

VEGETATION
OF
EAST KLUANE PLANNING AREA

by

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Introduction

A survey of the vegetation was requested to supplement a previously conducted survey of the surficial materials in the East Klwane Planning Area by the Department of Renewable Resource, Government of Yukon to assist them in developing a management plan. The initial objective was to construct a map of the existing vegetation at a scale of 1:100,000. As the project developed, it was decided that some data on forestry potential be obtained.

This report describes the methods used for field sampling the vegetation and in gathering data on tree growth, the classification system used for the vegetation and an annotated list of the plant communities. The species listed with the communities is by no means exhaustive, only species that either occurred regularly with 5% or more cover or were abundant in one or more occurrences of the community were included. The plant communities listed are only tentative as overlap in species distribution occurred and many are in successional stages following fires and other disturbances. Still, those included seemed to follow the terrain types reasonably well.

Maps of the vegetation communities and the location of sample sites accompany this report.

The study was funded through a cooperational arrangement between the Government of Yukon and the Pacific Forest Research Centre.

Methods

Aerial photographs at a scale of approximately 1:50,000 taken in 1979 were obtained for interpretation and mapping the current vegetation. Normally, pretyping is conducted on the aerial photographs and desired sample sites marked before field work begins. In this study, the photographs were not obtained in time to allow this preliminary work; consequently, sampling sites were selected in a cursory manner. As many sites as possible were selected along roadways, but sites inaccessible by automobile were sampled using a helicopter. To permit at least some data to be collected from a large number of sample sites, a technique was adopted whereby photographs were taken at various heights above the vegetation by using a hand-held 35 mm camera from a helicopter. These series of photographs gave an overview of the vegetation from the higher heights and a view of the ground vegetation from the lowest height. Stops were made in various areas to document the species by coverage and height class. This photographic sampling technique allowed for many more samples to be taken in the allotted time than if a stop was made at each site.

Sites supporting trees were sampled for forest capability by using the prism method. At each site selected for sampling, three prism plots were measured using prism basal area factors of 2 or 5 m²/ha depending on tree density. The first prism plot was selected in a representative part of the vegetation type, the second plot was 30 m in a random direction from the first and the third plot was 30 m in a random direction from the second plot. At each plot a prism sweep was conducted and the trees tallied by species and diameters using calipers. From the three plots, between 8 and 12 sample trees representing all height

classes were selected and the height, diameter at 1.3 m and age at 0.3 m were measured. The physical plot parameters (slope, aspect, drainage, moisture regime and elevation) and reference data (stand density, species distribution, vegetation cover, stand history, terrain classification and location) were measured or estimated and recorded.

In the laboratory, height/diameter curves were devised for each species of tree using the sample trees. The heights from the curve for each diameter class and the B.C. Forest Inventory Division volume tables for zones K & L in northern B.C. were used to determine the volume of each tree in the plots. Using per hectare conversion factor constants, the number of trees per hectare in each diameter class was determined. Multiplying the number of trees/ha by the individual tree volume and adding the total volume/ha for each diameter class, gives the total volume per hectare. The basal area/ha, total number of trees/ha, average diameter, age and height are also calculated for each site. Mean annual increment (M.A.I.) based on volume, age and density is then calculated.

Based on the field sampling, the plant community boundaries were drawn on the aerial photographs and transferred to a base map. In order to reduce the number of plant communities to a reasonable number, communities on ecologically similar sites were grouped together. A bias towards trees enters at this point as sites differing only in tree species composition were kept separate, especially where the tree mix consisted of both deciduous and coniferous trees. Because of this grouping, the species composition of a particular community will vary from one site to the next but the site type or ecological position should be very similar.

The Vegetation Classification System

The system of vegetation classification used represents another stage in the development of a national system to cover Canada; consequently only part of the system is relevant to the East Kluane Planning Area. It is being developed for use with a hierarchical ecological land classification system, therefore it must also be hierarchical. This is achieved by a broad zonation categorization followed by a physiognomic description of the vegetation which is refined by modifiers for more detailed work (Table I). The prevailing secondary level or strata of vegetation is also indicated.

One advantage to this approach is that the physiognomic characteristics can usually be determined from aerial photographs while doing the pretyping without knowing what species may be present. The modifiers for the upper or dominant vegetation layer can also sometimes be determined from aerial photographs at scales of 1:70,000 or larger. Aerial photographs at scales of about 1:20,000 may be required for determining the character and modifiers of most secondary vegetation layers. Field checking is required to confirm the physiognomic description.

The actual plant community is then added, naming it according to the dominant or characteristic species. This normally requires field examination unless one is familiar with the species occurring in the area being mapped. The plant community can be added to the physiognomic description by using abbreviated plant names as is the case in this study (Table II) or by developing a numeric symbol. The advantage to species abbreviations is that one can recognize the community from the map much easier than referring to a list of numbers.

Table I

<u>Zone</u>	<u>Physiognomic Character</u>	<u>Modifiers</u>
1. Alpine		Density
2. Arctic	<u>Forest</u>	1. Closed > 80%
3. Subalpine	A. Coniferous	2. Open 50-80%
4. Subarctic	B. Deciduous	3. Scattered 20-50%
5. Montane	C. Mixed	4. Sparse < 20%
6. Boreal	<u>Woodland</u>	
7. Prairie	D. Coniferous	Height
8. Temperate	E. Deciduous	a. > 25 m
9. Maritime	F. Mixed	b. 10-25 m
10. Coastal	<u>Parkland</u>	c. 5-10 m
	G. Coniferous	d. 1.5-5 m
	H. Deciduous	e. 0.5-1.5 m
	I. Mixed	f. 0.1-0.5 m
	<u>Shrubland</u>	g. prostrate & trailing
	J. Shrubs	
	<u>Grassland</u>	
	K. Grass, tall	
	L. Grass, short	
	M. Graminoid	
	<u>Forbland</u>	
	N. Forbs	
	<u>Non-Vascular</u>	
	O. Bryophytes	
	P. Lichens	
	<u>Non-Vegetated</u>	
	X1 Glaciers and Snowfields	
	X2 Talus, Rocks, Rubble	
	X3 Eroding Banks	
	X4 Eroding Stream Channel	
	X5 Sand Dunes	

Table II

Species abbreviations used in naming plant communities

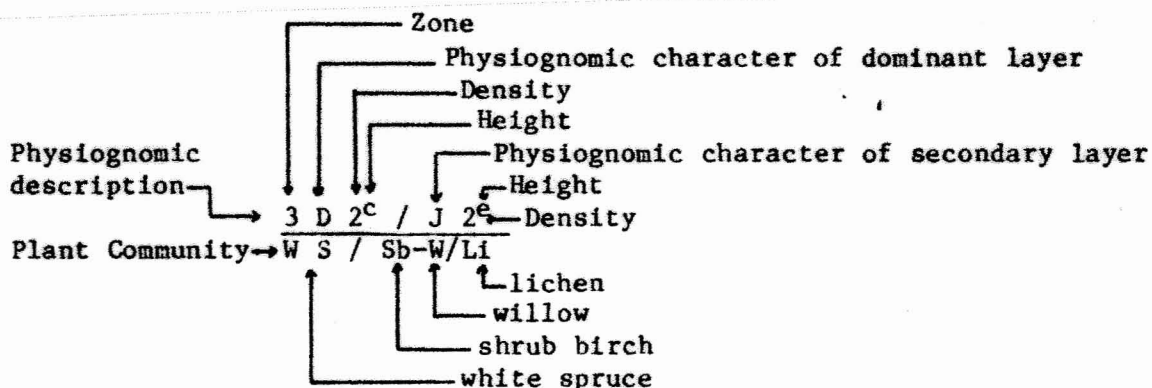
AF - Alpine fir
Bp - Balsam poplar
Bs - Black spruce
Lp - Lodgepole pine
TA - Trembling aspen
Ws - White spruce

bm - bog moss
dm - dryland moss
fm - feathermoss
wm - wetland moss
Li - lichen

Al - Alder
Bb - Bunchberry
D - Dryas
En - Crowberry
Ki - Kinnikinnick
Lb - Twinflower
Lg - Labrador tea
Ra - Rose
RL - Lapland rosebay
Sb - Shrub birch
Sc - Soapberry
Ve - High bush cranberry
Vv - Blueberry
W - Willow
Ww - Wormwood

Cc - Carex concinna
G - Grass
S - Sedge

The following example indicates how a map symbol would appear:



This symbol signifies a subalpine, coniferous, open, woodland with trees 5-10 m in height and a shrub understory with 50-80% cover and a height of 0.5-1.5 m composed of white spruce over shrub birch and willow with a recognizable ground layer of lichen.

Most terms used in the classification system are self-explanatory. The zones, however, may be somewhat confusing because the terms are variously used in the literature. As used here, they refer to large areas in a regional or biogeoclimatic sense. The category is useful for forming a mental image of the vegetation to be described.

Alpine refers to generally high elevation terrain, relative to latitude, and includes the area where the vegetation is low-growing, frequently prostrate, and often dominated by willows, dryas, ericaceous species and lichens. Shrubs usually are not more than 0.5 m in height, exceptions may occur in protected areas, and trees are generally absent with the possible exception of a few scattered, low-growing individuals. Wet areas normally support graminoid vegetation. The vegetation is often sparse on exposed or very rocky sites. This zone occurs on most mountain tops.

Arctic refers to low elevation terrain at high latitudes generally that north of the limits of trees, where the vegetation is dominated by graminoid species and various shrubs, most of which are willow, shrub birch and ericads. Most of the area is underlain with permafrost with a shallow active layer. Along the southern parts of this zone, shrub heights may be 1.5 m but decreases northward to below 0.5 m. Also the coverage of vegetation decreases northward with only a few scattered individuals occurring in the more extreme cases. This zone includes the Northern Coastal Plain in the Yukon and follows an irregular line to the north of Great Bear Lake crossing Hudson Bay near a middle line and to the south of Ungava Bay.

Subalpine includes the mountainous terrain from below alpine down to large valley bottoms and plateaus -- those large enough to support boreal vegetation. Alpine fir and shrub birch are primary constituents of this zone, but in some areas such as most of the East Kluane Planning Area, white spruce replaces alpine fir. Because of the ecotonal nature of this zone and the lack of alpine fir in some areas, it is difficult to define on a floristic basis. The upper limit may be considered as being where shrubs, primarily shrub birch, attain heights greater than 0.5 m with or without trees. The lower boundary is even more difficult to define as most of the boreal species for the northwestern boreal forest may be present, with the possible exceptions of black spruce and tamarack. The lower portion could for convenience be called the boreal-montane zone to include the lower slopes and foothills of mountainous terrain. In mapping practices, the division between subalpine and boreal often follows a physiographic break between mountain slope and valley or plateau.

Subarctic includes the broad ecotone between the Arctic and Boreal zones, or in some instances may meet the Subalpine Zone. The Subalpine Zone is associated with mountainous areas while the Subarctic Zone occurs on generally level to hilly terrain. Shrubs, primarily willow, shrub birch and ericads, may attain heights greater than 1.5 m, but are most commonly 0.5 to 1.5 m in height. Trees, when present, provide usually less than 50% cover and are mostly less than 5 m in height. The primary tree species are black and white spruce, tamarack and balsam poplar. This zone includes the Eagle Plains in the Yukon and follows a path of variable widths between the Arctic and Boreal zones to include Great Bear Lake on to Hudson Bay and part of northern Quebec.

Montane, as used in the current classification system, refers to the generally warmer and drier forest associated with mountains in south-central British Columbia as defined by Rowe in Forest Regions of Canada (1972). It may very well be that this zone should be expanded and subdivided into Boreal-montane, Coastal-montane and Southern-montane subzones.

The Boreal Zone includes the great expanse of coniferous dominated forest land stretching across Canada exclusive of the coastal forests. In general, white spruce and balsam fir form the climatic climax in this zone, but black spruce, tamarack, pine, aspen and birch are common species in seral stages or edaphic conditions. In the Yukon, however, the Boreal Zones is approaching its northern limits and the species composition and distribution differ somewhat from this zone to the south and east. Balsam fir does not occur here, and black spruce is often common on upland sites. Where permafrost is near the surface, black spruce can share dominance with white spruce in climax stands.

Lodgpole pine and aspen are primary seral species. White birch and balsam poplar are rather sporadic and, with few exceptions, are rarely prominent. As alluded to earlier, these same species occur on most mountain slopes and other northern areas not typical of boreal forest land making the distinctions among boreal, montane, subalpine and subarctic difficult to define.

The other zones do not occur in the Yukon. Prairie refers to the grass dominated lands, primarily those of southern Alberta, Saskatchewan and Manitoba, Temperate refers to the deciduous forest zone of southern Ontario. Maritime includes the lands near the Atlantic Ocean and Coastal to those of the Pacific Ocean.

As for the Physiognomic Character in the classification system, some confusion may occur among the terms "forest", "woodland" and "parkland". Forest is meant to refer to stands possessing more than 50% tree cover, usually with trees greater than 5 m in height. A woodland has up to 50% tree cover with fairly evenly spaced trees, or higher coverage if mature trees are less than 5 m in height. A parkland has trees occurring with a clumped distribution, usually the overall tree cover is less than 50% but may sometimes be slightly higher. The term, "parkland", has zonal significance to include the aspen parkland of the prairie provinces, but at this time is not used in that sense. Grassland and Forbland may eventually be combined under one heading but the separation between grass and forb dominated meadows will remain.

Plant Communities

- D-G/Li Dryas-grass/lichen: *Dryas integrifolia* - *D. octopetala*
Hierochlae alpina - *Poa* spp. - *Alectoria ochroleuca* - *A.*
nigricans - *Thamnotia vermicularis*, *Salix* spp., *Silene*
acaulis, *Saxifraga tricuspidata*, *Racomitrium canescens*,
Cetraria spp., *Sterocaulon tomentosum*. Occurs on alpine
peaks and exposed upper slopes; has a sparse vegetative
cover.
- W-Sb-D/Li Willow-shrub birch-dryas/lichen: *Salix* spp. - *Betula*
nana - *B. glandulosa* - *Dryas integrifolia* - *D. octopetala*
Cetraria nivalis - *C. cucullata* - *C. islandica* - *C.*
Richardsonii - *Dactylina arctica* - *Cladonia mitis* - *C.*
uncialis - *Thamnotia vermicularis* - *Icmadophila*
ericetorum, *Saxifraga* spp., *Pedicularis* spp., *Aconitum*
delphinifolium, *Vaccinium uliginosum*, *V. vitis-idaea*.
Occurs on upper mountain slopes and plateaus; shrubs are
mostly prostrate; vegetation distribution usually sparse
to scattered.
- W-Sb-D/G Willow-shrub birch-dryas/grass: very similar to W-Sb-D/Li
but *Hierochlae alpina*, *Poa* spp. and other grass is much
more abundant than lichens. Occurs in somewhat more
moist sites than W-Sb-D/Li such as lee sides of alpine
peaks and pockets where snow accumulates.

Sb-W/Li

Shrub birch-willow/lichen: *Betula glandulosa* - *Salix* spp.
Cetraria nivalis - *C. cucullata* - *C. islandica* - *C.*
Richardsonii - *Cladonia mitis* - *C. uncialis* - *C.*
rangiferina - *C. stellaris* - *Dactylina arctica*, *Ledum*
groenlandicum, *Vaccinium uliginosum*, *V. vitis-idaea*,
Empetrum nigrum, *Arctostaphylos alpina*, *A. rubra*,
Pedicularis spp., *Pyrola* spp., *Cornicularia muricata*,
Sterocaulon tomentosum. A very common type in lower
alpine and upper subalpine zones; shrub heights of
0.1-1.5 m most common.

W-Sb/G

Willow-shrub birch/grass: this presents two types, one
occurring at higher elevations on mesic sites is similar
to Sb-W/Li except that grass replaces the lichens,
vegetative cover can be closed and the moisture regime is
more moist; the other occurs on dry, exposed, lower
elevation sites, rock outcrops and eroding streams banks
with sparse to scattered vegetative cover and may have
Arctostaphylos uva-ursi, *Saxifraga tricuspidata*, *Carex*
concinna, *Linnaea borealis*, *Rosa acicularis*, *Shepherdia*
canadensis, *Dryas* spp., etc. associated with it.

Sb-W/Bb-G

Shrub birch-willow/bunchberry-grass: similar to, and
perhaps ecologically equivalent to, the higher elevation
form of W-Sb/G but has a high coverage of *Cornus*
canadensis; seems to occur where there is a high organic
matter content in the upper soil horizons, and may
represent a more mature phase.

- W-Sb/G-Li Willow-shrub birch/grass-lichen: An apparent combination of Sb-W/Li and W-Sb/G but only occurs in the alpine zone on exposed sites where the vegetation cover is sparse to scattered and shrub heights are less than 0.5 m.
- Sb-W/Ki Shrub birch-willow/kinnikinnick: *Betula glandulosa* - *Salix glauca*/*Arctostaphylos uva-ursi*, *Shepherdia canadensis*, *Alnus crispa*, *Ledum groenlandicum*, *Vaccinium vitis-idaea*, *Festuca altaica*, *Calamagrostis* spp., *Carex concinna*, *Hylocomium splendens*, *Abietinella abietina*, *Dicranum* spp., *Rhacomitrium canescens*. Occurs on dry, sandy soils in the subalpine and boreal zones; the ground vegetation is usually sparse to scattered; possibly successional to white spruce/kinnikinnick type at least at lower elevations.
- Ki/Li Kinnikinnick/lichen: *Arctostaphylos uva-ursi*/*Cladonia mitis* - *C. stellaris* - *C. rangiferina* and occasionally *Cetraria nivalis*. *Rhacomitrium canescens* may be present. Has few other species but those listed for Sb-W/Ki may be present. Occurs on very sandy, loose soil; vegetation cover is sparse to scattered.
- Sb-Lg-Vu/bm Shrub birch-Labrador tea-alpine blueberry/bog moss; *Betula nana* - *B. glandulosa* - *Ledum decumbens* - *Vaccinium uliginosum*/*Tomenthypnum nitens* - *Aulacomnium turgidum* - *A. palustre* - *Drepanocladus uncinatus*, *Arctostaphylos*

alpina, *A. rubra*, *Cassiope tetragona*, *Empetrum nigrum*, *Pedicularis* spp. Occurs in moist to wet depressions mostly in alpine and high subalpine zones.

W-Sb-Lg/bm Willow-shrub birch-Labrador tea/bog moss: *Salix* spp. - *Betula glandulosa* - *Ledum groenlandicum*/ *Tomenthypnum nitens* - *Aulacomnium turgidum* - *A. palustre*, *Drepanocladus uncinatus*, *Potentilla fruticosa*, *Vaccinium uliginosum*, *Arctostaphylos rubra*, *A. alpina*, *Pedicularis* spp., *Empetrum nigrum*, various graminoid species. Occurs in moist depressions and on seepage slopes arising from frost melting in the subalpine zone.

Sb-Lg/Li-bm Shrub birch-Labrador tea/lichen-bog moss: Very similar to Sb-Lg-Vu/bm except that blueberry is absent or very sparse and lichens are common to abundant, frequently growing on the moss. Occurs in wet sites that have deep organic matter accumulations and permafrost.

W-Lg/G/bm Willow-Labrador tea/grass/bog moss: *Salix glauca* - *Ledum groenlandicum*/*Festuca altaica* - *Calamagrostis purpurescens* - *Poa* spp./*Tomenthypnum nitens* - *Aulacomnium palustre* - *A. turgidum*, *Potentilla fruticosa*, *Arctostaphylos rubra*, *Pedicularis* spp., *Vaccinium vitis-idaea*, *Geocaulon lividum*, *Empetrum nigrum*, *Betula glandulosa*. Occurs in very moist sites, often associated with long persisting seasonal frost, on till soils.

- Sb-Vu/S/bm Shrub birch-alpine blueberry/sedge/bog moss: Similar to Sb-Lg-Vu/bm and W-Lg/G/bm but has a pronounced layer of Carex with Eriophorum spp., Tofieldia spp. and Juncus spp. frequently common. Occurs in wet alpine and high subalpine sites with free water at or near the surface for much of the growing season.
- Sb-Vu/S Shrub birch-alpine blueberry/sedge: very similar to Sb-Vu/S/bm but lacks the bog moss development. Occurs on much the same sites but the free water remains above the soil surface for a longer period which retards the development of bog moss.
- W-Lg/S Willow-Labrador tea/sedge: Salix spp. - Ledum groenlandicum/Carex spp., Betula glandulosa, Potentilla fruticosa, Vaccinium uliginosum, V. vitis-idaea, Alnus crispa, Eriophorum spp., Tofieldia spp., Scirpus spp., Juncus spp., Drepanocladus uncinatus. Occurs in wet subalpine and boreal depressions or lowlands with ample free water near the surface for much of the growing season.
- W-Lg/S/bm Willow-Labrador tea/sedge/bog moss: very similar to W-Lg/S but has a well developed bog moss layer of Tomenthypnum nitens and Aulacomnium turgidum. Probably represents a successional stage more advanced than W-Lg/S as there is more organic material which allows the bog

moss to develop on the drier surface.

- Sb-Rl/S Shrub birch-Lapland rosebay/sedge: *Betula glandulosa* -
Rhododendron lapponicum/*Carex* spp., *Ledum groenlandicum*,
Vaccinium uliginosum, *V. vitis-idaea*, *Potentilla*
fruticosa, *Empetrum nigrum*, *Salix* spp., *Arctostaphylos*
rubra, *Dryas* spp., *Eriophorum* spp. Occurs in very moist
to wet areas with deep organic blankets mostly in the
Burwash to Donjek River area.
- W/S/wm Willow/sedge/wetland moss: *Salix* spp./*Carex* spp./
Fontinalis antipyretica - *Drepanocladus uncinatus* -
Rhizomnium glabrescens, *Betula glandulosa*, *Ledum*
groenlandicum, *Empetrum nigrum*, *Arctostaphylos rubra*,
Eriophorum spp. Occurs in fens.
- Sw Sedge wetland: *Carex aquatilis*, *Juncus arcticus*,
Triglochin palustre, *Eriophorum* spp., *Rhizomnium*
glabrescens, *Fontinalis antipyretica*, *Drepanocladus*
uncinatis, *Betula glandulosa*, *Potentilla fruticosa*, *Ledum*
groenlandicum. Occurs in fens; the sedge may constitute
80% or more of vegetative cover.
- W/w Willow/willow: Mostly *Salix glauca*/*Salix myrtilifolia*
with *Potentilla fruticosa*, *Fragaria virginiana*, *Carex*
spp., *Festuca altaica*, *Calamagrostis purpurescens*,
Peltigera aphthosa. Occurs on moderately well to

imperfectly drained sites and is successional to white spruce but sometimes has aspen and lodgepole pine regeneration.

W-Sb Willow-shrub birch: *Salix glauca*-*Betula glandulosa* with a variable, inconsistent, usually sparse understory. Occurs on rock outcrops and eroding slopes and is successional to white spruce communities in most places.

W-Sb/En Willow-shrub birch/crowberry: *Salix* spp. - *Betula glandulosa*/*Empetrum nigrum*, *Ledum groenlandicum*, *Linnaea borealis*, *Juniperus communis*, *Arctostaphylos uva-ursi*, *Vaccinium vitis-idaea*, *Cornus canadensis*. Occurs on moist to dry till sites in subalpine and boreal-montane areas. Appears stable.

W/Lb Willow/twinflower: *Salix glauca*/*Linnaea borealis*, *Rosa acicularis*, *Arctostaphylos rubra*, *Lupinus arcticus*, *Shepherdia canadensis*, *Ledum groenlandicum*, *Mertensia paniculata*, *Abietinella abietina*. Occurs on various disturbed, usually burnt, sites and is probably successional to white spruce/feathermoss.

Ww/G Wormwood/grass: *Artemisia frigida*/*Calamagrostis purpurascens*, *Agropyron caninum*, *A. yukonense*, *Poa* spp., *Festuca altaica*, *Rosa acicularis*, *Juniperus communis*, *J. horizontalis*, *Arctostaphylos uva-ursi*, *Saxifraga*

tricuspidata, Pentstemon procerus, P. Gormanii. Occurs on steep, dry slopes and excessively drained soils.

- W/Ww-G Willow/wormwood-grass: very similar to Ww/G but has taller shrubs dominated by willow scattered throughout.
- WS/Sb-W White spruce/shrub birch-willow: Picea glauca/Betula glandulosa - Salix spp., with no other consistent species constituting more than 1% of cover, but usually has a poorly developed moss layer of mixed feathermoss and bog moss types. Possibly is successional to WS/Sb-Lg/bm.
- AF-WS/Sb-W Alpine fir-white spruce/shrub birch-willow: Abies lasiocarpa - Picea glauca/Betula glandulosa-Salix glauca; has no other consistent species constituting more than 1% cover but sometimes has a thin lichen layer; occurs only in southern part of study area.
- WS/Al White spruce/alder: Picea glauca/Alnus crispa, Salix spp., Betula glandulosa, Shepherdia canadensis, with virtually no ground vegetation. Occurs in areas flooded probably annually.
- BP/Al Balsam poplar/alder: Similar to and intermixed with WS/Al but Populus balsamifera is the dominant tree species; usually has white spruce regeneration.

- WS-BP/Sc White spruce-balsam poplar/soapberry: *Picea glauca*-*Populus balsamifera*/*Shepherdia canadensis*, *Viburnum edule*, *Salix* spp., with a very sparse cover of other species. Occurs on well drained soils with high water tables for much of the year.
- WS-TA/Sc White spruce-trembling aspen/soapberry: *Picea glauca* - *Populus tremuloides*/*Shepherdia canadensis*, *Cornus canadensis*, *Viburnum edule*, *Betula glandulosa*, *Vaccinium uliginosum*, *Salix* spp., *Peltigera aphthosa*. Most often occurs on lacustrine materials but also on slopes.
- WS/Sb-Lg White spruce/shrub birch-Labrador tea: *Picea glauca*/*Betula glandulosa*-*Ledum groenlandicum*, *Potentilla fruticosa*, *Salix* spp., *Vaccinium uliginosum*, *V. vitis-idaea*, *Empetrum nigrum*, *Arctostaphylos rubra*, *Pedicularis* spp., *Carex* spp. Occurs on very moist to wet sites.
- WS-BP/Sb-Lg White spruce-balsam poplar/shrub birch-Labrador tea, *Picea glauca* - *Populus balsamifera*/*Betula glandulosa* - *Ledum groenlandicum*, *Populus tremuloides*, *Salix* spp., *Shepherdia canadensis*, *Empetrum nigrum*, *Vaccinium uliginosum*, *V. vitis-idaea*. Occurs on moist sites that are moderately well or imperfectly drained; probably successional to WS/Sb-Lg/bm.

- BP/Sb-W Balsam poplar/shrub birch-willow: *Populus balsamifera*/*Betula glandulosa*-*Salix* spp., *Populus tremuloides*, *Picea glauca*, *Shepherdia canadensis*, *Ledum groenlandicum*, *Rosa acicularis*, *Vaccinium uliginosum*, *V. vitis-idaea*, *Linnaea borealis*. A successional stage to WS/Sb-W/fm.
- TA-WS/Sb-En Trembling aspen - white spruce/shrub birch-crowberry: *Populus tremuloides* - *Picea glauca*/*Betula glandulosa* - *Empetrum nigrum*, *Ledum groenlandicum*, *Salix* spp., *Arctostaphylos uva-ursi*, *Festuca altaica*, *Calamagrostis* spp., *Lycopodium annotinum*. A successional community with aspen and willow dying out.
- WS/W-En White spruce/willow-crowberry: Similar to TA-WS/Sb-En and is successional after fire to possibly WS/fm.
- TA/Sc-Ve Trembling aspen/soapberry-high bush cranberry: *Populus tremuloides*/*Shepherdia canadensis*-*Viburnum edule*, *Picea glauca*, *Populus balsamifera*, *Salix* spp., *Vaccinium uliginosum*, *V. vitis-idaea*, *Linnaea borealis*, *Hedysarum alpinum*, *Geocaulon lividum*, *Cornus canadensis*. A successional stage, probably to WS/Lb/fm.
- WS/Lg-Vu White spruce/Labrador tea-Alpine blueberry: *Picea glauca*, *Ledum groenlandicum*-*Vaccinium uliginosum*, *V. vitis-idaea*, *Potentilla fruticosa*, *Empetrum nigrum*, *Arctostaphylos*

rubra, *Tomenthypnum nitens*, *Aulacomnium turgidum*, *A. palustre*. Occurs on cool, moist sites in subalpine and boreal montane zones; probably a variant of WS/Sb-Lg/bm or WS/W-Vu/bm with a poorly developed bog moss layer.

TA/Lg-En

Trembling aspen/Labrador tea-crowberry: *Populus tremuloides*/*Ledum groenlandicum*-*Empetrum nigrum*, *Populus balsamifera*, *Picea glauca*, *Salix* spp., *Betula glandulosa*, *Potentilla fruticosa*, *Vaccinium uliginosum*, *V. vitis-idaea*. Occurs on moist to wet sites in the boreal and boreal-montane areas; probably successional to WS/Sb-Lg/bm.

WS-TA/Lg-En

White spruce-trembling aspen/Labrador tea-crowberry: Virtually the same as TA/Lg-En but white spruce constitutes more than 20% of the tree canopy.

TA/W

Trembling aspen/willow: *Populus tremuloides*/*Salix* spp., *Picea glauca*, *Populus balsamifera*, *Betula glandulosa*, *Ledum groenlandicum*, *Juniperus communis*, *Arctostaphylos uva-ursi*, *Epilobium angustifolium*, *Festuca altaica*, *Calamagrostis purpurescens*; *Lycopodium* spp., *Peltigera* spp. A community of variable composition occurring on rock outcrops, windblown knolls and kame deposits. Probably successional to WS/Sb-W/G.

- TA-WS/W Trembling aspen - white spruce/willow: Very similar to TA/W but has more white spruce. Occurs following fire on till slopes.
- BP-WS/W Balsam poplar-white spruce/ willow: Very similar to TA-WS/W but balsam poplar is more abundant than aspen. Occurs on alluvium, till or stabilized sand dunes following a disturbance.
- LP/W Lodgepole pine/willow: *Pinus contorta*/*Salix glauca*, *Arctostaphylos uva-ursi*, *Shepherdia canadensis*, *Cornus canadensis*, *Linnaea borealis* with various mosses, lichens and grasses providing low density ground cover; usually has white spruce regeneration and willow is dying out. Occurs along eastern part of area; successional following fire to WS/Lb/fm.
- LP/En-Vv Lodgepole pine/crowberry-alpine blueberry: *Pinus contorta*/*Empetrum nigrum*, *Vaccinium uliginosum*, *V. vitis-idaea*, *Picea glauca*, *Populus tremuloides*, *Ledum groenlandicum*, *Salix glauca*, *Betula glandulosa*, *Linnaea borealis*, *Hylocomium splendens*. Successional to a white spruce community, probably WS/Lg-En/fm.
- WS/S White spruce/Sedge: *Picea glauca*/*Carex* spp., *Betula glandulosa*, *Potentilla fruticosa*, *Salix* spp., *Ledum groenlandicum*, *Empetrum nigrum*, *Drepanocladus uncinatus*.

The primary characteristic is the scarcity of shrubs, although usually present they are widely scattered; occurs in wet areas in the boreal zone.

WS/Sb-Lg/S White spruce/shrub birch-Labrador tea/sedge: *Picea glauca*/*Betula glandulosa*-*Ledum groenlandicum*/*Carex* spp., *Potentilla fruticosa*, *Vaccinium uliginosum*, *V. vitis-idaea*, *Arctostaphylos rubra*, *Empetrum nigrum*, *Eriophorum* spp., *Equisetum scirpoides*. Occurs on seepage slopes and in depressions.

WS/Sb-Rl/S White spruce/shrub birch-Lapland rosebay/sedge: Very similar in most respects to WS/Sb-Lg/S but *Rhododendron lapponicum* is prevalent and there is often more organic matter accumulation. Only occurs in western part of study area at lower elevations.

WS-BS/Sb-Lg/S White spruce-black spruce/shrub birch-Labrador tea/sedge: Virtually the same as WS/Sb-Lg/S except that *Picea mariana* is also present, permafrost may be a greater factor; only occurs in western part of study area.

WS/W-Lg/S White spruce/willow-Labrador tea/sedge: Similar to WS/Sb-Lg/S but *Salix* spp. (mostly *S. glauca* and *S. myrtillofolia*) dominate the shrub layers; occurs on somewhat drier sites and is a successional stage following fire.

- WS-LP/W/S White spruce-lodgepole pine/willow/sedge: Appears to be very similar to WS/W-Lg/S except that *Pinus contorta* is present in the tree layer; occurs only in the eastern part of study area and is a successional stage following fire, probably to WS/Sb-Lg/S or WS/Sb-Lg/bm.
- BS-TA/Sb-Lg/S Black spruce-trembling aspen/shrub birch-Labrador tea/sedge: *Picea mariana*-*Populus tremuloides*/*Betula glandulosa*-*Ledum groenlandicum*/*Carex* spp., *Picea glauca*, *Salix* spp., *Potentilla fruticosa*, *Empetrum nigrum*, *Pedicularis* spp., *Tomenthypnum nitens*, *Hylocomium splendens*. Similar to WS/Sb-Lg/S except for tree cover, only occurs in western part of study area, probably a successional stage to WS-BS/Sb-Lg/S.
- WS-TA/Lg/S White spruce-trembling aspen/Labrador tea/sedge: ecologically equivalent to other treed communities with Sb-Lg/S undergrowth but differs in tree composition; it is successional to WS/Sb-Lg/S.
- WS-TA/W/S White spruce-trembling aspen/willow/sedge: *Picea glauca* - *Populus tremuloides*/*Salix glauca*/*Carex* spp., *Ledum groenlandicum*, *Potentilla fruticosa*, *Betula glandulosa*, *Empetrum nigrum*, *Vaccinium uliginosum*, *V. vitis-idaea*. Occupies sites only slightly drier than WS/Sb-Lg/S and is probably successional to it as willow and aspen are dying out in most occurrences.

- WS-BP/W/S White spruce-balsam poplar/willow/sedge: virtually the same as WS-TA/W/S except that *Populus balsamifera* replaces *Populus tremuloids*.
- BP/S Balsam poplar/sedge: *Populus balsamifera*/*Carex* spp., *Populus tremuloides*, *Picea glauca*, *Salix* spp., *Ledum groenlandicum*, *Vaccinium vitis-idaea*, *Calamagrostis* spp., *Poa* spp., *Hylocomium splendens*. Occurs in or associated with fens and appears successional to WS/Sb-Lg/bm or WS/Lg-En/fm.
- WS/Lg/S-wm White spruce/Labrador tea/sedge-wetland moss: *Picea glauca*/*Ledum groenlandicum*/*Carex* spp. - *Fontinalis antipyretica*-*Drepanocladus uncinatus*, *Potentilla fruticosa*, *Salix* spp., *Betula glandulosa*, *Empetrum nigrum*, *Ranunculus* spp., *Eriophorum* spp., *Rhizomnium glabrescens*. Occurs in valleys and depressions with free water at the surface for most of growing season; the shrub layer is thin, mostly on hummocks elevated above the general free water level.
- WS/Sb-Lg/bm White spruce/shrub birch-Labrador tea/bog moss: *Picea glauca*/*Betula glandulosa*-*Ledum groenlandicum*/*Tomentothnum nitens*-*Aulacomnium* spp. - *Drepanocladus uncinatus*, *Potentilla fruticosa*, *Salix* spp., *Vaccinium uliginosum*, *V. vitis-idaea*, *Empetrum nigrum*, *Arctostaphylos rubra*, *Pedicularis* spp., *Carex* spp.

Occurs on very moist to wet sites but free water remains below surface most of growing season.

WS-BS/Sb-Lg/bm White spruce-black spruce/shrub birch-Labrador tea/bog moss: the same as WS/Sb-Lg/bm but *Picea mariana* is a component of the tree layer, only occurs in western part of study area.

WS/Sb-RI/bm White spruce/shrub birch-Lapland rosebay/bog moss: essentially equivalent to WS/Sb-Lg/bm but *Rhododendron lapponicum* is a prominent constituent and *Ledum groenlandicum*, although present, was sparse. Always associated with organic matter 3 dm or more deep; only occurs in western part of study area.

WS-TA/Lg/bm White spruce-trembling aspen/Labrador tea/bog moss; Very similar, ecologically to WS/Sb-Lg/bm but has *Populus tremuloides* forming a significant amount of arboreal cover.

WS-BP/W-Lg/bm White spruce-balsam poplar/willow-Labrador tea/bog moss: Very similar, and probably successional to WS/Sb-Lg/bm, but has *Populus balsamifera* in the tree canopy and *Salix glauca* was more abundant than *Betula glandulosa*.

WS-TA/W/bm White spruce-trembling aspen/willow/bog moss: *Picea glauca*-*Populus tremuloides*/*Salix glauca*/*Tomentothnum*

nitens-Aulacomnium turgidum, Shepherdia canadensis, Empetrum nigrum, Mertensia paniculata, Pedicularis lapponica, Pyrola asarifolia, P. secunda, Fragaria virginiana, Festuca altaica, Carex spp., Hylocomium splendens, Peltigera aphthosa. Occurs on imperfectly drained soils in southern and eastern parts of study area; a successional stage with poorly developed understory and ground vegetation which may eventually go to WS/Lg-En/fm.

WS-LP/Lg/bm White spruce-lodgepole pine/Labrador tea/bog moss: A rather variable community of limited extent occurring in the southeastern (Kusawa Lake) portion of the study area; probably successional to WS/Sb-Lg/bm.

WS/W-Vu/bm White spruce/willow-alpine blueberry/bog moss: occurs mostly in subalpine and has a scattered tree density, it is otherwise similar to WS/Sb-Lg/bm but will not develop to it if the canopy remains open.

WS/fm White spruce/feathermoss: Picea glauca/Abietinella abietina-Hylocomium splendens-Pleurozium schreberi-Ptilium crista-castrensis, Vaccinium vitis-idaea, Linnaea borealis, Cornus canadensis, Geocaulon lividum, Pyrola spp., Peltigera aphthosa. The shrub and forb layers are poorly developed, being absent in some places; a stable community on mesic sites and normally has trees >10 m in

height and/or > 70% canopy cover, with some exceptions.

- WS-TA/fm White spruce-trembling aspen/feathermoss: A successional stage to WS/fm occupying similar sites and has a more variable understory layer in which *Rosa acicularis*, *Viburnum edule*, *Arctostaphylos uva-ursi*, *Epilobium angustifolium*, *Festuca altaica*, *Calamagrostis* spp., may be present.
- WS-BP/fm White spruce-balsam poplar/feathermoss: equivalent to WS-TA/fm but *Populus balsamifera* replaces *Populus tremuloides*, although both are sometimes present, and may also have *Salix glauca* in the shrub layer.
- WS/Sb-W/fm White spruce/shrub birch-willow/feathermoss: *Picea glauca*/*Betula glandulosa*-*Salix glauca*/*Hylocomium splendens*-*Abietinella abietina*-*Pleurozium schreberi*, *Ledum groenlandicum*, *Shepherdia canadensis*, *Arctostaphylos rubra*, *Empetrum nigrum*, *Lupinus arcticus*, *Pyrola* spp., *Dicranum* spp., *Peltigera aphthosa*, *Cetraria nivalis*, *Cladonia mitis*. Occurs in subalpine and northerly aspects in the boreal zone, the relative amounts of shrub birch and willow are variable but both are usually present.
- WS/Lg-En/fm White spruce/Labrador tea-crowberry/feathermoss: occupies sites somewhat wetter than WS/fm and seems to be ecotonal

between this and WS/Sb-Lg/bm as associated species from both communities are represented here to a greater or lesser extent, *Ledum groenlandicum* and/or *Empetrum nigrum* currently dominate the shrub layer.

WS-LP/En/fm White spruce-lodgepole pine/crowberry/feathermoss:
probably equivalent to WS/Lg-En/fm but has *Pinus contorta* in the tree layer, with very limited distribution and *Empetrum nigrum* was the dominant shrub species.

WS-BP/En/fm White spruce-balsam poplar/crowberry/feathermoss:
ecologically very similar to WS/Lg-En/fm but has *Populus balsamifera* and sometimes *P. tremuloides* in the tree layer, the shrub layer was variable with *Empetrum nigrum* being the only consistent species providing a significant amount of cover.

WS/Lb/fm White spruce/twinflower/feathermoss: represents the drier parts of the WS/fm spectrum and the feathermoss layer may be thin and discontinuous; may have *Lupinus arcticus*, *Arctostaphylos uva-ursi*, *Peltigera canina*, *Zygadenus elegans*, *Pulsatilla patens* and various grasses associated with it.

WS-TA/Sc/fm White spruce-trembling aspen/soapberry/feathermoss:
Similar to WS/Lb/fm except that *Populus tremuloides* is present and *Shepherdia canadensis* is more abundant than

Linnaea borealis; soils are usually somewhat more sandy and may be nutritionally poorer; *Pinus contorta* is often present in the eastern part of the study area.

- WS-BP/Sc/fm White spruce-balsam poplar/soapberry/feathermoss: The same as WS-TA/Sc/fm except that *Populus balsamifera* replaces *P. tremuloides* as the dominant deciduous component.
- WS/Al/fm White spruce/alder/feathermoss: *Picea glauca*/*Alnus crispa*/*Hylocomium splendens*-*Abietinella abietina*, *Shepherdia canadensis*, *Arctostaphylos rubra*, *Carex* spp., *Tomenthypnum nitens*, *Equisetum* spp. Occurs on bars and beaches of alluvial channels; probably successional to WS/fm.
- WS-BP/Al/fm White spruce-balsam poplar/alder/feathermoss: the same as WS/Al/fm except that *Populus balsamifera* is present in the tree layer; *P. tremuloides* may also be present but provides less coverage than *P. balsamifera*.
- WS/W/Cc White spruce/willow/dryland sedge: *Picea glauca*/*Salix* spp./*Carex concinna*, *Populus balsamifera*, *P. tremuloides*, *Pinus contorta*, *Shepherdia canadensis*, *Ledum groenlandicum*, *Arctostaphylos uva-ursi*, *Vaccinium vitis-idaea*, *Linnaea borealis*, *Lupinus arcticus*, *Festuca altaica*, *Tortula* spp., *Abietinella abietina*, *Hylocomium*

splendens. Occurs on fairly dry sites and appears to be seral to WS/Lb/fm.

WS/Ki White spruce/kinnikinnick: *Picea glauca*/*Arctostaphylos uva-ursi*, *Populus balsamifera*, *Empetrum nigrum*, *Vaccinium uliginosum*, *V. vitis-idaea*, *Juniperus communis*, *Lupinus arcticus*, *Hedysarum alpinum*, *Zygadenus elegans*, *Pulsatilla patens*, *Calamagrostis* spp., *Poa* spp., *Agropyron* spp., *Carex concinna*, *Tortula ruralis*. Occurs on dry, sandy soil mostly of aeolian origin.

TA/Ki Trembling aspen/kinnikinnick: much the same as WS/Ki except that *Populus tremuloides* dominates the tree stratum and it often has *Rosa acicularis*, *Shepherdia canadensis* and *Salix glauca* present; a successional stage to WS/Ki or WS/W-Sc/Ki.

LP/Ki Lodgepole pine/kinnikinnick: similar to WS/Ki except that *Pinus contorta* is the dominant tree species, *Picea glauca* and *Populus tremuloides* may also be present but provides little coverage; successional, probably to WS/Ki.

WS/W-Sc/Ki White spruce/willow-soapberry/kinnikinnick: *Picea glauca*/*Salix glauca*-*Shepherdia canadensis*/*Arctostaphylos uva-ursi*, *Populus tremuloides*, *Betula glandulosa*, *Vaccinium vitis-idaea*, *Hedysarum alpinum*, *Zygadenus elegans*, *Pulsatilla patens*, *Festuca altaica*,

Calamagrostis spp., *Poa* spp., *Carex concinna*, *Tortula ruralis*, *Dicranum* spp., *Peltigera canina*. Occurs on dry sites, tree density is open to scattered

WS-TA/W/Ki White spruce-trembling aspen/willow/kinnikinnick: Similar to WS/W-Sc/Ki, but *Populus tremuloides* is common to dominant in the tree layer, and is probably successional to it.

WS-BP/W/Ki White spruce-balsam poplar/willow/kinnikinnick: the same as Wg-TA/W/Ki but *Populus balsamifera* is more abundant than *P. tremuloides*.

TA/W-Lg/Ki Trembling aspen/willow-Labrador tea/kinnikinnick; *Populus tremuloides*/*Salix glauca*-*Ledum groenlandicum*/
Arctostaphylos uva-ursi, *Populus balsamifera*, *Picea glauca*, *Vaccinium vitis-idaea*, *Lupinus arcticus*,
Epilobium angustifolium, *Zygadenus elegans*, *Festuca* spp.,
Calamagrostis spp., *Agropyron* spp., *Peltigera canina*.
Similar to WS/W-Sc/Ki but has a proportionately higher cover of *Ledum* which may be related to the nearly pure aspen tree cover.

WS-LP/Ki-Li White spruce-lodgepole pine/kinnikinnick-lichen: *Picea glauca*-*Pinus contorta*/*Arctostaphylos uva-ursi* - *Cladonia mitis* - *C. rangiferina* - *C. stellaris* - *Cetraria nivalis*-*Cladonia* spp., *Populus tremuloides*, *Salix glauca*,

Vaccinium vitis-idaea, *Epilobium angustifolium*, *Zygadenus elegans*, *Hedysarum alpinum*, *Rhacomitrium canescens*, *Peltigera canina*. Had limited distribution and its ecological relationship could not be determined.

WS-TA/Ki-G White spruce-trembling aspen/kinnikinnick-grass: *Picea glauca*-*Populus tremuloides*/*Arctostaphylos uva-ursi*-*Festuca* spp. -*Calamagrostis* spp.-*Trisetum* spp. -*Poa* spp., *Pinus contorta*, *Linnaea borealis*, *Epilobium angustifolium*, *Zygadenus elegans*, *Carex concinna*, *Tortula ruralis*, *Cladonia* spp., *Peltigera canina*. A community occupying a mid point between WS/Ki and WS/G and is probably successional to one of them; it has characteristics of both of these communities.

WS-BP/Ki-G White spruce-balsam poplar/kinnikinnick-grass: much the same as WS-TA/Ki-G but *Populus balsamifera* is more abundant than *P. tremuloides*.

WS-LP/Ki-G White spruce-lodgepole pine/kinnikinnick-grass: Similar to above communities but *Pinus contorta* constitutes a significant amount of the tree cover and there are minimal deciduous trees.

LP-TA/Ki-G Lodgepole pine-trembling aspen/kinnikinnick-grass: Similar to above but *Pinus contorta* and *Populus tremuloides* dominate the tree layer; *Picea glauca* is

often present but mostly in the regeneration layers.

WS/G

White spruce/grass: *Picea glauca*/*Festuca altaica*-
Calamagrostis purpurescens-*Poa* spp.-*Agropyron*
caninum - *Bromus pumpellianus*, *Arctostaphylos uva-ursi*,
Linnaea borealis, *Salix glauca*, *Juniperus horizontalis*,
J. communis, *Zygadenus elegans*, *Pulsatilla patens*.
Occurs on medium textured, relatively dry, often
calcareous soils.

TA-WS/G

Trembling aspen-white spruce/grass: much the same as WS/G
but has *Populus tremuloides* adding a significant amount
of tree cover.

WS-BP/G

White spruce-balsam poplar/grass: same as above but
Populus balsamifera replaces most of the *P. tremuloides*.

LP-WS/G

Lodgepole pine-white spruce/grass: similar to above but
has a significant component of *Pinus contorta* and very
few or no deciduous trees.

TA/G

Trembling aspen/grass: similar to above but *Populus*
tremuloides is the sole dominant species in the arboreal
layer, may have some *P. balsamifera* in the canopy and
Picea glauca is often a component of the regeneration
layers; a seral stage to WS/G or WS/fm.

WS/W-Sb/G

White spruce/willow-shrub birch/grass: *Picea glauca*/*Salix* spp.- *Betula glandulosa*/*Festuca altaica*-*Poa* spp. -

Calamagrostis spp.- *Trisetum* spp., *Populus tremuloides*, *Arctostaphylos uva-ursi*, *Empetrum nigrum*, *Vaccinium uliginosum*, *V. vitis-idaea*, *Lycopodium annotinum*, *Hyloconium splendens*, *Pleurozium schreberi*, *Abietinella abietina*, *Peltigera aphthosa*. Occurs in subalpine and cooler boreal areas; appears transitional to WS/W-Sb/fm.

TA-WS/W/G

Trembling aspen-white spruce/willow/grass: similar to TA-WS/G but has a significant inclusion of *Salix* spp.; occurs on drier sites and is probably successional to WS/G.

WS-BP/Sb/G

White spruce-balsam poplar/shrub birch/grass: similar to WS-BP/G but occurs on slightly more moist sites and has *Betula glandulosa*, sometimes also *Salix* spp., forming a shrub layer; most likely successional to WS/Sb-Lg/bm.

WS-LP/W/G

White spruce-lodgepole pine/willow/grass: similar to LP-WS/G but has a significant component of *Salix glauca* in the shrub layer; appears successional to WS/G or WS/dm.

WS/Lg/G

White spruce/Labrador tea/grass: similar to WS/W-Sb/G but occurs on more moist sites, sometimes with organic matter accumulations; frequently has *Salix* spp. associated and

occasionally *Betula glandulosa*; it is most likely successional to WS/Sb-Lg/bm.

WS-TA/Ra/G White spruce-trembling aspen/rose/grass; similar to WS-TA/G but *Rosa acicularis* is abundant in the shrub layer; and the tree canopy is usually more open; probably successional to WS/G.

WS-BP/Al/G White spruce-balsam poplar/alder/grass: *Picea glauca*-*Populus balsamifera*/*Alnus crispa*/*Festuca altaica*-*Calamagrostis* spp., *Equisetum* spp. Has a variable mix of other species which constitute a low cover percentage; occurs on well drained alluvial sites.

LP-WS/Ww-G Lodgepole pine-white spruce/wormwood/grass: *Pinus contorta*-*Picea glauca*/*Artemisia frigida*- *A. tilesii*-*A. arctica*-*Calamagrostis purpurescens*- *Agropyron caninum*-*Festuca altaica*-*Trisetum* spp., *Juniperus communis*, *J. horizontalis*, *Rosa acicularis*, *Saxifraga tricuspidata*, *Zygadenus elegans*, *Pentstemon procera*, *Cladonia* spp., *Sterocaulon tomentosa*, *Rhacomitium canescens*. Occurs on excessively drained slopes and ridges of kame deposits.

WS/dm White spruce/dryland moss: *Picea glauca*/*Tortula ruralis*-*Dicranum* spp.-*Hypnum* spp., *Populus tremuloides*, *Arctostaphylos uva-ursi*, *Lupinus arcticus*, *Zygadenus elegans*, *Pulsatilla patens*, *Carex concinna*,

Calamagrostis spp., *Festuca altaica*, *Bromus pumpellianus*,
Cladonia spp., *Cetraria* spp., *Sterocaulon tomentosa*.

Occurs on dry, often sandy sites; understory vegetation
sometimes virtually absent, related to WS/KI and WS/G and
will probably succeed to one of them.

WS/G-Li

White spruce/grass-lichen: *Picea glauca*/*Festuca*
altaica-*Calamagrostis* spp.- *Poa* spp.-*Trisetum* spp. -
Cladonia mitis-*C. stellaris*- *C. rangiferina*-*Cetraria*
nivalis, *Epilobium angustifolia*, *Zygadenus elegans*,
Pulsatilla patens, *Mertinsia paniculata*, *Pentstemon*
procerus, *Pyrola secunda*, *Tortula ruralis*, *Dicranum* spp.
Occurs on dry, cool sites, mostly in subalpine areas;
tree canopy usually quite open.

WS-TA/G-Li

White spruce-trembling aspen/grass-lichen; similar to
WS/G-Li but has *Populus tremuloides* in the tree canopy,
sometimes with a poorly developed shrub layer of which
Arctostaphylos uva-ursi and *Rosa acicularis* are a part.
Possibly successional to WS/G as the lichen component
appears to have low vitality.

WS/Li

White spruce/lichen: *Picea glauca*/*Cladonia* spp.- *Cladonia*
spp.-*Cetraria nivalis*-*Peltigera canina* with few or no
other species; similar to WS/dm but has a lichen ground
layer; appears stable until the organic material
accumulates sufficiently to hold enough moisture to allow

other species to become established.

- WS-TA/Li White spruce-trembling aspen/lichen: similar to WS/Li except that *Populus tremuloides* and occasionally *P. balsamifera* are components of the tree' layer.
- WS-TA/W/Li White spruce-trembling aspen/willow/lichen: A variable community often associated with disturbed areas and may have *Betula glandulosa* and *Ledum groenlandicum* in the shrub layer; probably successional to WS/Lb/fm in most cases.
- WS/Sb-W/Li White spruce/shrub birch-willow/lichen: *Picea glauca*/
Betula glandulosa-*Salix glauca*/*Cetraria nivalis*-*C.*
cucullata-*C. islandica*-*C. Richardsonii*-*Cladina mitis*-*C.*
rangiferina-*Dactylina arctica*-*Sterea tomentosa*,
Arctostaphylos rubra, *Vaccinium uliginosum*, *V.*
vitis-idaea, *Empetrum nigrum*, *Pyrola* spp., *Pedicularis*
spp., *Aconitum delphinifolium*, *Tomenthypnum nitens*,
Hylocomium splendens, *Peltigera aphthosa*, *Nephroma*
arcticum. A common community in the subalpine zone and
appears stable.

Plant Community Relationships

Over one hundred communities have been recognized in this study, however, most are seral stages to other communities that have developed since fire or other disturbances. The vegetation of the study area varied from one part to another which also contributed to the large number of communities. Not only was there a high degree of elevation range (600-2500 m) but certain species were characteristic for parts of the area but not all. For example, black spruce and Lapland rosebay occurred only in the Burwash Uplands and to the west; lodgepole pine only occurred around Kusawa Lake and to the north and east of it; balsam poplar, although scattered pretty well throughout, was most prevalent around Haines Junction; and the increased precipitation near the British Columbia border caused differences in the vegetation not found elsewhere.

Figure 1 shows the approximate relationship of some communities according to elevation and moisture gradients. Most seral communities are not shown but could be interpolated by comparison to the communities in the figure. Temperature, aspect and edaphic situations also form gradients but these can not be included along with elevation and moisture on a two dimensional graph. For example, WS/G, WS/K1, WS/L1 and WS/dm all occur at the dry end of the moisture scale in the boreal zone. WS/K1 is usually found on sand, WS/L1 on gravelly sand, WS/G on finer textured material of lacustrine or till origin and WS/dm on deep, coarse textured till. There are gradations among these communities that further complicates their correlation; they can be considered as being very similar ecologically.

WS/fm is the most common and widespread community in the boreal

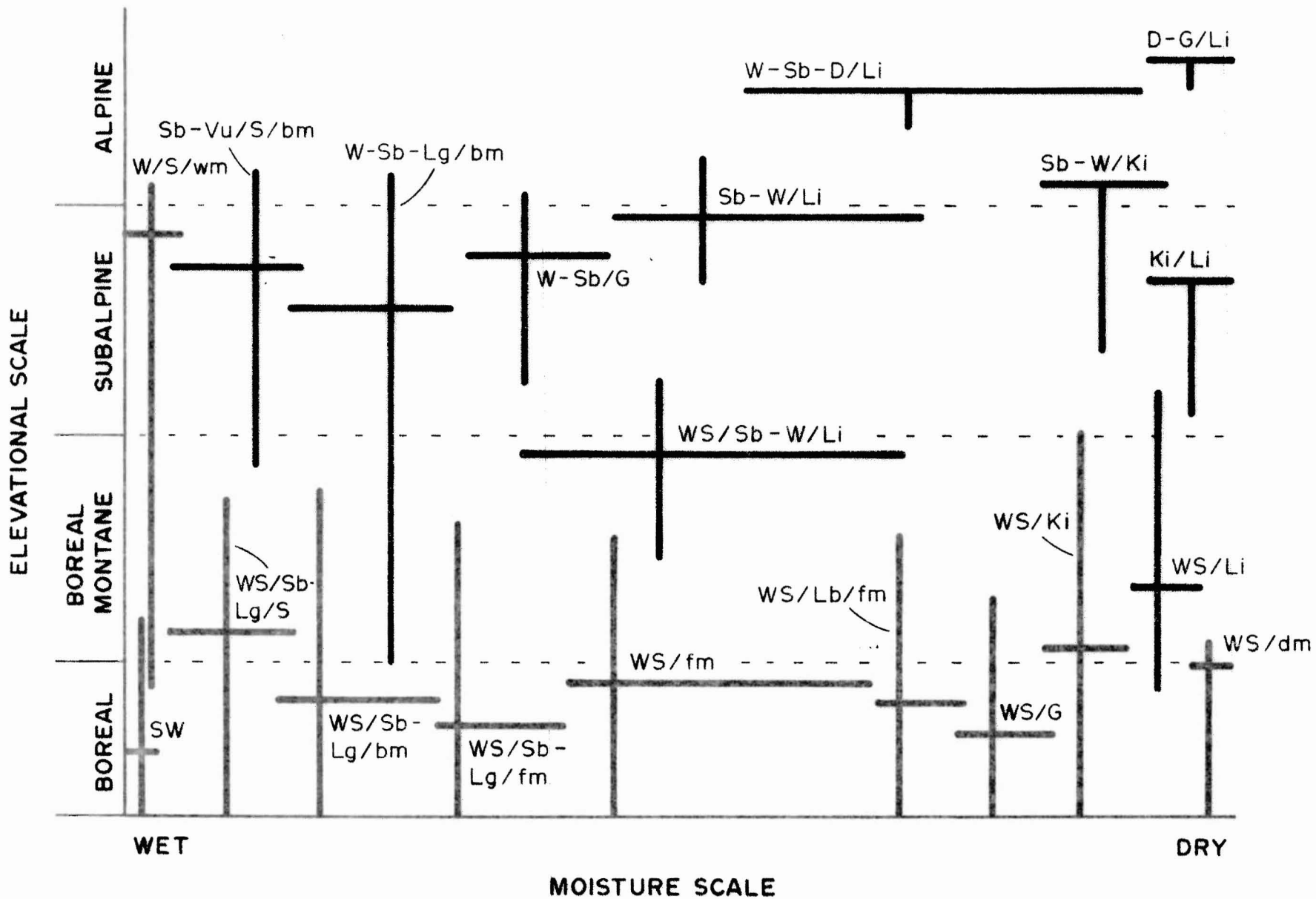


Fig. 1. Approximate ordination of some communities along elevational and moisture gradients; bars indicate the relative position of the communities in relation to each other.

and boreal-montane (lower subalpine) zones and probably represents the climatic climax for soils lacking much organic matter accumulation and with permafrost absent or well below the surface. There is a difference in the feathermoss composition in that Abietinella abiejina dominates this layer in the central and western sections while Hylocomium splendens is more prevalent in the eastern and southern parts. The significance of this is not clearly evident, but it may be related to soil alkalinity.

WS/Sb-Lg/bm is prevalent where organic matter has accumulated and where permafrost is often near the surface. Black spruce would be expected to codominate with white spruce on these sites but currently it is only found in the western part of the area. Also, Lapland rosebay would be expected to extend over more of the area as a component of this community; it currently only occurs in the Burwash Uplands and westward.

At higher elevations, Sb-W/Li is the most common community. Below tree line, white spruce and occasionally alpine fir, are included with increasing density and productivity of trees with decreasing elevation forming the WS/Sb-W/Li community. At the present, alpine fir has a very limited distribution, occurring only in the southeastern part of the area. In alpine areas, the W-Sb-D/Li community is similar in species composition to Sb-W/Li but the shrubs are of lower stature, mostly prostrate, include different species of willow and birch and are usually more open. In the most extreme situation on exposed, usually wind swept, ridges a community represented by W-D/G occurs where the vegetation is scattered to sparse and is prostrate to mat-forming.

Forestry Considerations

The mean annual increment (M.A.I.) was adopted as the standard for comparing forest capability across Canada in the Canada Land Inventory Program. There are seven classes ranging from Class 1 with no limitation to Class 7 with very severe limitations for forest capability. By and large, only Class 3 and better lands are considered for intensive forest management, but trees from less productive land are also harvested on a long rotation basis or are managed along with some other use, such as grazing or wildlife range, by selective cutting. Also to be considered when making the decisions on use of forested land is the intended purpose of the harvested wood. In general, consideration is only given to saw logs or pulp wood, but cutting for other purposes, such as cord wood, mining timbers or log construction, can be economically conducted on land with capability classes below 3.

Some parameters, including M.A.I., for the forests in the study area are listed in Table III. The indicated M.A.I. is calculated at stand age which would differ somewhat from the usual calculations which are based on stand ages of 50 or 100 years. The reason for using stand age is that the necessary growth curves suitable for this area have not been constructed to date due to lack of sufficient growth measurements. However, calculations at base age 100 would probably not change the capability class significantly. The best capability occurs on alluvial sites with little correlation to the designated vegetation type. The lowest capability occurred on wet sites, probably due to persisting seasonal frost or permafrost near the surface and at higher elevations. Somewhat surprising, the dry sites, e.g. WS/dm, had capabilities essentially equivalent to mesic sites, e.g. WS/fm.

Vegetation Type	Number of Prism Points	Stand Age @ .3 m	Basal Area per ha.	Volume per ha. (m ²)	M.A.I. @ Stand Age	CLI Capability Class
White Spruce/ Lichen	24	79 (46 to 115)	19.0 (9-27)	89.2 (42-124)	1.15 (.66-1.82)	6 (6-7)
White Spruce/ Labrador Tea	21	141 (52-242)	18.0 (8.0-30.0)	93.0 (33-181)	0.75 (.21-1.31)	7 (6-7)
Aspen/ Kinnikinnick - Grass	45	67 (34-111)	22.8 (3-42)	103.2 (11-208)	1.40 (.22-2.65)	6 (5-7)
White Spruce/ Willow - Shrub Birch	48	132 (41-219)	22.1 (5-45)	129.5 (28-264)	1.01 (.35-1.83)	6 (5-6)
Mixed White Spruce - Aspen/ Kinnikinnick - Grass	39	93 (59-125)	30.1 (10-50)	159.2 (95-294)	1.74 (.85-3.26)	6 (5-6)
White Spruce/ Dryland Moss	54	120 (41-207)	33.6 (3-62)	183.9 (3-371)	1.58 (.21-2.67)	6 (5-7)
White Spruce/ Feather Moss	69	140 (80-300)	39.4 (20-58)	221.9 (88-380)	1.74 (.64-3.69)	6 (5-7)
Lodgepole Pine/Kinninnick - Grass	6	78 (76-79)	29.1 (28-30)	130.8 (130-132)	1.69 (1.67-1.70)	6 (6)
Black Poplar/ Alder	6	168 (135-200)	53.3 (43-63)	340.3 (291-389)	2.17 (1.45-2.88)	6 (5-6)

Table III: Forest Productivity Data. Average values are indicated on the top line and the range is included in brackets below.

Based on the capabilities determined, a forest harvesting operation for saw logs or pulpwood could not be maintained economically in any part of the study area on a sustained basis. However, one of the main demands is for cord wood for local consumption. Since the primary population centre is Haines Junction with a population of about 400 people which should equate to around 150 families, and assuming each family would require about 10 cords annually, it would seem the current forest could sustain this consumption, but any increase would have to be monitored fairly closely. One advantage to the Haines Junction area is a reasonably large (about 50 km²) area of deciduous trees surrounding the village. Since deciduous trees are preferable over conifers for fire wood, they are relatively fast growing in the immature stages and are accessible, barring any land ownership constraints, a plan to harvest them selectively on a sustained basis supplemented with additional wood from accessible burnt areas, could be developed.