
592.54
645.16
NUMBER OF OBSERVATIONS= 29
INCREMENT Y = 2.26
INCREMENT X = 5.26

Betula papyrifera (including B. resinifera)

SPECIES B

NUMBER OF OBSERVATIONS 9

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	DBH	0,775556D+01	0,191514E+01	0,540000E+01	0,105000E+02	24,69
X 2	DBH*DBH	0,634089D+02	0,297604E+02	0,291600E+02	0,110250E+03	46,93
X 3	HT	0,601111D+02	0,120773E+02	0,450000E+02	0,800000E+02	20,09
X 4	HT-4,5	0,556111D+02	0,120773E+02	0,405000E+02	0,755000E+02	21,72

SPECIES B

COVARIANCE MATRIX = UNCORRECTED SUMS OF SQUARES AND PRODUCTS

ROW X 1	DBH			
0,570680D+03				
ROW X 2	DBH*DBH			
0,468008D+04	0,432716D+05			
ROW X 3	HT			
0,436970D+04	0,370442D+05	0,336870D+05		
ROW X 4	HT-4,5			
0,405560D+04	0,344761D+05	0,312525D+05	0,290003D+05	

SPECIES B

CORRELATION MATRIX

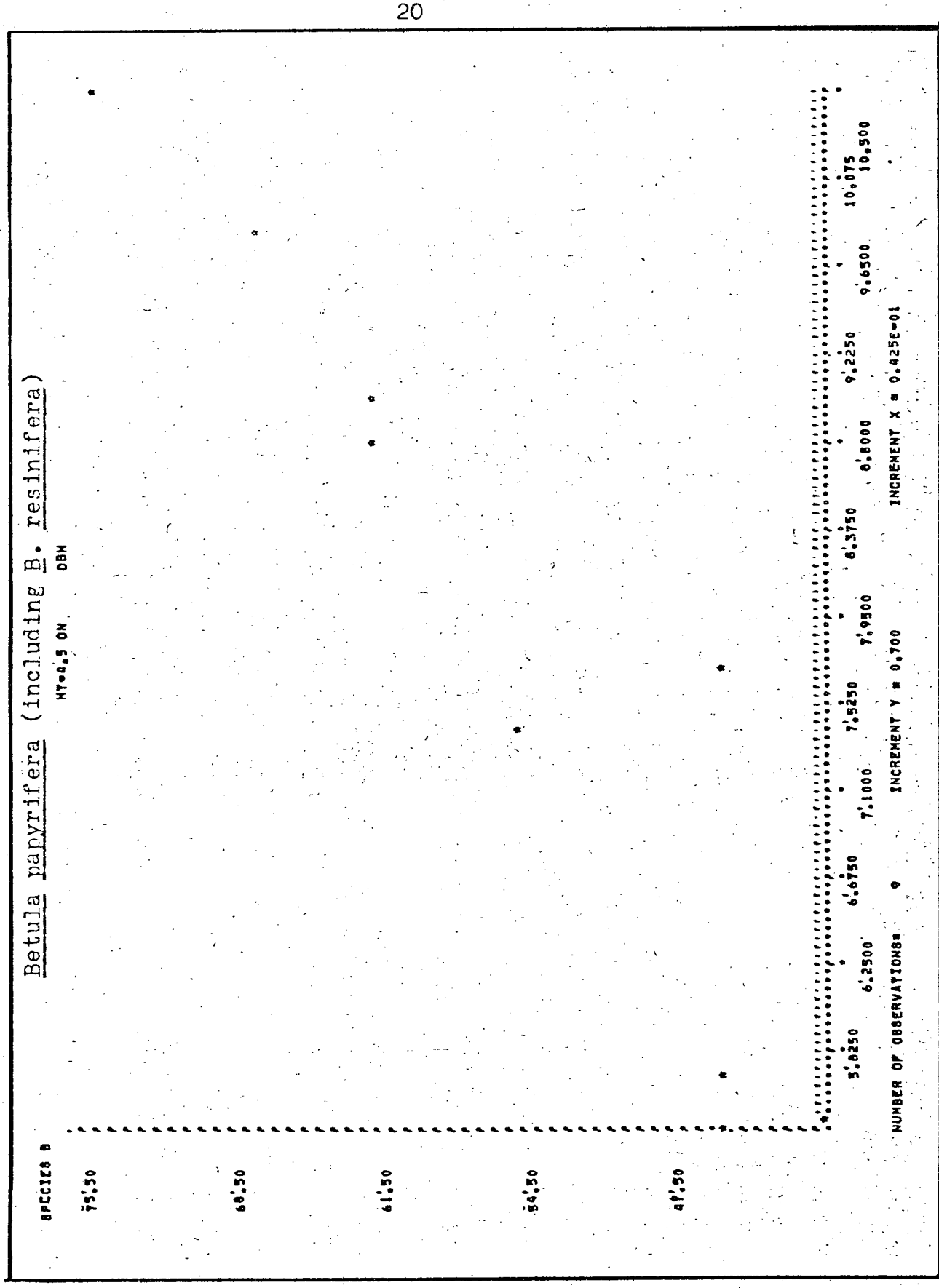
ROW X 1	DBH		
1,00000			
ROW X 2	DBH*DBH		
0,99600	1,00000		
ROW X 3	HT		
0,94004	0,95291	1,00000	
ROW X 4	HT-4,5		
0,94005	0,95291	1,00000	1,00000

SPECIES B

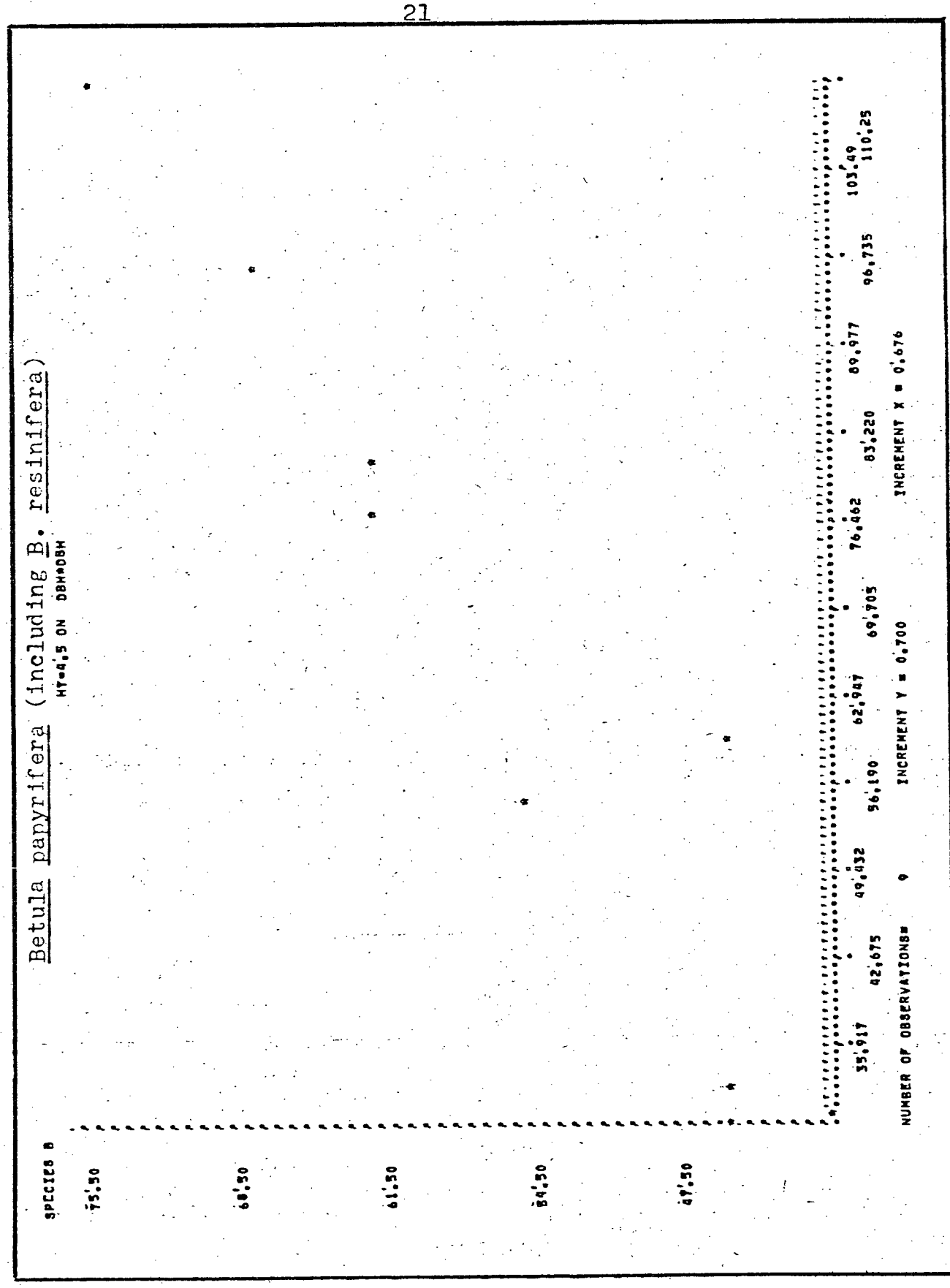
REGRESSION ANALYSIS, THE DEPENDENT VARIABLE IS HT-4,5

INDEPENDENT VARIABLE	REGRESSION COEFFICIENT	STAND. REGR. COEFFICIENT	STANDARD ERROR	VARIANCE RATIO(F)
DBH	0,824272D+01	0,130708E+01	0,103213E+01	63,778
DBH*DBH	-0,132857D+00	-0,327381E+00	0,118531E+00	1,256

INTERCEPT = 0,0
STANDARD ERROR OF ESTIMATE = 0,465213E+01
RESIDUAL VARIANCE = 0,216423E+02
MULTIPLE CORRELATION COEFFICIENT = 0,93283
R SQUARED = 0,87017
VARIANCE RATIO (F) = 23,459 WITH 2 AND 7 DEGREES OF FREEDOM


Betula papyrifera (including B. resinifera)
HT=4.5 ON DBH
SPECIES B
75.50
68.50
61.50
54.50
47.50
5.6250 6.2500 6.8750 7.5000 8.1250 8.7500 9.3750 10.000 10.625
NUMBER OF OBSERVATIONS= 9 INCREMENT Y = 0.700
INCREMENT X = 0.425E-01

21


Betula papyrifera (including B. resinifera)
HT=4.5 ON DBH=DBH
SPECIES B
75.50
68.50
61.50
54.50
47.50
35.017
42.675
49.432
56.190
62.947
69.705
76.462
83.220
89.977
96.735
103.49
110.25
NUMBER OF OBSERVATIONS= 9
INCREMENT Y = 0.700
INCREMENT X = 0.676

APPENDIX H

Standing volume, number of trees, and basal area by species for individual sample plots.

1 - Picea glauca
2 - Picea mariana
3 - Pinus contorta (including P. banksiana)
4 - Larix laricina
5 - Abies lasiocarpa
6 - Populus tremuloides
7 - Populus balsamifera
8 - Betula papyrifera (including B. resinifera)
9 - Total of all species/plot

A - Ft^3/Acre
B - # trees/Acre
C - B.A. in Ft^2/Acre
D - M^3/Hectare
E - # trees/Hectare
F - B.A. in M^2/Hectare

Average values for each plant association are identified as "plot No. -1".

Tree Species		1	2	3	4	5	6	7	8	9
BLACK SPRUCE - EQUISETUM SYLVATICUM										
PLOT NO 52										
	A	0.00	2169.58	0.00	349.82	0.00	0.00	0.00	6.23	2525.63
	B	0.00	1780.00	0.00	140.00	0.00	0.00	0.00	10.00	1930.00
	C	0.00	148.59	0.00	21.23	0.00	0.00	0.00	0.52	170.74
	D	0.00	149.70	0.00	24.14	0.00	0.00	0.00	0.43	174.27
	E	0.00	4396.60	0.00	345.80	0.00	0.00	0.00	24.70	4767.10
	F	0.00	34.27	0.00	4.88	0.00	0.00	0.00	0.12	39.27
BLACK SPRUCE - EQUISETUM SYLVATICUM										
PLOT NO 29										
		0.00	3558.90	0.00	0.00	0.00	0.00	0.00	0.00	3558.90
		0.00	1480.00	0.00	0.00	0.00	0.00	0.00	0.00	1480.00
		0.00	155.80	0.00	0.00	0.00	0.00	0.00	0.00	155.80

	10.45	5.78	84.64	0.00	0.00	58.36	0.00	0.00	159.26
	74.10	135.65	382.95	0.00	0.00	197.60	0.00	0.00	790.40
	1.47	1.23	10.53	0.00	0.00	5.87	0.00	0.00	19.10
ASPEN - WHITE SPRUCE									
PLOT NO 2									
	0.00	0.00	0.00	0.00	0.00	7002.12	925.29	0.00	7927.41
	0.00	0.00	0.00	0.00	0.00	270.00	10.00	0.00	280.00
	0.00	0.00	0.00	0.00	0.00	187.74	20.95	0.00	208.69
	0.00	0.00	0.00	0.00	0.00	483.15	63.85	0.00	546.99
	0.00	0.00	0.00	0.00	0.00	666.90	24.70	0.00	691.60
	0.00	0.00	0.00	0.00	0.00	43.18	4.82	0.00	48.00
ASPEN - WHITE SPRUCE									
PLOT NO 3									
	14.56	0.00	0.00	0.00	0.00	5805.13	708.51	0.00	6528.19
	20.00	0.00	0.00	0.00	0.00	440.00	90.00	0.00	550.00
	1.05	0.00	0.00	0.00	0.00	176.92	27.64	0.00	205.60
	1.90	0.00	0.00	0.00	0.00	400.55	48.89	0.00	450.45
	49.40	0.00	0.00	0.00	0.00	1086.80	222.30	0.00	1358.50
	0.24	0.00	0.00	0.00	0.00	40.69	6.36	0.00	47.29
ASPEN - WHITE SPRUCE									
PLOT NO 4									
	0.00	0.00	0.00	0.00	0.00	5858.32	0.00	0.00	5858.32
	0.00	0.00	0.00	0.00	0.00	300.00	0.00	0.00	300.00
	0.00	0.00	0.00	0.00	0.00	167.10	0.00	0.00	167.10
	0.00	0.00	0.00	0.00	0.00	404.22	0.00	0.00	404.22
	0.00	0.00	0.00	0.00	0.00	741.00	0.00	0.00	741.00
	0.00	0.00	0.00	0.00	0.00	38.43	0.00	0.00	38.43
ASPEN - WHITE SPRUCE									
PLOT NO 9									
	10.07	0.00	0.00	0.00	0.00	8342.70	0.00	358.72	8711.48
	10.00	0.00	0.00	0.00	0.00	180.00	0.00	50.00	240.00
	0.67	0.00	0.00	0.00	0.00	213.54	0.00	13.87	228.08
	0.69	0.00	0.00	0.00	0.00	575.65	0.00	24.75	601.09
	24.70	0.00	0.00	0.00	0.00	444.60	0.00	123.50	592.80
	0.15	0.00	0.00	0.00	0.00	49.11	0.00	3.19	52.46
ASPEN - WHITE SPRUCE									
PLOT NO 13									
	5075.21	220.94	87.07	0.00	0.00	2968.67	0.00	10.22	8362.11
	420.00	120.00	10.00	0.00	0.00	100.00	0.00	10.00	660.00
	167.09	13.10	3.32	0.00	0.00	78.75	0.00	0.75	263.01
	350.19	15.25	6.01	0.00	0.00	204.84	0.00	0.71	576.99
	1037.40	296.40	24.70	0.00	0.00	247.00	0.00	24.70	1630.20
	38.43	3.01	0.76	0.00	0.00	18.11	0.00	0.17	60.49
ASPEN - WHITE SPRUCE									
PLOT NO 14									
	114.85	21.33	0.00	0.00	0.00	4054.51	0.00	41.68	4232.37
	70.00	20.00	0.00	0.00	0.00	320.00	0.00	10.00	420.00
	0.53	1.52	0.00	0.00	0.00	126.63	0.00	2.03	136.71
	7.92	1.47	0.00	0.00	0.00	279.76	0.00	2.88	292.03
	172.90	49.40	0.00	0.00	0.00	790.40	0.00	24.70	1037.40
	1.90	0.35	0.00	0.00	0.00	29.12	0.00	0.47	31.44
ASPEN - WHITE SPRUCE									
PLOT NO 16									
	331.21	0.00	647.07	0.00	0.00	0.00	0.00	0.00	978.29
	70.00	0.00	30.00	0.00	0.00	0.00	0.00	0.00	100.00
	14.05	0.00	19.65	0.00	0.00	0.00	0.00	0.00	33.70
	22.88	0.00	44.65	0.00	0.00	0.00	0.00	0.00	67.50
	172.90	0.00	74.10	0.00	0.00	0.00	0.00	0.00	247.00
	3.23	0.00	4.52	0.00	0.00	0.00	0.00	0.00	7.75
ASPEN - WHITE SPRUCE									

PLOT NO 37								
14.40	0.00	0.00	0.00	0.00	5387.64	0.00	0.00	5402.04
10.00	0.00	0.00	0.00	0.00	530.00	0.00	0.00	540.00
0.87	0.00	0.00	0.00	0.00	175.98	0.00	0.00	176.85
0.99	0.00	0.00	0.00	0.00	371.75	0.00	0.00	372.74
24.70	0.00	0.00	0.00	0.00	1309.10	0.00	0.00	1333.80
0.20	0.00	0.00	0.00	0.00	40.48	0.00	0.00	40.68
ASPEN - WHITE SPRUCE								
PLOT NO 40								
1330.43	0.00	0.00	0.00	0.00	6084.63	0.00	203.02	7618.08
50.00	0.00	0.00	0.00	0.00	220.00	0.00	20.00	290.00
36.72	0.00	0.00	0.00	0.00	161.37	0.00	7.57	205.65
91.80	0.00	0.00	0.00	0.00	419.84	0.00	14.01	525.65
123.50	0.00	0.00	0.00	0.00	543.40	0.00	49.40	716.30
8.44	0.00	0.00	0.00	0.00	37.11	0.00	1.74	47.30
ASPEN - WHITE SPRUCE								
PLOT NO 7								
0.00	0.00	0.00	0.00	0.00	0.00	0.00	3167.44	3167.44
0.00	0.00	0.00	0.00	0.00	0.00	0.00	260.00	260.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	110.66	110.66
0.00	0.00	0.00	0.00	0.00	0.00	0.00	219.55	219.55
0.00	0.00	0.00	0.00	0.00	0.00	0.00	642.20	642.20
0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.45	25.45
ASPEN - WHITE SPRUCE								
PLOT NO 15								
3520.71	110.90	0.00	0.00	0.00	2959.87	0.00	255.63	6847.11
830.00	80.00	0.00	0.00	0.00	280.00	0.00	100.00	1290.00
152.26	7.40	0.00	0.00	0.00	92.61	0.00	13.96	266.22
242.93	7.65	0.00	0.00	0.00	204.23	0.00	17.64	472.45
2060.10	197.60	0.00	0.00	0.00	691.60	0.00	247.00	3196.30
35.02	1.70	0.00	0.00	0.00	21.30	0.00	3.21	61.23
ASPEN - WHITE SPRUCE								
PLOT NO 16								
1832.21	12.65	2033.14	0.00	0.00	2170.15	54.18	0.00	6102.32
360.00	10.00	140.00	0.00	0.00	200.00	10.00	0.00	720.00
74.79	0.87	65.86	0.00	0.00	70.06	2.45	0.00	214.02
126.42	0.87	140.29	0.00	0.00	149.74	3.74	0.00	421.06
889.20	24.70	345.80	0.00	0.00	494.00	24.70	0.00	1778.40
17.20	0.20	15.15	0.00	0.00	16.11	0.56	0.00	49.22
ASPEN - WHITE SPRUCE								
PLOT NO 19								
3041.00	34.20	412.34	0.00	0.00	2240.46	0.00	0.00	5728.00
280.00	30.00	10.00	0.00	0.00	200.00	0.00	0.00	520.00
106.75	2.38	11.15	0.00	0.00	71.37	0.00	0.00	191.65
209.83	2.36	28.45	0.00	0.00	154.59	0.00	0.00	395.23
691.60	74.10	24.70	0.00	0.00	494.00	0.00	0.00	1284.40
24.55	0.55	2.57	0.00	0.00	16.41	0.00	0.00	44.08
ASPEN - WHITE SPRUCE								
PLOT NO 26								
3267.09	400.10	0.00	0.00	0.00	2746.17	71.46	0.00	8484.81
810.00	210.00	0.00	0.00	0.00	110.00	10.00	0.00	940.00
194.19	23.33	0.00	0.00	0.00	74.72	2.99	0.00	295.23
343.43	27.61	0.00	0.00	0.00	109.49	4.93	0.00	585.45
1506.70	518.70	0.00	0.00	0.00	271.70	24.70	0.00	2321.80
44.56	5.37	0.00	0.00	0.00	17.19	0.69	0.00	67.90
ASPEN - WHITE SPRUCE								
PLOT NO 32								
3236.53	548.66	0.00	0.00	0.00	6629.64	0.00	0.00	10415.03
230.00	150.00	0.00	0.00	0.00	300.00	0.00	0.00	680.00
104.24	26.43	0.00	0.00	0.00	184.02	0.00	0.00	314.70

	223.32	37.87	0.00	0.00	0.00	457.45	0.00	0.00	718.64
	568.10	370.50	0.00	0.00	0.00	741.00	0.00	0.00	1679.60
	23.98	6.08	0.00	0.00	0.00	42.32	0.00	0.00	72.38
ASPEN - WHITE SPRUCE									
PLOT NO 33									
	6752.95	51.70	0.00	0.00	0.00	0.00	0.00	0.00	6804.68
	760.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00	790.00
	238.76	3.27	0.00	0.00	0.00	0.00	0.00	0.00	242.03
	465.96	3.57	0.00	0.00	0.00	0.00	0.00	0.00	469.52
	1877.20	74.10	0.00	0.00	0.00	0.00	0.00	0.00	1951.30
	54.92	0.75	0.00	0.00	0.00	0.00	0.00	0.00	55.67
ASPEN - WHITE SPRUCE									
PLOT NO 38									
	6289.39	164.23	0.00	0.00	0.00	348.80	0.00	17.72	6820.13
	1040.00	120.00	0.00	0.00	0.00	20.00	0.00	10.00	1190.00
	246.49	10.70	0.00	0.00	0.00	10.26	0.00	1.10	268.56
	433.97	11.33	0.00	0.00	0.00	24.07	0.00	1.22	470.59
	2568.80	296.40	0.00	0.00	0.00	49.40	0.00	24.70	2939.30
	56.69	2.46	0.00	0.00	0.00	2.36	0.00	0.25	61.77
ASPEN - WHITE SPRUCE									
PLOT NC -1									
	2301.92	97.81	198.73	0.00	0.00	3912.42	109.97	253.40	6874.23
	297.50	48.13	11.88	0.00	0.00	216.88	7.50	28.75	610.63
	84.03	5.55	6.25	0.00	0.00	111.54	3.38	9.37	220.53
	158.83	6.75	13.71	0.00	0.00	269.56	7.59	17.48	474.32
	734.82	118.87	29.33	0.00	0.00	535.68	18.52	71.01	1508.24
	19.33	1.28	1.44	0.00	0.00	25.75	0.78	2.16	50.72
LODGEPOLE PINE - CLUBMOSS									
PLOT NC 35									
	0.00	0.00	5322.38	0.00	0.00	408.38	0.00	205.22	5935.98
	0.00	0.00	370.00	0.00	0.00	50.00	0.00	50.00	470.00
	0.00	0.00	172.80	0.00	0.00	14.06	0.00	9.86	196.72
	0.00	0.00	367.24	0.00	0.00	28.18	0.00	14.16	409.58
	0.00	0.00	913.90	0.00	0.00	123.50	0.00	123.50	1160.90
	0.00	0.00	39.74	0.00	0.00	3.23	0.00	2.27	45.25
LODGEPOLE PINE - CLUBMOSS									
PLOT NC 55									
	0.00	17.56	1440.38	0.00	0.00	2803.17	0.00	71.61	4332.73
	0.00	10.00	400.00	0.00	0.00	110.00	0.00	10.00	530.00
	0.00	1.10	66.96	0.00	0.00	75.58	0.00	2.99	146.63
	0.00	1.21	99.39	0.00	0.00	193.42	0.00	4.94	298.96
	0.00	24.70	988.00	0.00	0.00	271.70	0.00	24.70	1309.10
	0.00	0.25	15.40	0.00	0.00	17.38	0.00	0.69	33.73
LODGEPOLE PINE - CLUBMOSS									
PLOT NO 41									
	23.51	0.00	2315.94	0.00	0.00	0.00	0.00	0.00	2339.45
	10.00	0.00	670.00	0.00	0.00	0.00	0.00	0.00	680.00
	1.26	0.00	108.17	0.00	0.00	0.00	0.00	0.00	109.43
	1.62	0.00	159.80	0.00	0.00	0.00	0.00	0.00	161.42
	24.70	0.00	1654.90	0.00	0.00	0.00	0.00	0.00	1679.60
	0.25	0.00	24.88	0.00	0.00	0.00	0.00	0.00	25.17
LODGEPOLE PINE - CLUBMOSS									
PLOT NO 42									
	0.00	21.25	1928.08	0.00	0.00	68.79	0.00	0.00	2018.12
	0.00	20.00	830.00	0.00	0.00	20.00	0.00	0.00	870.00
	0.00	1.54	100.54	0.00	0.00	3.01	0.00	0.00	105.08
	0.00	1.47	133.04	0.00	0.00	4.75	0.00	0.00	139.25
	0.00	49.40	2050.10	0.00	0.00	49.40	0.00	0.00	2148.90
	0.00	0.35	23.12	0.00	0.00	0.69	0.00	0.00	24.17
LODGEPOLE PINE - CLUBMOSS									

PLOT NO 43									
	108.38	0.00	2408.59	0.00	0.00	363.44	0.00	119.81	3000.72
	30.00	0.00	610.00	0.00	0.00	10.00	0.00	20.00	670.00
	4.75	0.00	108.63	0.00	0.00	9.36	0.00	5.20	127.94
	7.51	0.00	166.19	0.00	0.00	25.08	0.00	8.27	207.05
	74.10	0.00	1506.70	0.00	0.00	24.70	0.00	49.40	1654.90
	1.09	0.00	24.99	0.00	0.00	2.15	0.00	1.20	29.43
LODGEPOLE PINE - CLUBMOSS									
PLOT NO 1									
	20.48	7.76	2683.07	0.00	0.00	728.76	0.00	79.33	3525.40
	8.00	6.00	576.00	0.00	0.00	38.00	0.00	16.00	644.00
	1.20	0.53	111.42	0.00	0.00	20.40	0.00	3.61	137.16
	1.83	0.54	185.13	0.00	0.00	50.28	0.00	5.47	243.25
	19.76	14.62	1422.72	0.00	0.00	93.86	0.00	39.52	1590.68
	0.28	0.12	25.63	0.00	0.00	4.69	0.00	0.83	31.55
BLACK SPRUCE - MOSS									
PLOT NO 1									
	0.00	2451.86	1744.29	0.00	0.00	0.00	0.00	105.70	4301.84
	0.00	900.00	140.00	0.00	0.00	0.00	0.00	70.00	1110.00
	0.00	127.37	60.20	0.00	0.00	0.00	0.00	6.64	194.21
	0.00	169.18	120.36	0.00	0.00	0.00	0.00	7.29	296.83
	0.00	2223.00	345.80	0.00	0.00	0.00	0.00	172.90	2741.70
	0.00	29.30	13.85	0.00	0.00	0.00	0.00	1.53	44.67
BLACK SPRUCE - MOSS									
PLOT NO 5									
	0.00	3556.77	305.56	0.00	0.00	831.21	68.81	34.45	4796.80
	0.00	950.00	20.00	0.00	0.00	50.00	10.00	10.00	1040.00
	0.00	172.16	10.17	0.00	0.00	24.52	2.91	1.77	211.53
	0.00	245.42	21.08	0.00	0.00	57.35	4.75	2.38	330.98
	0.00	2346.50	49.40	0.00	0.00	123.50	24.70	24.70	2568.80
	0.00	39.60	2.34	0.00	0.00	5.64	0.67	0.41	48.65
BLACK SPRUCE - MOSS									
PLOT NO 6									
	0.00	788.52	4561.54	0.00	0.00	72.63	0.00	83.83	5506.62
	0.00	360.00	860.00	0.00	0.00	20.00	0.00	50.00	1310.00
	0.00	45.91	186.40	0.00	0.00	3.04	0.00	5.21	240.56
	0.00	54.41	314.75	0.00	0.00	5.01	0.00	5.78	379.96
	0.00	938.60	2124.20	0.00	0.00	49.40	0.00	123.50	3235.70
	0.00	10.56	42.87	0.00	0.00	0.70	0.00	1.20	55.33
BLACK SPRUCE - MOSS									
PLOT NO 9									
	393.91	4438.31	0.00	0.00	0.00	0.00	0.00	85.11	4917.33
	30.00	840.00	0.00	0.00	0.00	0.00	0.00	40.00	910.00
	13.44	190.12	0.00	0.00	0.00	0.00	0.00	4.89	208.45
	27.18	306.24	0.00	0.00	0.00	0.00	0.00	5.87	339.30
	74.10	2074.80	0.00	0.00	0.00	0.00	0.00	98.80	2247.70
	3.09	43.73	0.00	0.00	0.00	0.00	0.00	1.12	47.94
BLACK SPRUCE - MOSS									
PLOT NO 17									
	676.77	2039.50	38.58	87.44	0.00	0.00	0.00	0.00	2842.29
	200.00	1390.00	20.00	10.00	0.00	0.00	0.00	0.00	1620.00
	32.04	132.20	2.16	3.94	0.00	0.00	0.00	0.00	170.34
	46.70	140.73	2.66	6.03	0.00	0.00	0.00	0.00	196.12
	494.00	3433.30	49.40	24.70	0.00	0.00	0.00	0.00	4001.40
	7.37	30.41	0.50	0.91	0.00	0.00	0.00	0.00	39.18
BLACK SPRUCE - MOSS									
PLOT NO 23									
	0.00	3553.79	481.26	0.00	272.43	0.00	0.00	0.00	4317.48
	0.00	1140.00	130.00	0.00	150.00	0.00	0.00	0.00	1420.00
	0.00	179.46	22.04	0.00	15.18	0.00	0.00	0.00	216.67

0.00	245.90	32.21	0.00	18.80	0.00	0.00	0.00	297.91
0.00	2815.80	321.10	0.00	370.50	0.00	0.00	0.00	3507.40
0.00	41.27	5.07	0.00	3.49	0.00	0.00	0.00	49.83
BLACK SPRUCE - MOSS								
PLOT NO 36								
0.00	2462.86	1167.06	0.00	0.00	0.00	49.78	0.00	3679.70
0.00	1360.00	280.00	0.00	0.00	0.00	10.00	0.00	1630.00
0.00	148.33	50.30	0.00	0.00	0.00	2.30	0.00	200.94
0.00	169.94	80.53	0.00	0.00	0.00	3.43	0.00	253.90
0.00	3309.80	691.60	0.00	0.00	0.00	24.70	0.00	4026.10
0.00	34.12	11.57	0.00	0.00	0.00	0.53	0.00	46.22
BLACK SPRUCE - MOSS								
PLOT NO 54								
0.00	2424.08	12.58	419.09	0.00	0.00	0.00	0.00	2855.76
0.00	1920.00	10.00	180.00	0.00	0.00	0.00	0.00	2110.00
0.00	164.15	0.79	25.02	0.00	0.00	0.00	0.00	189.96
0.00	167.25	0.87	28.92	0.00	0.00	0.00	0.00	197.05
0.00	4742.40	24.70	444.60	0.00	0.00	0.00	0.00	5211.70
0.00	37.76	0.18	5.76	0.00	0.00	0.00	0.00	43.69
BLACK SPRUCE - MOSS								
PLOT NO 10								
3745.43	1668.72	0.00	69.86	0.00	0.00	969.31	144.72	6598.04
370.00	500.00	0.00	10.00	0.00	0.00	40.00	50.00	970.00
128.06	82.45	0.00	3.32	0.00	0.00	27.92	7.59	249.33
258.43	115.14	0.00	4.82	0.00	0.00	66.88	9.99	455.26
913.90	1235.00	0.00	24.70	0.00	0.00	98.80	123.50	2395.90
29.45	18.96	0.00	0.76	0.00	0.00	6.42	1.75	57.35
BLACK SPRUCE - MOSS								
PLOT NO 18								
421.74	1227.25	2572.53	0.00	0.00	442.72	0.00	0.00	4664.23
20.00	310.00	180.00	0.00	0.00	50.00	0.00	0.00	560.00
12.98	57.15	83.89	0.00	0.00	15.06	0.00	0.00	169.08
29.10	84.68	177.50	0.00	0.00	30.55	0.00	0.00	321.83
49.40	765.70	444.60	0.00	0.00	123.50	0.00	0.00	1383.20
2.98	13.14	19.29	0.00	0.00	3.46	0.00	0.00	38.89
BLACK SPRUCE - MOSS								
PLOT NO 24								
0.00	1461.33	2594.76	0.00	0.00	0.00	0.00	0.00	4056.09
0.00	560.00	970.00	0.00	0.00	0.00	0.00	0.00	1530.00
0.00	79.07	128.37	0.00	0.00	0.00	0.00	0.00	207.44
0.00	100.83	179.04	0.00	0.00	0.00	0.00	0.00	279.87
0.00	1383.20	2395.90	0.00	0.00	0.00	0.00	0.00	3779.10
0.00	18.19	29.52	0.00	0.00	0.00	0.00	0.00	47.71
BLACK SPRUCE - MOSS								
PLOT NO 49								
1[illegible].40	3534.45	963.56	0.00	0.00	595.44	0.00	41.26	5330.11
10.00	1090.00	40.00	0.00	0.00	120.00	0.00	50.00	1310.00
6.13	175.14	28.48	0.00	0.00	22.73	0.00	3.20	235.67
13.48	243.88	66.49	0.00	0.00	41.09	0.00	2.85	367.78
24.70	2692.30	98.80	0.00	0.00	296.40	0.00	123.50	3235.70
1.41	40.28	6.55	0.00	0.00	5.23	0.00	0.74	54.21
BLACK SPRUCE - MOSS								
PLOT NO 79								
0.00	508.63	2203.90	0.00	0.00	0.00	0.00	0.00	2712.53
0.00	140.00	1070.00	0.00	0.00	0.00	0.00	0.00	1210.00
0.00	25.50	117.37	0.00	0.00	0.00	0.00	0.00	142.88
0.00	35.10	152.07	0.00	0.00	0.00	0.00	0.00	187.16
0.00	345.80	2642.90	0.00	0.00	0.00	0.00	0.00	2988.70
0.00	5.87	27.00	0.00	0.00	0.00	0.00	0.00	32.86
BLACK SPRUCE - MOSS								

PLOT NO 64									
	0.00	0.00	0.00	0.00	0.00	0.00	8748.33	0.00	8748.33
	0.00	0.00	0.00	0.00	0.00	0.00	220.00	0.00	220.00
	0.00	0.00	0.00	0.00	0.00	0.00	229.02	0.00	229.02
	0.00	0.00	0.00	0.00	0.00	0.00	603.63	0.00	603.63
	0.00	0.00	0.00	0.00	0.00	0.00	543.40	0.00	543.40
	0.00	0.00	0.00	0.00	0.00	0.00	52.67	0.00	52.67
FLOODPLAIN BALSAM POPLAR									
PLOT NO 65									
	2006.46	0.00	0.00	0.00	0.00	0.00	9462.33	0.00	11468.79
	440.00	0.00	0.00	0.00	0.00	0.00	190.00	0.00	630.00
	86.05	0.00	0.00	0.00	0.00	0.00	238.87	0.00	324.91
	138.45	0.00	0.00	0.00	0.00	0.00	652.90	0.00	791.35
	1086.80	0.00	0.00	0.00	0.00	0.00	469.30	0.00	1556.10
	19.79	0.00	0.00	0.00	0.00	0.00	54.94	0.00	74.73
FLOODPLAIN BALSAM POPLAR									
PLOT NO 73									
	0.00	0.00	0.00	0.00	0.00	0.00	17558.92	0.00	17558.92
	0.00	0.00	0.00	0.00	0.00	0.00	170.00	0.00	170.00
	0.00	0.00	0.00	0.00	0.00	0.00	394.80	0.00	394.80
	0.00	0.00	0.00	0.00	0.00	0.00	1211.57	0.00	1211.57
	0.00	0.00	0.00	0.00	0.00	0.00	419.90	0.00	419.90
	0.00	0.00	0.00	0.00	0.00	0.00	90.81	0.00	90.81
FLOODPLAIN BALSAM POPLAR									
PLOT NO 74									
	0.00	0.00	0.00	0.00	0.00	0.00	12691.13	0.00	12691.13
	0.00	0.00	0.00	0.00	0.00	0.00	260.00	0.00	260.00
	0.00	0.00	0.00	0.00	0.00	0.00	316.50	0.00	316.50
	0.00	0.00	0.00	0.00	0.00	0.00	875.69	0.00	875.69
	0.00	0.00	0.00	0.00	0.00	0.00	642.20	0.00	642.20
	0.00	0.00	0.00	0.00	0.00	0.00	72.79	0.00	72.79
FLOODPLAIN BALSAM POPLAR									
PLOT NO 84									
	0.00	0.00	0.00	0.00	0.00	0.00	127.02	0.00	127.02
	0.00	0.00	0.00	0.00	0.00	0.00	100.00	0.00	100.00
	0.00	0.00	0.00	0.00	0.00	0.00	8.60	0.00	8.60
	0.00	0.00	0.00	0.00	0.00	0.00	8.76	0.00	8.76
	0.00	0.00	0.00	0.00	0.00	0.00	247.00	0.00	247.00
	0.00	0.00	0.00	0.00	0.00	0.00	1.98	0.00	1.98
FLOODPLAIN BALSAM POPLAR									
PLOT NO 83									
	1987.98	0.00	0.00	0.00	0.00	0.00	9021.80	0.00	11009.78
	190.00	0.00	0.00	0.00	0.00	0.00	130.00	0.00	320.00
	70.77	0.00	0.00	0.00	0.00	0.00	213.76	0.00	284.53
	137.17	0.00	0.00	0.00	0.00	0.00	622.50	0.00	759.68
	469.30	0.00	0.00	0.00	0.00	0.00	321.10	0.00	790.40
	16.28	0.00	0.00	0.00	0.00	0.00	49.16	0.00	65.44
FLOODPLAIN BALSAM POPLAR									
PLOT NO 84									
	0.00	0.00	0.00	0.00	0.00	0.00	1813.94	0.00	1813.94
	0.00	0.00	0.00	0.00	0.00	0.00	680.00	0.00	680.00
	0.00	0.00	0.00	0.00	0.00	0.00	90.90	0.00	90.90
	0.00	0.00	0.00	0.00	0.00	0.00	125.16	0.00	125.16
	0.00	0.00	0.00	0.00	0.00	0.00	1679.60	0.00	1679.60
	0.00	0.00	0.00	0.00	0.00	0.00	20.91	0.00	20.91
FLOODPLAIN BALSAM POPLAR									
PLOT NO 85									
	179.46	0.00	0.00	0.00	0.00	0.00	10900.71	0.00	11080.17
	150.00	0.00	0.00	0.00	0.00	0.00	300.00	0.00	450.00
	11.31	0.00	0.00	0.00	0.00	0.00	286.61	0.00	297.92

	0.00	11.38	0.00	0.00	0.00	0.00	0.00	0.00	11.38
	0.00	419.90	0.00	0.00	0.00	0.00	0.00	0.00	419.90
	0.00	2.77	0.00	0.00	0.00	0.00	0.00	0.00	2.77
BLACK SPRUCE - SALIX MYRTILLIFOLIA - AULACOMNIUM									
PLOT NO 88									
	246.16	78.76	0.00	0.00	0.00	0.00	10.22	0.00	335.14
	110.00	60.00	0.00	0.00	0.00	0.00	10.00	0.00	180.00
	12.81	5.14	0.00	0.00	0.00	0.00	0.75	0.00	18.70
	16.98	5.43	0.00	0.00	0.00	0.00	0.71	0.00	23.12
	271.70	148.20	0.00	0.00	0.00	0.00	24.70	0.00	444.60
	2.95	1.18	0.00	0.00	0.00	0.00	0.17	0.00	4.30
BLACK SPRUCE - SALIX MYRTILLIFOLIA - AULACOMNIUM									
PLOT NO 89									
	0.00	11.79	0.00	0.00	0.00	0.00	0.00	0.00	11.79
	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
	0.00	0.83	0.00	0.00	0.00	0.00	0.00	0.00	0.83
	0.00	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.81
	0.00	24.70	0.00	0.00	0.00	0.00	0.00	0.00	24.70
	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.19
BLACK SPRUCE - SALIX MYRTILLIFOLIA - AULACOMNIUM									
PLOT NO 91									
	0.00	7.45	0.00	0.00	0.00	0.00	0.00	0.00	7.45
	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00
	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.59
	0.00	0.51	0.00	0.00	0.00	0.00	0.00	0.00	0.51
	0.00	24.70	0.00	0.00	0.00	0.00	0.00	0.00	24.70
	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.14
BLACK SPRUCE - SALIX MYRTILLIFOLIA - AULACOMNIUM									
PLOT NO -1									
	41.03	58.51	0.00	0.00	0.00	0.00	1.70	0.00	101.24
	18.33	51.67	0.00	0.00	0.00	0.00	1.67	0.00	71.67
	2.14	4.02	0.00	0.00	0.00	0.00	0.12	0.00	6.28
	2.83	4.04	0.00	0.00	0.00	0.00	0.12	0.00	6.99
	45.28	127.62	0.00	0.00	0.00	0.00	4.12	0.00	177.02
	0.49	0.93	0.00	0.00	0.00	0.00	0.03	0.00	1.44
BLACK SPRUCE - SPHAGNUM FUSCUM									
PLOT NO 27									
	0.00	386.69	0.00	116.45	0.00	0.00	0.00	0.00	503.14
	0.00	330.00	0.00	40.00	0.00	0.00	0.00	0.00	370.00
	0.00	26.61	0.00	6.60	0.00	0.00	0.00	0.00	33.21
	0.00	26.82	0.00	7.90	0.00	0.00	0.00	0.00	34.72
	0.00	815.10	0.00	98.80	0.00	0.00	0.00	0.00	913.90
	0.00	6.12	0.00	1.52	0.00	0.00	0.00	0.00	7.64
BLACK SPRUCE - SPHAGNUM FUSCUM									
PLOT NO 28									
	0.00	29.55	0.00	0.00	0.00	0.00	0.00	0.00	29.55
	0.00	30.00	0.00	0.00	0.00	0.00	0.00	0.00	30.00
	0.00	2.17	0.00	0.00	0.00	0.00	0.00	0.00	2.17
	0.00	2.04	0.00	0.00	0.00	0.00	0.00	0.00	2.04
	0.00	74.10	0.00	0.00	0.00	0.00	0.00	0.00	74.10
	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.50
BLACK SPRUCE - SPHAGNUM FUSCUM									
PLOT NO -1									
	0.00	69.71	0.00	19.08	0.00	0.00	0.00	0.00	88.78
	0.00	60.00	0.00	6.67	0.00	0.00	0.00	0.00	66.67
	0.00	4.80	0.00	1.10	0.00	0.00	0.00	0.00	5.90
	0.00	4.81	0.00	1.32	0.00	0.00	0.00	0.00	6.13
	0.00	148.20	0.00	16.47	0.00	0.00	0.00	0.00	164.67
	0.00	1.10	0.00	0.25	0.00	0.00	0.00	0.00	1.36
FLOODPLAIN BALSAM POPLAR									

PLOT NO -1									
	417.94	2317.40	1280.43	44.34	20.96	149.38	83.68	38.08	4352.21
	48.46	881.54	286.15	15.38	11.54	18.46	4.62	20.77	1286.92
	14.82	121.46	53.09	2.48	1.17	5.03	2.55	2.25	202.85
	28.84	159.90	88.35	3.06	1.45	10.31	5.77	2.63	300.30
	119.70	2177.40	706.80	38.00	28.50	45.60	11.40	51.30	3178.70
	3.41	27.94	12.21	0.57	0.27	1.16	0.59	0.52	46.66
TAMARACK - SWAMP BIRCH - MENYANTHES									
PLOT NO 53									
	0.00	22.10	0.00	743.24	0.00	0.00	0.00	0.00	765.34
	0.00	20.00	0.00	220.00	0.00	0.00	0.00	0.00	240.00
	0.00	1.58	0.00	40.41	0.00	0.00	0.00	0.00	41.99
	0.00	1.53	0.00	51.28	0.00	0.00	0.00	0.00	52.81
	0.00	49.40	0.00	543.40	0.00	0.00	0.00	0.00	592.80
	0.00	0.36	0.00	9.29	0.00	0.00	0.00	0.00	9.66
TAMARACK - SWAMP BIRCH - MENYANTHES									
PLOT NO 76									
	0.00	0.00	0.00	600.35	0.00	0.00	0.00	0.00	600.35
	0.00	0.00	0.00	270.00	0.00	0.00	0.00	0.00	270.00
	0.00	0.00	0.00	36.05	0.00	0.00	0.00	0.00	36.05
	0.00	0.00	0.00	41.42	0.00	0.00	0.00	0.00	41.42
	0.00	0.00	0.00	666.90	0.00	0.00	0.00	0.00	666.90
	0.00	0.00	0.00	8.29	0.00	0.00	0.00	0.00	8.29
TAMARACK - SWAMP BIRCH - MENYANTHES									
PLOT NO 77									
	0.00	0.00	0.00	333.78	0.00	0.00	0.00	0.00	333.78
	0.00	0.00	0.00	290.00	0.00	0.00	0.00	0.00	290.00
	0.00	0.00	0.00	24.16	0.00	0.00	0.00	0.00	24.16
	0.00	0.00	0.00	23.03	0.00	0.00	0.00	0.00	23.03
	0.00	0.00	0.00	716.30	0.00	0.00	0.00	0.00	716.30
	0.00	0.00	0.00	5.56	0.00	0.00	0.00	0.00	5.56
TAMARACK - SWAMP BIRCH - MENYANTHES									
PLOT NO 78									
	0.00	10.20	0.00	829.82	0.00	0.00	0.00	0.00	840.02
	0.00	10.00	0.00	440.00	0.00	0.00	0.00	0.00	450.00
	0.00	0.75	0.00	52.72	0.00	0.00	0.00	0.00	53.46
	0.00	0.70	0.00	57.26	0.00	0.00	0.00	0.00	57.96
	0.00	24.70	0.00	1086.80	0.00	0.00	0.00	0.00	1111.50
	0.00	0.17	0.00	12.12	0.00	0.00	0.00	0.00	12.30
TAMARACK - SWAMP BIRCH - MENYANTHES									
PLOT NO -1									
	0.00	8.08	0.00	626.80	0.00	0.00	0.00	0.00	634.87
	0.00	7.50	0.00	305.00	0.00	0.00	0.00	0.00	312.50
	0.00	0.58	0.00	38.33	0.00	0.00	0.00	0.00	38.91
	0.00	0.56	0.00	43.25	0.00	0.00	0.00	0.00	43.81
	0.00	18.52	0.00	753.35	0.00	0.00	0.00	0.00	771.88
	0.00	0.13	0.00	8.82	0.00	0.00	0.00	0.00	8.95
BLACK SPRUCE - SALIX MYRTILLIFOLIA - AULACOMNIUM									
PLOT NO 44									
	0.00	88.20	0.00	0.00	0.00	0.00	0.00	0.00	88.20
	0.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	60.00
	0.00	5.54	0.00	0.00	0.00	0.00	0.00	0.00	5.54
	0.00	6.09	0.00	0.00	0.00	0.00	0.00	0.00	6.09
	0.00	148.20	0.00	0.00	0.00	0.00	0.00	0.00	148.20
	0.00	1.27	0.00	0.00	0.00	0.00	0.00	0.00	1.27
BLACK SPRUCE - SALIX MYRTILLIFOLIA - AULACOMNIUM									
PLOT NO 45									
	0.00	164.88	0.00	0.00	0.00	0.00	0.00	0.00	164.88
	0.00	170.00	0.00	0.00	0.00	0.00	0.00	0.00	170.00
	0.00	12.03	0.00	0.00	0.00	0.00	0.00	0.00	12.03

12.38	0.00	0.00	0.00	0.00	0.00	752.15	0.00	764.53
370.50	0.00	0.00	0.00	0.00	0.00	741.00	0.00	1111.50
2.60	0.00	0.00	0.00	0.00	0.00	65.92	0.00	68.52
FLOODPLAIN BALSAM POPLAR								
PLOT-NO-1								
536.27	0.00	0.00	0.00	0.00	0.00	10046.30	0.00	10642.58
111.43	0.00	0.00	0.00	0.00	0.00	292.86	0.00	404.29
24.02	0.00	0.00	0.00	0.00	0.00	254.15	0.00	278.17
41.14	0.00	0.00	0.00	0.00	0.00	693.20	0.00	734.34
275.23	0.00	0.00	0.00	0.00	0.00	723.36	0.00	998.58
5.52	0.00	0.00	0.00	0.00	0.00	58.45	0.00	63.98
FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE								
PLOT NO 80								
8058.70	0.00	0.00	0.00	0.00	0.00	0.00	225.19	8283.89
250.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	260.00
211.05	0.00	0.00	0.00	0.00	0.00	0.00	6.84	217.89
556.05	0.00	0.00	0.00	0.00	0.00	0.00	15.54	571.59
617.50	0.00	0.00	0.00	0.00	0.00	0.00	24.70	642.20
48.54	0.00	0.00	0.00	0.00	0.00	0.00	1.57	50.11
FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE								
PLOT NO 75								
15570.27	0.00	0.00	0.00	0.00	0.00	0.00	19.76	15590.03
140.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	160.00
328.33	0.00	0.00	0.00	0.00	0.00	0.00	1.46	329.78
1074.35	0.00	0.00	0.00	0.00	0.00	0.00	1.36	1075.71
345.80	0.00	0.00	0.00	0.00	0.00	0.00	49.40	395.20
75.52	0.00	0.00	0.00	0.00	0.00	0.00	0.33	75.85
FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE								
PLOT NO 71								
9997.93	0.00	0.00	0.00	0.00	0.00	0.00	858.34	10856.27
130.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	140.00
222.93	0.00	0.00	0.00	0.00	0.00	0.00	18.87	241.80
689.86	0.00	0.00	0.00	0.00	0.00	0.00	59.23	749.08
321.10	0.00	0.00	0.00	0.00	0.00	0.00	24.70	345.80
51.27	0.00	0.00	0.00	0.00	0.00	0.00	4.34	55.61
FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE								
PLOT NO 39								
5749.54	0.00	0.00	0.00	0.00	47.17	0.00	128.94	5925.64
610.00	0.00	0.00	0.00	0.00	10.00	0.00	60.00	680.00
201.72	0.00	0.00	0.00	0.00	1.90	0.00	7.42	211.04
396.72	0.00	0.00	0.00	0.00	3.25	0.00	8.90	408.87
1506.70	0.00	0.00	0.00	0.00	24.70	0.00	148.20	1679.60
46.40	0.00	0.00	0.00	0.00	0.44	0.00	1.71	48.54
FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE								
PLOT NO 25								
8653.91	0.00	0.00	0.00	0.00	580.89	0.00	0.00	9244.80
590.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	590.00
259.60	0.00	0.00	0.00	0.00	14.31	0.00	0.00	283.92
597.81	0.00	0.00	0.00	0.00	40.08	0.00	0.00	637.89
1432.60	0.00	0.00	0.00	0.00	24.70	0.00	0.00	1457.30
62.01	0.00	0.00	0.00	0.00	3.29	0.00	0.00	65.30
FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE								
PLOT NO 22								
10502.82	0.00	0.00	0.00	126.01	0.00	0.00	0.00	10628.83
340.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	350.00
270.60	0.00	0.00	0.00	4.52	0.00	0.00	0.00	275.11
724.65	0.00	0.00	0.00	8.69	0.00	0.00	0.00	733.39
839.80	0.00	0.00	0.00	24.70	0.00	0.00	0.00	864.50
62.24	0.00	0.00	0.00	1.04	0.00	0.00	0.00	63.28
FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE								

	0.00	245.56	0.00	0.00	0.00	0.00	0.00	0.00	245.56
	0.00	3655.60	0.00	0.00	0.00	0.00	0.00	0.00	3655.60
	0.00	45.03	0.00	0.00	0.00	0.00	0.00	0.00	45.03
BLACK SPRUCE - EQUISETUM SYLVATICUM									
PLOT NO 30									
	0.00	5508.69	158.52	0.00	0.00	0.00	0.00	447.39	6114.60
	0.00	750.00	20.00	0.00	0.00	0.00	0.00	90.00	860.00
	0.00	212.72	6.11	0.00	0.00	0.00	0.00	20.14	238.96
	0.00	380.10	10.94	0.00	0.00	0.00	0.00	30.87	421.91
	0.00	1852.50	49.40	0.00	0.00	0.00	0.00	222.30	2124.20
	0.00	48.92	1.40	0.00	0.00	0.00	0.00	4.63	54.96
BLACK SPRUCE - EQUISETUM SYLVATICUM									
PLOT NO 47									
	0.00	632.74	0.00	23.02	0.00	0.00	0.00	0.00	655.76
	0.00	510.00	0.00	20.00	0.00	0.00	0.00	0.00	530.00
	0.00	43.00	0.00	1.69	0.00	0.00	0.00	0.00	44.69
	0.00	43.66	0.00	1.59	0.00	0.00	0.00	0.00	45.25
	0.00	1259.70	0.00	40.40	0.00	0.00	0.00	0.00	1300.10
	0.00	9.89	0.00	0.39	0.00	0.00	0.00	0.00	10.28
BLACK SPRUCE - EQUISETUM SYLVATICUM									
PLOT NO 51									
	0.00	750.60	0.00	175.76	0.00	0.00	0.00	0.00	926.37
	0.00	750.00	0.00	80.00	0.00	0.00	0.00	0.00	830.00
	0.00	54.49	0.00	10.69	0.00	0.00	0.00	0.00	65.18
	0.00	51.79	0.00	12.13	0.00	0.00	0.00	0.00	63.92
	0.00	1852.50	0.00	197.60	0.00	0.00	0.00	0.00	2050.10
	0.00	12.53	0.00	2.46	0.00	0.00	0.00	0.00	14.99
BLACK SPRUCE - EQUISETUM SYLVATICUM									
PLOT NO -1									
	0.00	2524.10	31.70	109.72	0.00	0.00	0.00	90.72	2756.25
	0.00	1054.00	4.00	48.00	0.00	0.00	0.00	20.00	1126.00
	0.00	131.00	1.22	6.72	0.00	0.00	0.00	4.13	143.07
	0.00	174.16	2.19	7.57	0.00	0.00	0.00	6.26	190.18
	0.00	2603.38	6.88	118.56	0.00	0.00	0.00	49.40	2781.22
	0.00	30.13	0.28	1.55	0.00	0.00	0.00	0.95	32.91
TAMARACK - BLACK SPRUCE - EQUISETUM ARVENSE									
PLOT NO 31									
	0.00	1046.49	0.00	460.43	0.00	0.00	0.00	199.79	1706.72
	0.00	440.00	0.00	140.00	0.00	0.00	0.00	160.00	740.00
	0.00	57.26	0.00	25.41	0.00	0.00	0.00	13.51	96.17
	0.00	72.21	0.00	31.77	0.00	0.00	0.00	13.79	117.76
	0.00	1086.80	0.00	345.80	0.00	0.00	0.00	395.20	1827.80
	0.00	13.17	0.00	5.84	0.00	0.00	0.00	3.11	22.12
TAMARACK - BLACK SPRUCE - EQUISETUM ARVENSE									
PLOT NO 48									
	2128.83	2169.58	0.00	90.14	0.00	0.00	367.90	0.00	4756.55
	150.00	390.00	0.00	10.00	0.00	0.00	20.00	0.00	570.00
	69.83	92.79	0.00	4.03	0.00	0.00	11.41	0.00	178.05
	146.85	149.71	0.00	6.22	0.00	0.00	25.39	0.00	328.20
	370.50	963.30	0.00	24.70	0.00	0.00	49.40	0.00	1407.90
	16.06	21.34	0.00	0.93	0.00	0.00	2.62	0.00	40.95
TAMARACK - BLACK SPRUCE - EQUISETUM ARVENSE									
PLOT NO 56									
	1328.88	3851.20	0.00	20.41	0.00	0.00	0.00	281.86	5482.34
	80.00	1020.00	0.00	10.00	0.00	0.00	0.00	130.00	1240.00
	42.20	180.27	0.00	1.31	0.00	0.00	0.00	16.12	239.90
	91.69	255.73	0.00	1.41	0.00	0.00	0.00	19.45	378.28
	197.60	2519.40	0.00	24.70	0.00	0.00	0.00	321.10	3062.80
	9.71	41.46	0.00	0.30	0.00	0.00	0.00	3.71	55.18
TAMARACK - BLACK SPRUCE - EQUISETUM ARVENSE									

PLOT NO 57									
	735.62	1840.83	0.00	25.15	0.00	0.00	0.00	0.00	2601.60
	370.00	1340.00	0.00	10.00	0.00	0.00	0.00	0.00	1720.00
	39.52	120.95	0.00	1.53	0.00	0.00	0.00	0.00	162.01
	50.76	127.02	0.00	1.74	0.00	0.00	0.00	0.00	179.51
	913.90	3309.80	0.00	24.70	0.00	0.00	0.00	0.00	4248.40
	9.09	27.82	0.00	0.35	0.00	0.00	0.00	0.00	37.26
TAMARACK - BLACK SPRUCE - EQUISETUM ARVENSE									
PLOT NO 58									
	0.00	5225.37	0.00	1663.96	0.00	0.00	0.00	0.00	6889.33
	0.00	970.00	0.00	70.00	0.00	0.00	0.00	0.00	1040.00
	0.00	223.68	0.00	59.85	0.00	0.00	0.00	0.00	283.53
	0.00	360.55	0.00	114.81	0.00	0.00	0.00	0.00	475.36
	0.00	2395.90	0.00	172.90	0.00	0.00	0.00	0.00	2568.80
	0.00	51.45	0.00	13.77	0.00	0.00	0.00	0.00	65.21
TAMARACK - BLACK SPRUCE - EQUISETUM ARVENSE									
PLOT NO -1									
	838.56	2826.71	0.00	452.02	0.00	0.00	73.58	96.33	4287.30
	120.00	832.00	0.00	48.00	0.00	0.00	4.00	58.00	1062.00
	30.31	134.99	0.00	18.43	0.00	0.00	2.28	5.93	191.93
	57.87	195.04	0.00	31.19	0.00	0.00	5.08	6.65	295.82
	296.40	2055.04	0.00	118.56	0.00	0.00	9.88	143.26	2623.14
	6.97	31.05	0.00	4.24	0.00	0.00	0.52	1.36	44.14
LODGEPOLE PINE - KINNIKINNICK - LICHEN									
PLOT NO 59									
	0.00	48.92	1516.15	0.00	0.00	0.00	0.00	0.00	1565.07
	0.00	50.00	270.00	0.00	0.00	0.00	0.00	0.00	320.00
	0.00	3.60	61.83	0.00	0.00	0.00	0.00	0.00	65.43
	0.00	3.38	104.61	0.00	0.00	0.00	0.00	0.00	107.99
	0.00	123.50	666.90	0.00	0.00	0.00	0.00	0.00	790.40
	0.00	0.83	14.22	0.00	0.00	0.00	0.00	0.00	15.05
LODGEPOLE PINE - KINNIKINNICK - LICHEN									
PLOT NO 81									
	347.70	137.74	697.60	0.00	0.00	2735.08	0.00	0.00	3878.13
	70.00	70.00	40.00	0.00	0.00	150.00	0.00	0.00	330.00
	14.54	8.14	21.14	0.00	0.00	75.56	0.00	0.00	119.38
	23.95	9.50	45.37	0.00	0.00	188.72	0.00	0.00	267.59
	172.90	172.90	98.80	0.00	0.00	370.50	0.00	0.00	815.10
	3.34	1.87	4.86	0.00	0.00	17.38	0.00	0.00	27.46
LODGEPOLE PINE - KINNIKINNICK - LICHEN									
PLOT NO 82									
	0.00	135.60	1860.60	0.00	0.00	216.50	0.00	0.00	2212.70
	0.00	90.00	230.00	0.00	0.00	30.00	0.00	0.00	350.00
	0.00	8.77	70.19	0.00	0.00	7.81	0.00	0.00	86.77
	0.00	9.36	128.38	0.00	0.00	14.94	0.00	0.00	152.68
	0.00	222.30	568.10	0.00	0.00	74.10	0.00	0.00	864.50
	0.00	2.02	16.14	0.00	0.00	1.80	0.00	0.00	19.96
LODGEPOLE PINE - KINNIKINNICK - LICHEN									
PLOT NO 92									
	260.30	12.65	872.53	0.00	0.00	431.38	0.00	0.00	1576.85
	50.00	10.00	80.00	0.00	0.00	140.00	0.00	0.00	280.00
	11.01	0.67	30.06	0.00	0.00	18.74	0.00	0.00	60.68
	17.96	0.87	60.20	0.00	0.00	29.76	0.00	0.00	108.80
	123.50	24.70	197.60	0.00	0.00	345.80	0.00	0.00	691.60
	2.53	0.20	6.91	0.00	0.00	4.31	0.00	0.00	13.96
LODGEPOLE PINE - KINNIKINNICK - LICHEN									
PLOT NO -1									
	152.00	83.73	1226.72	0.00	0.00	845.74	0.00	0.00	2308.19
	30.00	55.00	155.00	0.00	0.00	80.00	0.00	0.00	320.00
	6.39	5.35	45.80	0.00	0.00	25.53	0.00	0.00	83.07

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 PLOT NO 21
                  4810.50     0.00     0.00     0.00     0.00   109.58   222.30   299.08  5441.45
                   570.00     0.00     0.00     0.00     0.00    10.00    10.00    60.00   650.00
                   172.05     0.00     0.00     0.00     0.00     3.58     6.84    13.62   196.09
                   331.92     0.00     0.00     0.00     0.00     7.56    15.34    20.64   375.46
                  1407.90     0.00     0.00     0.00     0.00    24.70    24.70   148.20  1605.50
                    39.57     0.00     0.00     0.00     0.00     0.82     1.57     3.13    45.10
 FLOODPLAIN (YOUNG TERRACE) WHITE SPRUCE
 PLOT NO -1
                  9050.52     0.00     0.00     0.00    18.00   105.38    31.76   218.76  9424.41
                   374.29     0.00     0.00     0.00     1.43     4.29     1.43    22.86   404.29
                   239.47     0.00     0.00     0.00     0.65     2.83     0.58     6.89   250.80
                   624.49     0.00     0.00     0.00     1.24     7.27     2.19    15.09   650.28
                   924.48     0.00     0.00     0.00     3.53    10.59     3.53    56.46   998.59
                    55.08     0.00     0.00     0.00     0.15     0.65     0.22     1.58    57.68
 FLOODPLAIN ALDER (WITH BALSAM POPLAR)
 PLOT NO 68
                     0.00     0.00     0.00     0.00     0.00     0.00  2188.76     0.00  2188.76
                     0.00     0.00     0.00     0.00     0.00     0.00   660.00     0.00   660.00
                     0.00     0.00     0.00     0.00     0.00     0.00   106.63     0.00   106.63
                     0.00     0.00     0.00     0.00     0.00     0.00   151.02     0.00   151.02
                     0.00     0.00     0.00     0.00     0.00     0.00  1630.20     0.00  1630.20
                     0.00     0.00     0.00     0.00     0.00     0.00    24.53     0.00    24.53
 FLOODPLAIN ALDER (WITH BALSAM POPLAR)
 PLOT NO -1
                     0.00     0.00     0.00     0.00     0.00     0.00   547.19     0.00   547.19
                     0.00     0.00     0.00     0.00     0.00     0.00   165.00     0.00   165.00
                     0.00     0.00     0.00     0.00     0.00     0.00    26.66     0.00    26.66
                     0.00     0.00     0.00     0.00     0.00     0.00    37.76     0.00    37.76
                     0.00     0.00     0.00     0.00     0.00     0.00   407.55     0.00   407.55
                     0.00     0.00     0.00     0.00     0.00     0.00     6.13     0.00     6.13

 CORE USAGE     OBJECT CODE=    <<24 BYTES,ARRAY AREA=    2344 BYTES,TOTAL AREA AVAILABLE=  102400  BYTES

 DIAGNOSTICS     NUMBER OF ERRORS=     0, NUMBER OF WARNINGS=     0, NUMBER OF EXTENSIONS=     0

 COMPILE TIME=    0.16 SEC,EXECUTION TIME=    3.65 SEC,  WATFIV - VERSION 1 LEVEL 3 MARCH  1971     DATE=  01-29-75

            $STOP
 EXECUTION TERMINATED

 $SIG
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APPENDIX I

Chemical and Physical Properties of Ground Waters

Dissolved oxygen (D.O.) was measured in situ, with a Y.S.I. Model 54 oxygen Meter (Yellow Springs Instrument Co., Yellow Springs, Ohio). Conductivity (μMHO) was additionally measured in situ, with an Orion Model 407 Ionalyzer (Orion Research, Inc., Cambridge, Massachusetts). PO_4, SiO_2, SO_4, Ca, Mg, and K were determined on water samples (frozen shortly after field collection) in the Ecology Laboratory, Faculty of Forestry, University of British Columbia.

APPENDIX I

Chemical and Physical Properties of Ground Waters

	Plot No.	D.O. ppm	Conductivity μMHO	Temp. C	PO_4	SiO_2	SO_4	Ca	Mg	K
					in ppm					
Black Spruce-Moss	10	-	410	5	.07	4.0	13.2	45.2	29.5	1.9
Black Spruce-*Equisetum sylvaticum*	52	3.4	100	6	.25	2.6	12.5	17.2	4.8	1.1
	47	5.4	55	4	.57	2.0	10.0	8.9	2.0	0.3
	51	3.6	50	8	.26	0.7	13.0	6.3	1.4	0.2
	Avg.	4.1	68	6.0	.36	1.8	11.8	10.8	2.7	0.5
	Range	3.4-5.4	50-100	4-8	.25-.57	0.7-2.6	10.0-13.0	6.3-17.2	1.4-4.8	0.2-1.1
Tamarack-Black Spruce-*Equisetum arvense*	31	2.8	150	10	.06	3.1	0.7	25.8	5.2	0.1
	48	0.8	85	7	.28	2.4	6.0	16.6	2.8	0.5
	56	6.8	80	7	.92	2.5	2.8	9.2	4.0	1.6
	57	6.0	115	6	.72	6.9	1.7	12.1	5.1	0.8
	58	5.0	80	8	.35	3.3	1.8	13.2	4.5	0.4
	Avg.	4.3	102	7.6	.47	3.6	2.6	15.4	4.3	0.6
	Range	0.8-6.8	80-150	6-10	.06-.92	2.4-6.9	0.7-6.0	9.2-25.8	2.8-5.2	0.1-1.6
Tamarack-Swamp-Birch-*Menyanthes*	53	2.6	150	12	-	-	-	-	-	-
	76	0.2	200	15	.02	6.2	3.0	27.5	6.9	0.2
	77	3.4	195	12	.02	4.2	4.0	28.2	7.9	0.5
	78	1.2	160	12	.03	5.8	3.4	28.1	6.7	0.6
	Avg.	1.8	176	12.7	.02	5.4	3.5	27.9	7.2	0.4
	Range	0.2-3.4	150-200	12-15	.02-.03	4.2-6.2	3.0-4.0	27.5-28.2	6.7-7.9	0.2-0.6
Black Spruce-*Salix myrtillifolia*-*Aulacomnium*	44	3.8	75	1	.08	3.0	3.2	17.7	3.4	0.2
	45	3.9	230	1	.03	2.9	14.2	39.2	12.1	0.4
	88	3.4	110	2	.07	2.6	2.2	20.1	5.2	0.2
	89	3.5	82	3	.15	1.7	0.5	13.7	3.5	0.4
	90	4.0	95	3	.20	2.9	0.2	14.8	3.7	0.7
	91	4.4	120	2	.56	1.5	0.2	27.2	7.4	0.2
	Avg.	3.8	119	2.0	.18	2.4	3.4	22.1	5.9	0.3
	Range	3.4-4.4	75-230	1-3	.03-.56	1.5-3.0	0.2-14.2	13.7-39.2	3.4-12.1	0.2-0.7
Black Spruce-*Sphagnum fuscum*	27	6.4	90	3	.36	1.1	20.0	17.2	2.9	1.9
	46	4.9	82	2	-	-	-	-	-	-
	Avg.	5.6	86	2.5						
	Range	4.9-6.4	82-86	2-3						
Pitcher Plant-*Sphagnum*	11	1.6	46	14	.61	0.5	9.8	1.8	0.5	0.2
	34	1.9	50	15	.61	0.3	4.1	1.8	0.4	0.6
	Avg.	1.7	48	14.5	.61	0.4	6.9	1.8	0.4	0.4
	Range	1.6-1.9	46-50	14-15		0.3-0.5	4.1-9.8		0.4-0.5	0.2-0.6
Myrica gale-*Menyanthes*	60	0.7	200	16	.02	5.2	0.7	23.9	6.6	0.2
	61	0.4	200	16	.02	5.6	1.5	32.5	8.2	0.4
	Avg.	0.5	200	16	.02	5.4	1.1	28.2	7.4	0.3
	Range	0.4-0.7				5.2-5.6	0.7-1.5	23.9-32.5	6.6-8.2	0.2-0.4

BOG WATERS

PAGE 1

(2X,2F3.0,3F4.0,3F3.0,F2.0,2(F3.0,F4.0),F4.0,F3.0,F5.0,2F4.0,2F5.0,F4.0)

NUMBER OF OBSERVATIONS 23

VARIABLE	SYMBOL	MEAN	STANDARD DEVIATION	MINIMUM	MAXIMUM	COEFFICIENT OF VARIATION
X 1	PO4	0.270870D+CC	0.267185E+CC	0.200000E-C1	C.920000E+00	98.64
X 2	SI O2	0.313913D+01	0.181552E+01	0.4C0000E+CC	C.690000E+01	57.84
X 3	SO4	C.603913C+C1	0.633990E+01	0.200000E+CC	C.2C0CC0E+C2	104.98
X 4	CA IN H2O	0.197522D+C2	0.107902E+02	0.180000E+C1	C.452000E+02	54.63
X 5	MG IN H2O	0.591304D+01	0.578629E+01	0.4C00CCE+CC	C.295CC0E+C2	97.86
X 6	K IN H2O	0.652174D+CC	0.554215E+00	0.1CJ000E+0C	0.200000E+01	84.98
X 7	D.C.	0.3500000+C1	0.210259E+C1	0.2C0000E+CC	C.770000E+01	60.07
X 8	COND	0.131043D+03	0.815010E+02	0.5C0000E+C2	C.410000E+C3	62.19
X 9	TEMP	C.734783D+C1	0.492312E+01	0.100000E+C1	0.160000E+02	67.00
X10	PH	0.528261D+01	0.932565E+00	C.350000E+C1	C.680000E+01	17.65
X11	C/N	0.474343D+02	0.175897E+02	0.274000E+02	C.999000E+C2	37.08
X12	P	0.717391D+02	0.481675E+02	0.600000E+01	0.164000E+03	67.14
X13	CA	0.401957D+02	0.190205E+02	0.680000E+C1	C.775CC0E+C2	47.32
X14	MG-1	C.956957D+C1	0.446302E+01	0.340000E+01	C.198CC0E+C2	46.64
X15	K-1	C.137391D+C1	0.823639E+00	0.0	C.280000E+01	59.95
X16	CA	0.226292D+05	0.171259E+05	0.230900E+C4	C.690470E+C5	75.68
X17	MG-2	0.205857D+C4	0.113977E+04	0.562000E+03	0.456800E+04	55.37
X18	K-2	C.709783D+C3	0.341979E+03	0.1430CCE+C3	C.142700E+04	48.18
X19	FE	C.520479D+04	0.609617E+04	0.117CCCE+C3	C.2C271CE+C5	117.16
X20	AL	C.167657D+04	0.200054E+04	0.231000E+03	0.732100E+04	119.32
X21	MN	0.423739D+03	0.684510E+03	C.7C00CCE+01	C.288400E+04	161.54

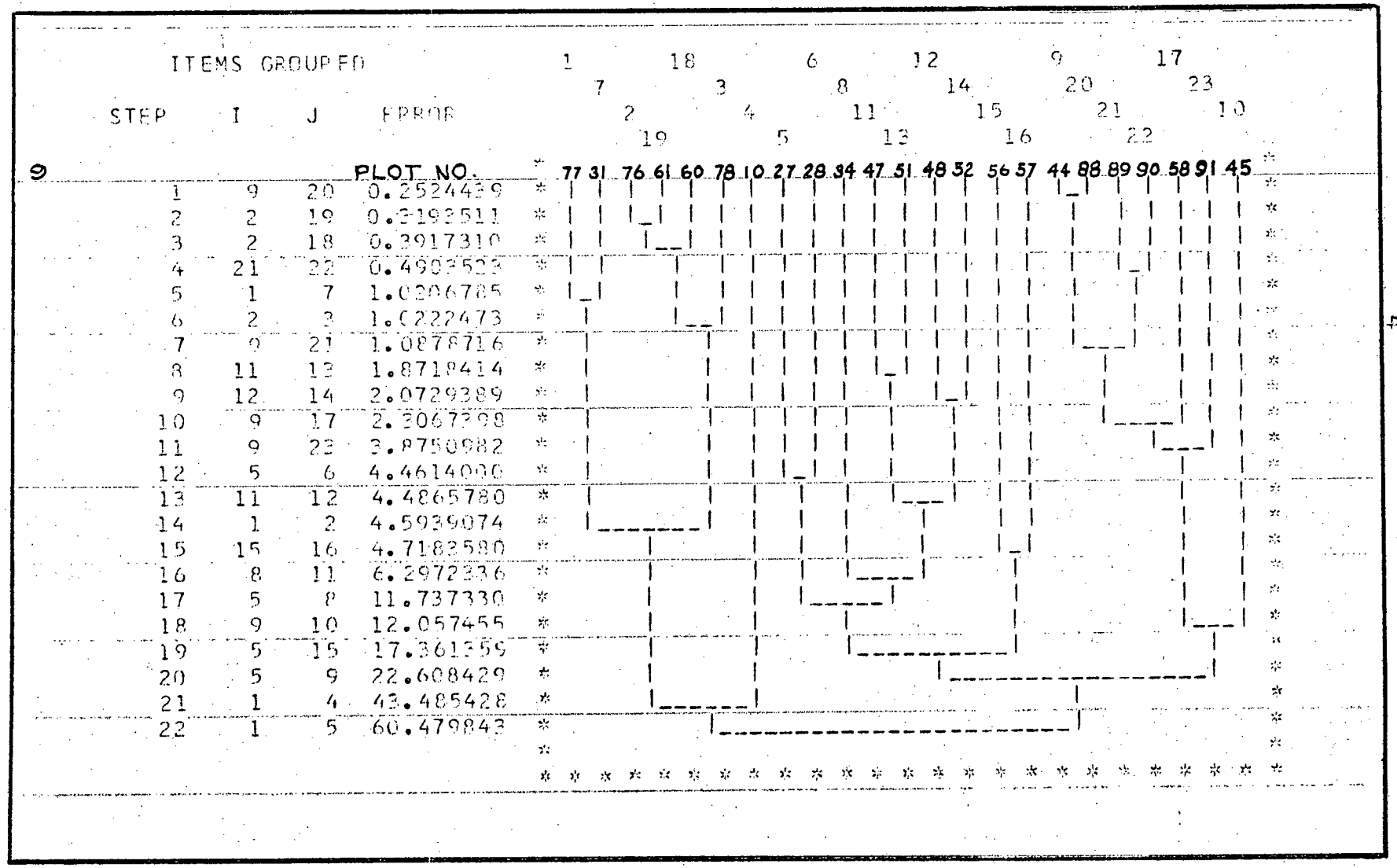
Correlation matrix of chemical and physical properties of ground waters and surface organic layers from 23 plots. Correlation is significant at the 1%, 5%, and 10% level where r is greater than .54, .42, and .36 respectively.

		PO_4	PO_4																			
		SiO_2	-.37	SiO_2																		
		SO_4	.12	-.42	SO_4																	
		Ca	-.66	.50	-.02	Ca																
		Mg	-.37	.35	.12	.82	Mg															
		K	.35	-.14	.59	.03	.34	K														
		D.O.	.44	-.22	.25	-.04	.32	.55	D.O.													
		μ	-.52	.53	.06	.90	.94	.23	.06	μ												
		TEMP	-.18	.44	-.27	.05	-.05	-.19	-.63	.19	TEMP											
		PH	-.40	.40	-.53	.47	.25	-.24	-.28	.32	.17	PH										
		C/N	.40	-.37	.66	-.50	-.37	.45	.22	-.39	-.23	-.60	C/N									
		P	.46	-.31	.31	-.35	-.08	.44	.33	-.19	-.05	-.51	.32	P								
SURFACE ORGANIC LAYERS	Exchangeable Cations	Ca	-.42	.21	-.38	.43	.24	-.25	-.20	.24	-.11	.88	-.51	-.59	Ca							
		Mg	-.21	.09	-.52	.20	.11	-.28	-.08	.06	-.16	.77	-.45	-.48	.87	Mg						
		K	.28	-.06	.03	-.12	-.02	.19	.42	-.14	-.32	-.11	.06	.63	-.19	-.10	K					
	Ash Elements	Ca	-.35	.11	-.37	.34	.15	-.32	-.21	.17	-.08	.81	-.47	-.41	.86	.69	-.09	Ca				
		Mg	-.30	.04	-.46	.29	.18	-.31	-.07	.14	-.17	.83	-.47	-.50	.90	.90	-.09	.90	Mg			
		K	.21	-.35	.25	-.01	.16	.35	.54	-.02	-.50	.01	.06	.15	.06	.18	.60	-.05	.18	K		
		Fe	-.50	.39	-.16	.41	.15	-.27	-.46	.32	.50	.52	-.23	-.18	.33	.14	-.06	.48	.29	-.37	Fe	
		Al	-.16	-.17	.02	.23	.27	-.06	.03	.18	-.21	.34	-.27	.08	.37	.14	.20	.64	.43	.02	.36	Al
		Mn	-.09	.01	.01	.08	.00	.01	-.27	.01	.06	.46	-.22	-.07	.39	.23	.18	.47	.39	.30	.27	.53

GROUND WATERS

U.B.C. C GROUP

Keys used - First 9 variables listed on p. 406.



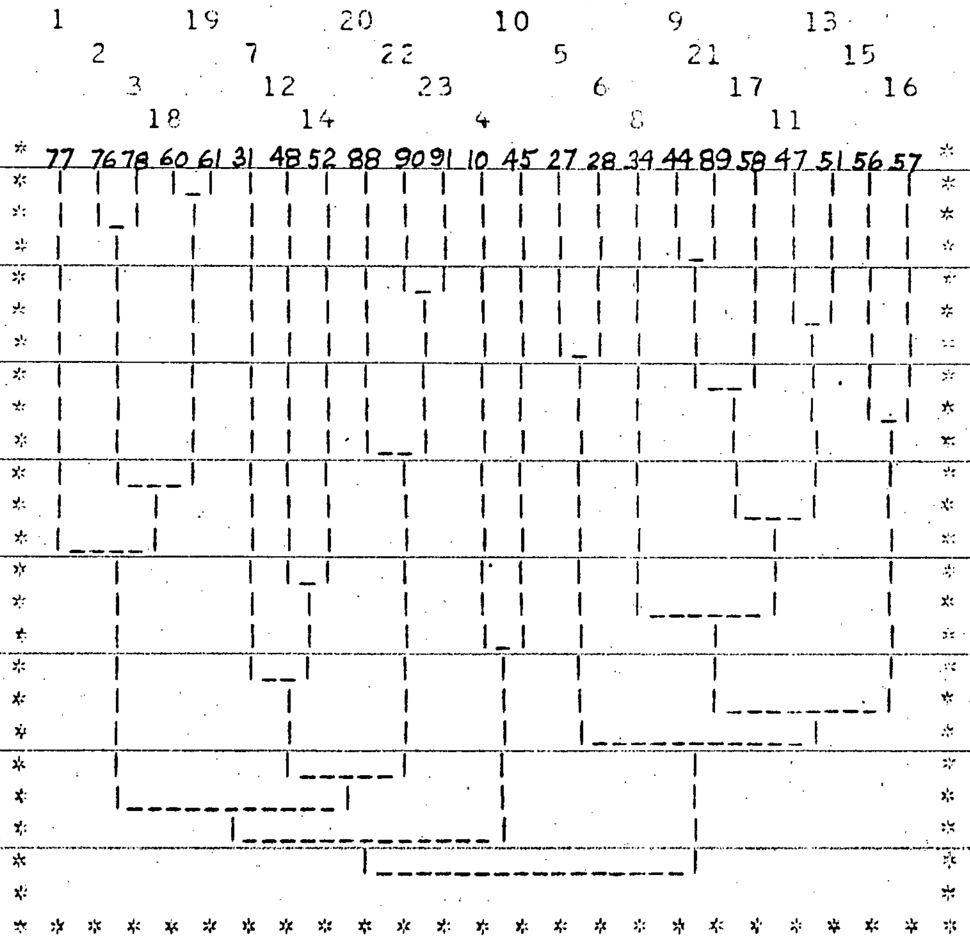
STEP	I	J	ERROR	PLOT NO.
1	9	20	0.2524439	77 31 76 61 60 78 10 27 28 34 47 51 48 52 56 57 44 88 89 90 58 91 45
2	2	19	0.3193511	
3	2	18	0.3917310	
4	21	22	0.4903523	
5	1	7	1.0206785	
6	2	3	1.0222473	
7	9	21	1.0878716	
8	11	13	1.8718414	
9	12	14	2.0729389	
10	9	17	2.3067398	
11	9	23	3.8750982	
12	5	6	4.4614000	
13	11	12	4.4865780	
14	1	2	4.5939074	
15	15	16	4.7182580	
16	8	11	6.2972336	
17	5	8	11.737330	
18	9	10	12.057455	
19	5	15	17.361359	
20	5	9	22.608429	
21	1	4	43.485428	
22	1	5	60.479843	

U.B.C. C GROUP

Keys used - All 21 variables listed on pages 406 & 407.

ITEMS GROUPED

STEP	I	J	ERROR
1	18	19	1.7595778
2	2	3	2.2642794
3	9	21	3.7871685
4	22	23	5.1344080
5	11	13	5.2879553
6	5	6	5.3016167
7	9	17	6.6155567
8	15	16	7.6194649
9	20	22	7.8379679
10	2	18	10.303268
11	9	11	11.960709
12	1	2	13.718239
13	12	14	14.073013
14	8	9	17.548920
15	4	10	19.447754
16	7	12	20.597153
17	8	15	20.734985
18	5	8	31.052216
19	7	20	38.723618
20	1	7	55.795517
21	1	4	57.372391
22	1	5	126.05899



APPENDIX I
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