



# Plant Associations and Post-fire Vegetation Succession in Yukon-Charley Rivers National Preserve

Natural Resource Technical Report NPS/YUCH/NRTR—2005/001



**ON THE COVER**

Photograph of Kandik River on July 4, 2003.

Photograph by: Alaska Natural Heritage Program.

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# **Plant Associations and Post-fire Vegetation Succession in Yukon-Charley Rivers National Preserve**

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## SUMMARY

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This document presents a plant association classification for Yukon-Charley Rivers National Preserve (Yukon-Charley Rivers NP) and describes boreal forest successional trajectories following fire. The classification and successional trajectories provide resource managers with essential information to understand the vegetation and ecology of Yukon-Charley Rivers NP. This document also lists vascular plant species identified during the project, a review of the Preserve's ecological literature, a description of the climate and geology, and the project's methods. The results were developed by the National Park Service (NPS) Landcover Mapping Program, Inventory and Monitoring Program, Alaska Support Office (AKSO) in cooperation with the Alaska Natural Heritage Program (AKNHP), Environment and Natural Resources Institute, University of Alaska Anchorage.

Yukon-Charley Rivers NP encompasses 2,523,509 acres along the Canadian border in central Alaska. It includes the entire Charley River drainage as well as roughly 130 miles of the Yukon River. It is characterized by boreal forests that transition through steep mountain slopes to alpine tundra. The elevations range from 183 meters along the Yukon River to over 2,000 meters in the mountains.

Plant association is the finest scale (level V) of The Alaska Vegetation Classification (Viereck et al. 1992) and is equal to the plant association scale of the National Vegetation Classification System (Grossman et al. 1998). Sixty-nine plant associations are described for Yukon-Charley Rivers NP based on 69 plots collected by AKNHP and AKSO in 2003, 44 National Park Service Firepro paired plots originally sampled in 1983, 159 National Park Service Firepro ground truth plots collected from 1984 through 1988, and 76 USDA Forest Service Forest Health Monitoring plots collected in 1979 and 1980. The plot data includes full plant species lists, plant structure, and canopy cover. Soil profiles and landscape descriptions were described in the 2003 plot data but not in the other data sets. Plant association descriptions include a list of other studies of the region, distribution of the plant association, vegetation structure and composition, photograph, and environmental factors such as soils and hydrology. A dichotomous key, based on indicator species, is provided to aid in field identification of plant associations.

Fire is the dominant disturbance factor in the Preserve, and over 900,000 acres of it has burned since 1950 based on the NPS FireScar database. Some regions experience fire frequencies of 30 years or less, leading to a patchwork of early, mid, and late seral communities across the landscape.

Boreal forest vegetation succession following fire was determined using the plant association field information, a Ducks Unlimited landcover map, the FireScar database, and a literature review. The successional sequences are based on the chronosequence approach for describing succession. At a coarse scale, vegetation succession correlated well with slope, aspect or hydrology. Six major successional sequences are identified and are named for their slope, aspect or hydrology and the late seral vegetation stage. Multiple pathways occur and are a function of landscape characteristics and species life history. The following are the generalized fire induced boreal forest seres in the Preserve.

- South-facing slopes / Late seral *Populus tremuloides* or *Picea glauca*
- East- and west-facing slopes / Late seral *Picea glauca*
- North-facing slopes / Late seral *Picea mariana*
- Wet level or low angle slopes / Late seral *Picea mariana* and tussock tundra
- Mesic level or low angle slopes / Late seral *Picea mariana*
- Floodplain / Late seral *Picea mariana*

**Keywords:** Alaska, Yukon-Charley Rivers National Preserve, plant association, vegetation classification, fire succession, boreal forest

## TABLE OF CONTENTS

Summary	ii
Introduction	1
Study Area	3
Geology	5
Climate	5
Literature Review	7
Plant Associations	7
Landcover Mapping	8
Soils	8
Ecoregions	8
Methods	10
Plant Association Determinations	10
Sampling Design	10
Plot Field Data Collection	15
Field Information Compilation and Entry	17
Determination of Plant Associations	17
Fire induced vegetation succession	18
Taxonomy	18
Post-fire boreal forest succession	19
Literature review of post-fire boreal forest succession	19
Successional Sequence results	20
South-facing slopes / Late seral <i>Populus tremuloides</i> or <i>Picea glauca</i>	21
East- and west-facing slopes / Late seral <i>Picea glauca</i>	24
North-facing slopes / Late seral <i>Picea mariana</i>	27
Mesic level or low angle slopes / Late seral <i>Picea mariana</i>	30
Wet level or low angle slopes / Late seral <i>Picea mariana</i> and tussock tundra	33
Floodplain / Late seral <i>Picea mariana</i>	35
Plant Associations	38
Natural Heritage Program Plant Association Ranks	38
Key to Plant Associations	39
Plant Association Descriptions	45
<i>Picea glauca</i> plant associations	45
<i>Picea glauca</i> / <i>Alnus viridis</i> ssp. <i>crispa</i> Floodplain	45
<i>Picea glauca</i> / <i>Betula nana</i> / <i>Carex bigelowii</i>	47
<i>Picea glauca</i> / Bryophyte	49
<i>Picea glauca</i> / <i>Rosa acicularis</i>	51
<i>Picea glauca</i> / <i>Salix</i> species / <i>Carex bigelowii</i>	53
<i>Picea glauca</i> / <i>Vaccinium uliginosum</i>	55
Woodland <i>Picea glauca</i> / <i>Betula nana</i>	57
<i>Picea mariana</i> plant associations	59
Dwarf <i>Picea mariana</i> / <i>Betula nana</i>	59
Dwarf <i>Picea mariana</i> / <i>Betula nana</i> - <i>Carex bigelowii</i>	61

Dwarf <i>Picea mariana</i> / <i>Betula nana</i> - <i>Eriophorum vaginatum</i>	63
Dwarf <i>Picea mariana</i> / <i>Carex lugens</i>	65
Dwarf <i>Picea mariana</i> / <i>Eriophorum vaginatum</i>	67
Dwarf <i>Picea mariana</i> / <i>Ledum palustre</i> ssp. <i>decumbens</i>	69
Dwarf <i>Picea mariana</i> / <i>Vaccinium vitis-idaea</i>	71
<i>Picea mariana</i> / <i>Alnus viridis</i> ssp. <i>crispa</i>	73
<i>Picea mariana</i> / <i>Betula nana</i>	75
<i>Picea mariana</i> / Bryophyte	77
<i>Picea mariana</i> / <i>Ledum palustre</i> ssp. <i>decumbens</i>	79
<i>Picea glauca</i> - <i>Picea mariana</i> Plant Associations	81
<i>Picea glauca</i> - <i>Picea mariana</i> / <i>Vaccinium uliginosum</i>	81
Deciduous Plant Associations	83
<i>Betula papyrifera</i> / <i>Rosa acicularis</i>	83
<i>Populus balsamifera</i> / <i>Alnus viridis</i> ssp. <i>crispa</i> Floodplain	85
<i>Populus tremuloides</i> / <i>Rosa acicularis</i>	87
Young <i>Betula papyrifera</i>	89
Young <i>Populus balsamifera</i> ssp. <i>balsamifera</i> Floodplain	91
Young <i>Populus tremuloides</i>	93
Mixed Needleleaf-Deciduous Forest Plant Associations	95
<i>Picea glauca</i> - <i>Betula papyrifera</i> / <i>Rosa acicularis</i>	95
<i>Picea glauca</i> - <i>Populus tremuloides</i>	97
<i>Picea mariana</i> - <i>Betula papyrifera</i> / <i>Alnus viridis</i> ssp. <i>crispa</i>	99
Young <i>Picea glauca</i> - <i>Betula papyrifera</i>	101
Young <i>Picea mariana</i> - <i>Betula papyrifera</i>	103
Tall and Low Shrub Plant Associations	105
<i>Alnus viridis</i> ssp. <i>crispa</i> / <i>Eriophorum vaginatum</i>	105
<i>Alnus viridis</i> ssp. <i>crispa</i> Floodplain	107
<i>Amelanchier alnifolia</i>	109
<i>Artemisia frigida</i>	110
<i>Artemisia frigida</i> - <i>Calamagrostis purpurascens</i> – <i>Pseudoroegneria spicata</i> ssp. <i>spicata</i>	111
<i>Betula nana</i>	112
<i>Betula nana</i> / <i>Carex bigelowii</i>	114
<i>Betula nana</i> - <i>Ledum palustre</i> ssp. <i>decumbens</i> - <i>Vaccinium uliginosum</i>	116
<i>Juniperus communis</i>	118
<i>Ledum palustre</i> ssp. <i>decumbens</i>	119
<i>Ledum palustre</i> ssp. <i>decumbens</i> / <i>Eriophorum vaginatum</i>	121
<i>Ledum palustre</i> ssp. <i>decumbens</i> /- <i>Vaccinium uliginosum</i>	123
<i>Ledum groenlandicum</i>	125
<i>Myrica gale</i>	127
<i>Salix alaxensis</i> Floodplain	129
<i>Salix alaxensis</i> Sideslope	131
<i>Salix pulchra</i> - <i>Betula nana</i>	133
<i>Vaccinium uliginosum</i> / <i>Carex bigelowii</i>	135

Dwarf Shrub Plant Associations	137
<i>Arctostaphylos rubra</i>	137
<i>Betula nana</i> - <i>Vaccinium uliginosum</i> - <i>Carex bigelowii</i>	138
<i>Cassiope tetragona</i>	140
<i>Dryas integrifolia</i>	141
<i>Dryas octopetala</i>	143
<i>Dryas octopetala</i> / <i>Carex stylosa</i>	144
<i>Dryas octopetala</i> - <i>Cassiope tetragona</i>	146
<i>Empetrum nigrum</i> - <i>Vaccinium vitis-idaea</i>	148
<i>Ledum palustre</i> ssp. <i>decumbens</i> - <i>Vaccinium uliginosum</i> – <i>Eriophorum vaginatum</i>	150
<i>Salix pulchra</i>	152
 Herbaceous Plant Associations	 153
<i>Artemisia alaskana</i>	153
<i>Bromus inermis</i> var. <i>arcticus</i>	154
<i>Calamagrostis canadensis</i>	156
<i>Calamagrostis purpurascens</i>	157
<i>Carex aquatilis</i>	158
<i>Carex bigelowii</i>	159
<i>Carex rostrata</i>	161
<i>Chamerion angustifolium</i> ssp. <i>angustifolium</i>	162
<i>Eriophorum vaginatum</i>	163
<i>Festuca altaica</i> / <i>Calamagrostis</i> species	165
 Relationship of Landcover Classes and Plant Associations to Detailed Subsections	 167
 Literature Cited	 177
 Glossary	 183
 Figures	
Figure 1. The location of Yukon-Charley Rivers National Preserve	1
Figure 2. Landcover map of Yukon-Charley Rivers National Preserve	2
Figure 3. Idealized topographic and vegetation cross-section for Yukon-Charley Rivers National Preserve	4
Figure 4. The Tintina Fault overlaying the landcover map for Yukon-Charley Rivers National Preserve	5
Figure 5. Subsections of Yukon-Charley Rivers National Preserve	10
Figure 6. Polygons depicting post-1950 fire history within the Preserve	12
Figure 7. The 69 plot locations collected by AKNHP and AKSO in 2003	13
Figure 8. The National Park Service Firepro ground truth plots collected from 1984 through 1988	14
Figure 9. The National Park Service Firepro paired plots originally sampled in 1983	14
Figure 10. Form used to record ground data	16
Figure 11. Succession following fire on south-facing slopes	22
Figure 12. Succession following fire on east- and west-facing slopes	25
Figure 13. Succession following fire on north-facing slopes	28
Figure 14. Succession following fire on mesic level or low angle slopes	31
Figure 15. Succession following fire on wet level or low angle slopes	33
Figure 16. Idealized cross-section of geomorphic and vegetation succession on a floodplain	36

Tables	
Table 1. Climate data for Circle City and Eagle, Alaska	6
Table 2. The actual versus expected number of plots per subsection	11
Table 3. The actual versus expected number of plots per age of burn	13
Table 4. Cover of dominant species on sites of increasing age following fire on south-facing slopes	23
Table 5. Cover of dominant species on sites of increasing age following fire on east- and west-facing slopes	26
Table 6. Cover of dominant species on sites of increasing age following fire on north-facing slopes	29
Table 7. Cover of dominant species on sites of increasing age following fire on mesic, level or low angle slopes	32
Table 8. Cover of dominant species on sites of increasing age following fire on wet, level or low angle slopes	34
Table 9. Cover of dominant species on sites of increasing age on floodplains	37
Table 10. List of subsections and detailed subsections	168
Table 11. Summary of Landcover Class by detailed ecological subsection	169
Appendices	
Appendix 1. List of plant associations found within the Ducks Unlimited (1998) landcover classes	173
Appendix 2. Indicator species used in the key to plant associations	175

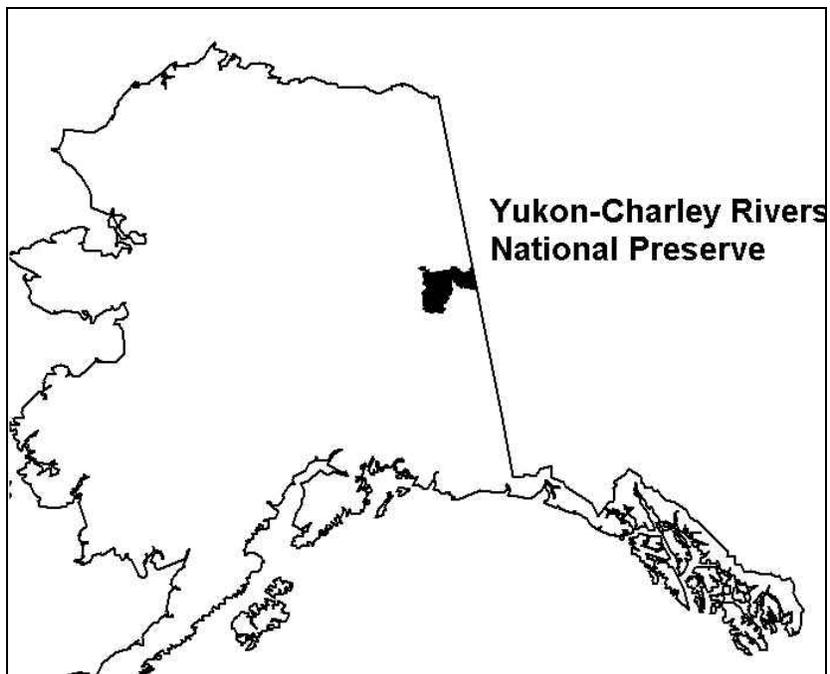
## INTRODUCTION

This document is intended to provide resource managers with an understanding of plant associations and post-fire succession in the boreal forests of Yukon-Charley Rivers National Preserve (Yukon-Charley Rivers NP) (Figure 1). The objectives of this study are as follows:

- Develop a plant association classification
- Describe post-fire boreal forest succession
- Relate the plant associations and existing landcover classes (Ducks Unlimited 1998) to ecoregions (Swanson 2001) and fire history

Each objective is addressed in separate sections within the document. A review of Yukon-Charley Rivers NP ecological literature is also given.

Figure 1. The location of Yukon-Charley Rivers National Preserve.



This work was undertaken by the National Park Service Landcover Mapping Program, Inventory and Monitoring Program, Alaska Support Office (AKSO) in cooperation with the Alaska Natural Heritage Program (AKNHP). The goal of the Inventory and Monitoring Program of the National Park Service is to provide reliable and consistent information for assessing the status and trends in the condition of National Park ecosystems. This work compliments the landcover map of Yukon-Charley Rivers NP generated by the USDI Bureau of Land Management and Ducks Unlimited (1998). The plant associations defined in this report provide a more detailed description of landcover mapping units while the description of fire ecology provides a perspective on a dominant ecological process within Yukon-Charley Rivers NP. The plant association classification can be used to understand habitat and fuels availability, provide baseline information about natural resources in the Preserve, and for conducting coarse scale analyses including regional ecological planning. For example, the resulting classification, in conjunction with the existing landcover map (Ducks Unlimited 1998) (Figure 2), can help wildlife biologists evaluate forage availability for bear and moose and to understand the distribution of wetlands, rare habitats and species. In addition, the fine-scale vegetation structural information can enhance ecological analyses for evaluating passerine bird habitat distribution.

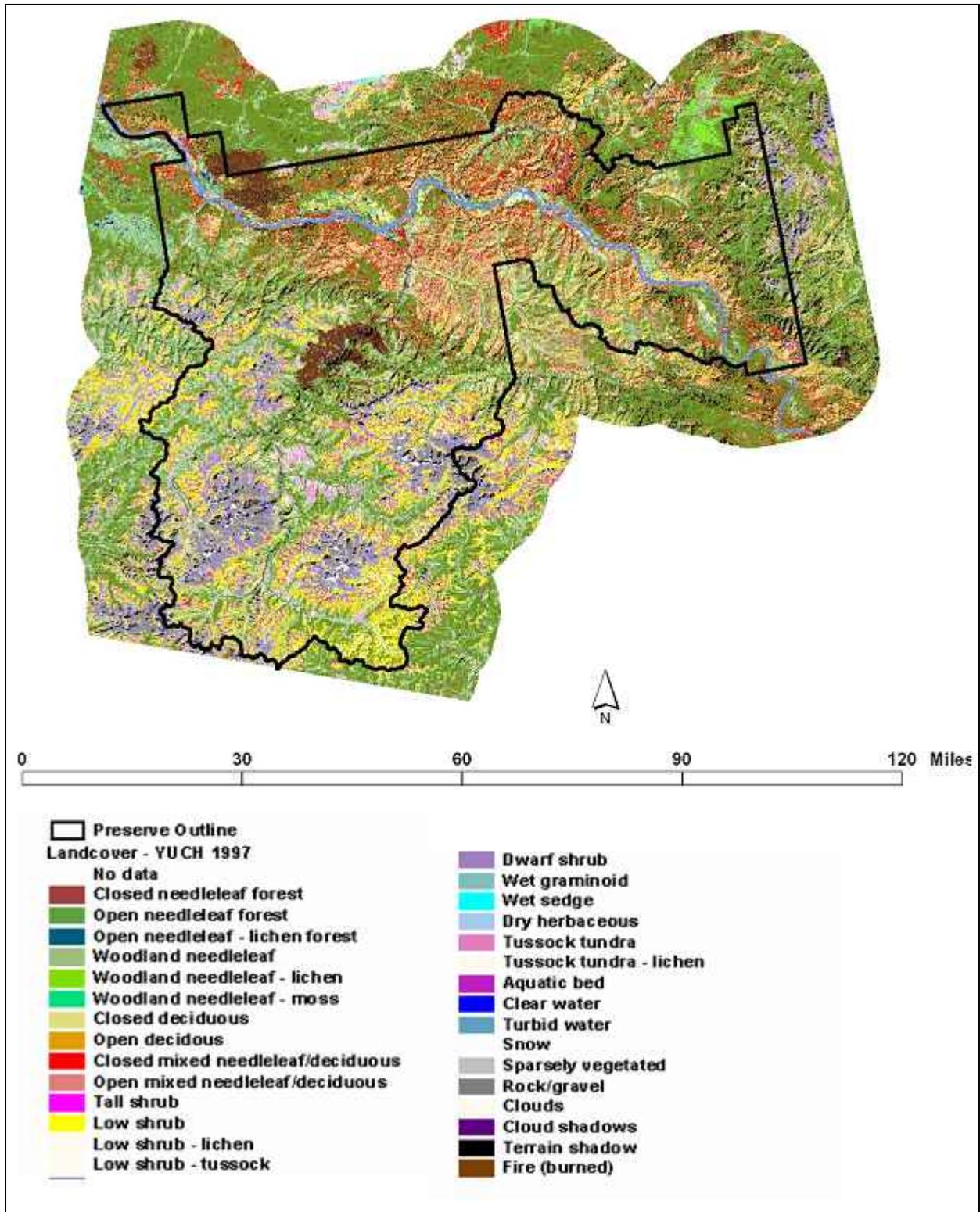


Figure 2. Landcover map of Yukon-Charley Rivers National Preserve (Ducks Unlimited 1998). The Preserve boundary is given in black. Based on Landsat TM5 Path 66 Row 14 shifted 40% south, 08/20/1991.

Plant association is the finest scale vegetation community classification, and is defined as "a plant community type of definite floristic composition, uniform habitat conditions, and uniform physiognomy" (Flahault and Schroter 1910). It is equal to the finest hierarchical level of both The Alaska Vegetation Classification (Viereck et al. 1992) and the National Vegetation Classification System (Grossman et al. 1998). The National Vegetation Classification System has not been developed for application within Alaska. Plant associations are considered taxonomic in nature because they are repeatable across the landscape, much as soils are taxonomically based and repeatable across the landscape. Each association represents a relatively narrow segment of the variation in vegetation communities across the Preserve. Plot data making up an association at times is consistent in structure and composition, whereas other associations are highly variable, each plot appearing on a continuum. The term plant association has also been defined by Daubenmire (1968) as the climax community only, but the authors of this document do not use it in that context.

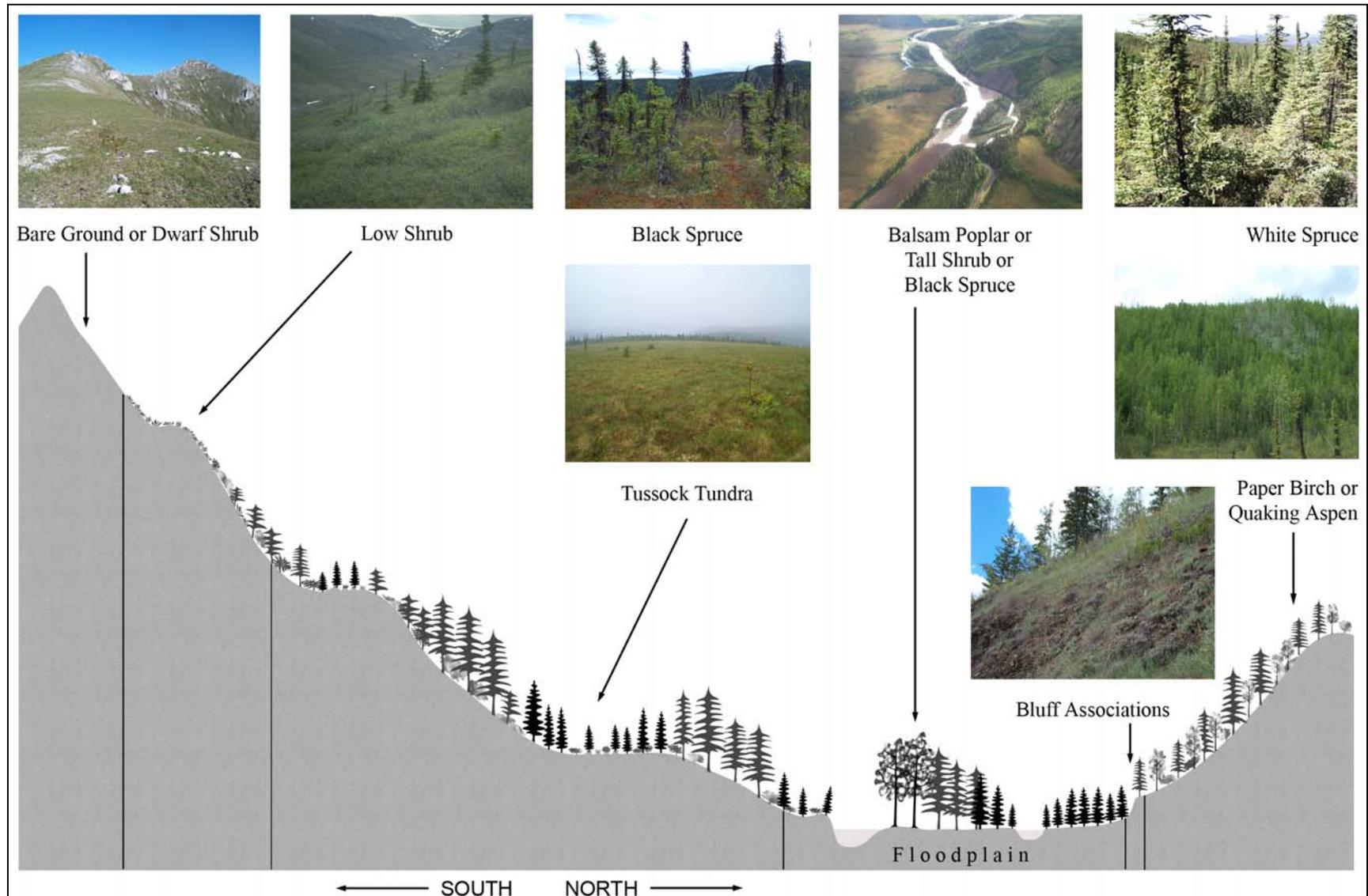
For Yukon-Charley Rivers NP, 69 plant associations were defined based on 348 field data plots. Field data included 69 plots sampled by AKNHP and AKSO during the 2003 field season, 44 National Park Service Firepro paired plots originally sampled in 1983, 159 National Park Service Firepro ground truth plots sampled from 1984 through 1988, and 76 USDA Forest Service Forest Health Monitoring plots sampled in 1979 and 1980. Plant association descriptions include a list of other studies of the region, distribution of the plant association, vegetation structure and composition, and environmental factors such as soils and hydrology. Plant associations are nested within the coarser scale landcover classes used to map Yukon-Charley Rivers NP.

Fire is one of the most common natural disturbances in Yukon-Charley Rivers NP. Some regions experience fire frequencies of 30 years or less, leading to a patchwork of early, mid and late seral communities across the landscape. This successional process offers important opportunities for scientific study. Vegetation succession ranges from pioneer species on recently burned areas to old growth forests and peatlands on older landscapes. The successional sequences described for this study are inferred chronosequences; this method presents certain problems in accuracy. Studies have shown that a consistent stepwise progression in seral stages is not an accurate portrayal of succession on any given surface (Boggs and Weaver 1994, Fastie 1995, Johnstone 2003, Payette 1992). Multiple pathways occur and are likely a function of landscape characteristics and species life history. In addition fire intensity is a significant determinant to site disturbance and the subsequent successional pathways. This classification does not attempt to describe absolute steps in community succession but rather presents general or multiple pathways. Knowing the site conditions (i.e. landscape) under which a community develops can also greatly enhance the understanding of successional pathways.

## **STUDY AREA**

Yukon-Charley Rivers NP is located along the Canadian border in central Alaska. It encompasses 2,523,509 acres. Of this, 2,249,071 acres are Federal and 274,438 acres are non-Federal. The Preserve includes the entire Charley River drainage as well as roughly 130 miles of the Yukon River. It is characterized by boreal forests that transition through steep mountain slopes to alpine tundra in a landscape that is largely unchanged by human development (Figure 3). The elevations range from 183 meters along the Yukon River to over 2,000 meters in the mountains. Fire is the dominant disturbance factor in the Preserve, and approximately 36% of it has burned since 1950. Less than five percent of the Preserve was ever glaciated. Glaciers that did form were alpine glaciers occurring only in the highest portions of the Charley and Seventy Mile River drainages.

Figure 3. Idealized topographic and vegetation cross-section for Yukon-Charley Rivers National Preserve.



## Geology

The Tintina Fault divides Yukon-Charley Rivers NP into two distinct geologic areas (Figure 4). This is a strike-slip fault that runs parallel to the Yukon River corridor south of the river [Geologic maps (1:250,000 scale) by Brabb and Churkin 1969, Dover and Miyaoka 1988, and Foster 1976]. Southwest of the Tintina Fault is a mixture of complex volcanic, igneous, metamorphic and sedimentary rocks. The greatest bedrock diversity within the Preserve occurs northeast of the Tintina Fault in a triangle formed by the Nation and Yukon Rivers and the Canadian border. This triangular area is the only portion of east-central Alaska thought to be part of the original North American plate and it comprises a sequence of unmetamorphosed sediments. The Ogilvie Mountains is the only region in the Preserve with extensive dolostone or limestone.

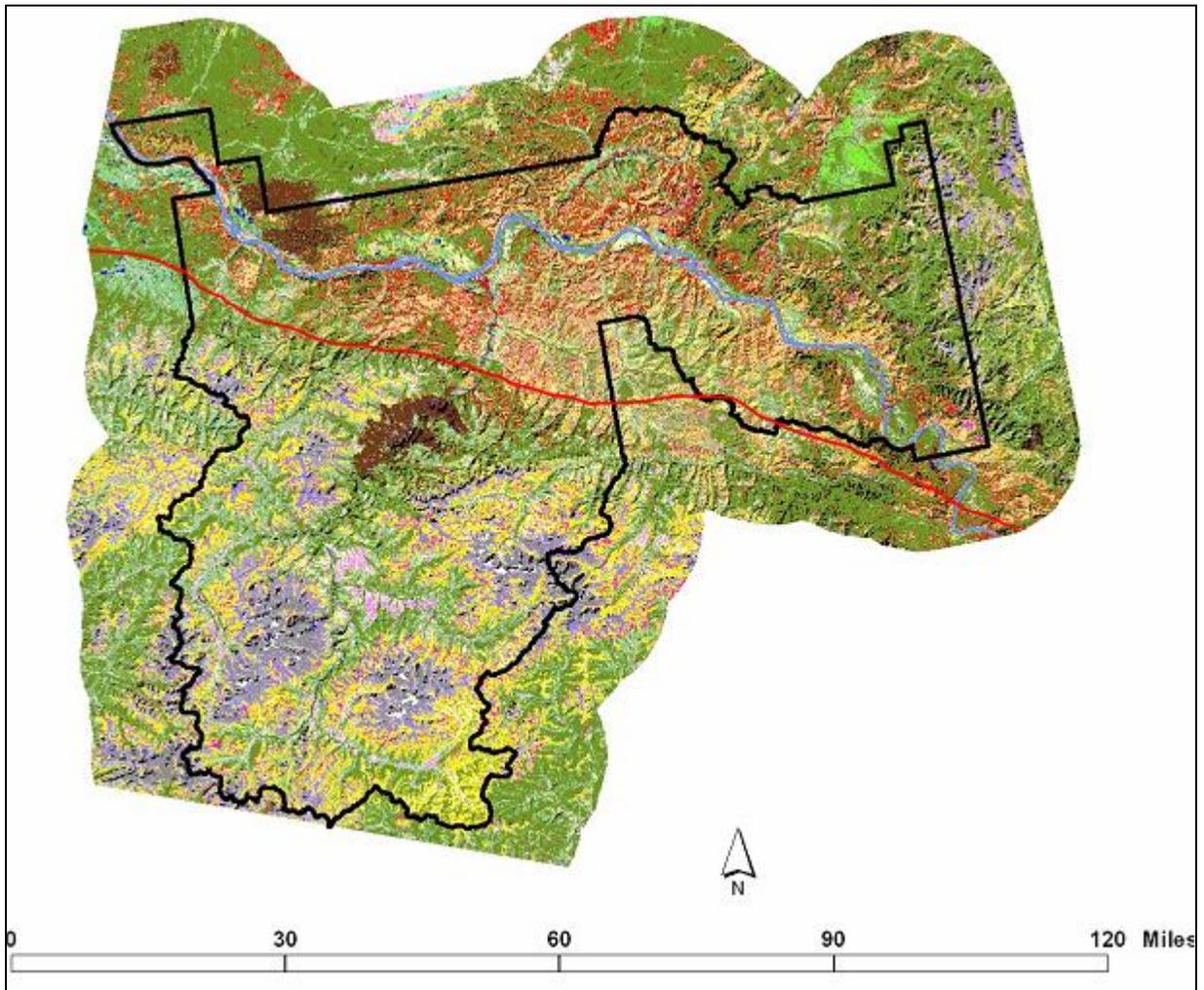


Figure 4. The Tintina Fault (line in red) overlaying the landcover map (Ducks Unlimited 1998) for Yukon-Charley Rivers National Preserve.

## Climate

Yukon-Charley Rivers NP has a continental climate with hot summers and cold winters (Table 1). In the summer, thunderstorms and lightning are common and the average maximum temperature in July is in the mid 70° F. The highest temperature recorded was 97 °F. Winter temperatures are extreme, averaging in

the  $-20^{\circ}$  F in January with only a thin covering of snow. The extreme low was  $-71^{\circ}$  F. The climate data is based on climate stations in the nearby towns of Circle City and Eagle, both of which occur at low elevations (200 and 333 meters, respectively) along the Yukon River.

Table 1. Climate data for Circle City and Eagle, Alaska. Circle City and Eagle summaries are based on 42 years of data between June 1947 and Oct. 1999 and 55 years of data between Sept. 1949 and June 2004, respectively. Data is from the Western Regional Climate Center.

Location	Time Reported (monthly or yearly)	Average daily minimum ( $^{\circ}$ F)	Average daily maximum ( $^{\circ}$ F)	Average precipitation (inches)
Circle City	January	-25.0	-9.2	0.47
	July	49.6	73.1	1.24
	Yearly	9.8	31.4	8.16
Eagle	January	-21.6	-3.7	0.52
	July	47.0	72.7	2.25
	Yearly	12.9	36.0	12.01

## LITERATURE REVIEW

The following are brief descriptions and reviews of the literature relating to plant associations, landcover mapping, soils and ecoregions of Yukon-Charley Rivers NP. Note that a literature review for fire is provided in the section Post-Fire Boreal Forest Succession, Literature Review of Post-Fire Boreal Forest Succession.

### PLANT ASSOCIATIONS

Little descriptive plant community research has been conducted within Yukon-Charley Rivers NP; therefore, much of the literature described below and listed within each plant association concerns studies in proximity to the Yukon-Charley Rivers NP in Interior Alaska or Yukon Territory.

For Alaska as a whole, The Alaska Vegetation Classification (Viereck et al. 1992) provides descriptions of vegetation at multiple scales based on studies by many authors. These descriptions, however, are not specific to an area.

River bluff communities have been studied in and near Yukon-Charley Rivers NP by several researchers over the last three decades. Shacklette (1966) describes sparsely vegetated plant communities at Eagle. He describes the chemical and physical characteristics of the soils that preclude other species from colonizing these areas and suggests a new community, *Bupleurum americanum* - *Zygedenus elegans*, based on constancy and fidelity among sites he sampled. Batten, Murray and Dawe (1979) looked for rare taxa in four areas of Alaska, three of which are in or near Yukon-Charley Rivers NP (Eagle Bluff, Chicken and Kathul Mountain). When rare taxa were found they also analyzed the environment, including plant communities in which the taxa were located.

Murray et al. (1983) compare species and community data from studies in Alaska to studies by Yurtsev in eastern Russia/northeastern Asia and found similarities in species composition for bluff communities. Howenstein, Murray and Armbruster (1985) reported on steppe flora on bluffs of the upper Porcupine, upper Yukon and middle Tanana rivers at the 36<sup>th</sup> Arctic Science Conference in Fairbanks. Wesser and DeVoe (1987) surveyed south-facing bluff communities on the Yukon River, all but one of which was in Yukon-Charley Rivers NP. They used two-way indicator species analysis (Hill 1979) to describe and compare the vegetation at the sampled locations. Roland (1990) surveyed bluff communities within Yukon-Charley Rivers NP and used detrended correspondence analysis (Hill and Gauch 1980) to explain the variance in the data.

Viereck (1979) describes general tree line communities for all Alaska including a *Picea mariana*-*Picea glauca*/*Betula nana*/feathermoss community for the Tanana-Yukon uplands. Buckley and Libby (1957) broadly describe different plant association types within the Yukon River drainage from the Canadian border to the Tanana River as well as other rivers outside of Yukon-Charley Rivers NP. They used aerial photographs to determine sample locations in their study area. Neiland and Viereck (1977) describe floodplain forest and bog types from the Susitna, Tanana, Kuskokwim and Yukon Rivers. Farjon and Bogaers (1985) describe communities in relation to floodplain succession of the Porcupine River north of the study area.

Johnson and Vogel (1966) sampled forest communities in the Yukon Flats area. They measured standing crop for woody species and enumerated herbaceous species cover. Each stand was named by density and basal area of tree species (i.e. *Picea glauca* / *Salix* sp.). Yarie (1983a, 1983b) developed a forest community classification for the Porcupine River drainage located north of the study area. Forty forest communities were described vegetatively and to a limited extent environmentally. The classification was

based on 365 plots within a stratified random design and communities were identified using TWINSpan (Hill 1979).

## **LANDCOVER MAPPING**

Yukon-Charley Rivers NP was mapped in 1998 by the National Park Service, Bureau of Land Management, and Ducks Unlimited, Inc. One Landsat TM satellite scene (66-14 shifted south acquired August 20, 1991) was used to classify the project area into 30 landcover classes. The field data was collected in 1997, and was supplemented with National Park Service plots collected from 1983 through 1988. The overall accuracy of the landcover map major categories was found to be 80% (Ducks Unlimited 1998).

Young and Racine (1976) mapped vegetation in Yukon-Charley Rivers NP using 1:250,000 Landsat (ERTS-1). They also utilized two 1:5,000 aerial photograph strips to check for accuracy of the satellite imagery. Four map classes were described and delineated: 1) *Picea* forest, 2) *Populus tremuloides* and *Betula papyrifera* woodland, 3) dwarf shrub bogs, and 4) alpine tundra and barrens.

Other landcover maps that cover all of Yukon-Charley Rivers NP were developed at a statewide scale. Viereck and Little (1972) developed a statewide map of vegetation using eight vegetation classes and one ice and snow class. Fleming (1997) developed an AVHRR (1-km pixel) map for Alaska with 21 classes. The Terrain Study of Alaska (U.S. Department of the Army, Office of the Chief of Engineers 1961) includes coarse-scale maps of different water and land variables, including vegetation and physiographic regions for all Alaska.

## **SOILS**

There are no soil surveys or maps specific to the Yukon-Charley Rivers NP region. Bennett and Rice (1915) were the first to survey Alaska soils and concentrated on the Kenai Peninsula, Yukon-Tanana area, Copper River and Matanuska-Susitna Valley. They surveyed some areas close to Yukon-Charley Rivers NP such as Eagle and Yukon Flats. There was a general survey of soils intended for agricultural use. Some of their information was based on reviews of other surveys.

The first known soil information from Yukon-Charley Rivers NP is from Kellogg and Nygard (1951) who defined broad soil groups for all of Alaska. During the early 1960's the U.S. Department of the Army, Office of the Chief of Engineers (1961) conducted terrain studies in Alaska, and created coarse-scale maps for soils, physiographic regions, water resources, climate, permafrost, and rock types for all Alaska. Rieger, Shoephorster and Furbush (1979) conducted a general soil survey for all Alaska at a scale of 1:500,000. This was accomplished with maps and some helicopter support to remote areas, but the descriptions are broad.

Michaelson (1974) investigated soils and watershed resources as part of the Joint Federal-State Land Use Planning Commission, Resource Planning Team. This inventory included the Upper Yukon-Canada area and the Porcupine River north of Yukon-Charley Rivers NP. Michaelson describes the types of soils found in certain kinds of sites.

## **ECOREGIONS**

Several ecosystem and ecoregional maps have been developed that encompass Yukon-Charley Rivers NP. Four classifications were developed on a statewide scale: Wahrhaftig (1965), Gallant et al. (1995), Nowacki and Brock (1995) and Nowacki et al. (2001). The earliest was by Wahrhaftig (1965), who developed a three level hierarchy, based on physiography. The finest scale of the hierarchy has 55 units.

Gallant et al. (1995) used a top down approach to create 20 ecoregions for Alaska using a variety of environmental characters including climate, physiography, elevation, local relief, surficial and bedrock geology, soils, permafrost, hydrology, and current and potential vegetation. Nowacki and Brock (1995) developed a map for Alaska using the upper four levels of Bailey et al.'s (1994) hierarchy, and McNab and Avers (1994) describe the sections. Nowacki et al. (2001) further refined ecoregions of Alaska by unifying the Gallant et al. (1995) and Nowacki and Brock (1995) ecoregional maps for Alaska. Thirty-two ecoregions were defined.

Specific to Yukon-Charley Rivers NP, Swanson (2001) divided the Preserve into 14 ecological subsections based on Bailey's (1996) methodology (Figure 5). Subsections were further subdivided into finer units where possible resulting in 30 detailed subsections. The subsections and detailed subsections were recognized by a qualitative interpretation and synthesis of the available data for the study area, including the author's knowledge of what is ecologically important. At the (1:250,000) scale, boundaries were drawn by mentally synthesizing geologic or geomorphologic information with data from the following references:

- Color-infrared aerial photographs (1:60,000 scale, 1979 - 1984) viewed in stereo for vegetation and landforms.
- Geologic maps (1:250,000 scale) for major bedrock features (Brabb and Churkin, 1969; Dover and Miyaoka, 1988; and Foster, 1976).
- Color-infrared aerial photographs (1:60,000 scale, 1979 - 1984) viewed in stereo for vegetation and landforms.
- Land cover map (1:63,360 scale, Ducks Unlimited, 1998) classified from Landsat imagery for vegetation and other land cover classes.

Most of the subsections could be readily subdivided into the finer scale detailed subsections. However, not all of these more detailed subsections are fine enough to qualify as the next level down in the National Hierarchical Framework of Ecological Units, the Landtype Association (Cleland et al. 1997). Thus the finer units were referred to simply as "detailed subsections".

## METHODS

The methods section is divided into two sections: plant association determinations and fire induced vegetation succession.

### PLANT ASSOCIATION DETERMINATIONS

#### Sampling Design

Sixty-nine plots along 16 transects were sampled during July 2003 in Yukon-Charley Rivers NP. The location selection for proposed transects was based on: 1) systematic transect location across the Preserve, and 2) a refinement of transect locations based on other factors such as ecoregions, existing plots and fire history. A transect traversed numerous map classes and plant associations.

The Ducks Unlimited (1998) satellite image-derived landcover map of the Preserve was used as the base map for placement of the transects. A grid large enough to ensure placement of 16+ transects across the Preserve was superimposed on the satellite image. A transect was then placed at the intersection of all grid lines. We then evaluated whether each ecoregional subsection (Figure 5) was adequately represented in the sampling scheme based on weighting by area (Table 2) and existing plot information. Existing plots included NPS Firepro paired plots, Firepro ground truth plots, and USDA National Forest Service Forest Health Monitoring plots. In order to adequately sample plots in each ecoregion, the transects were moved or additional transects were systematically selected.

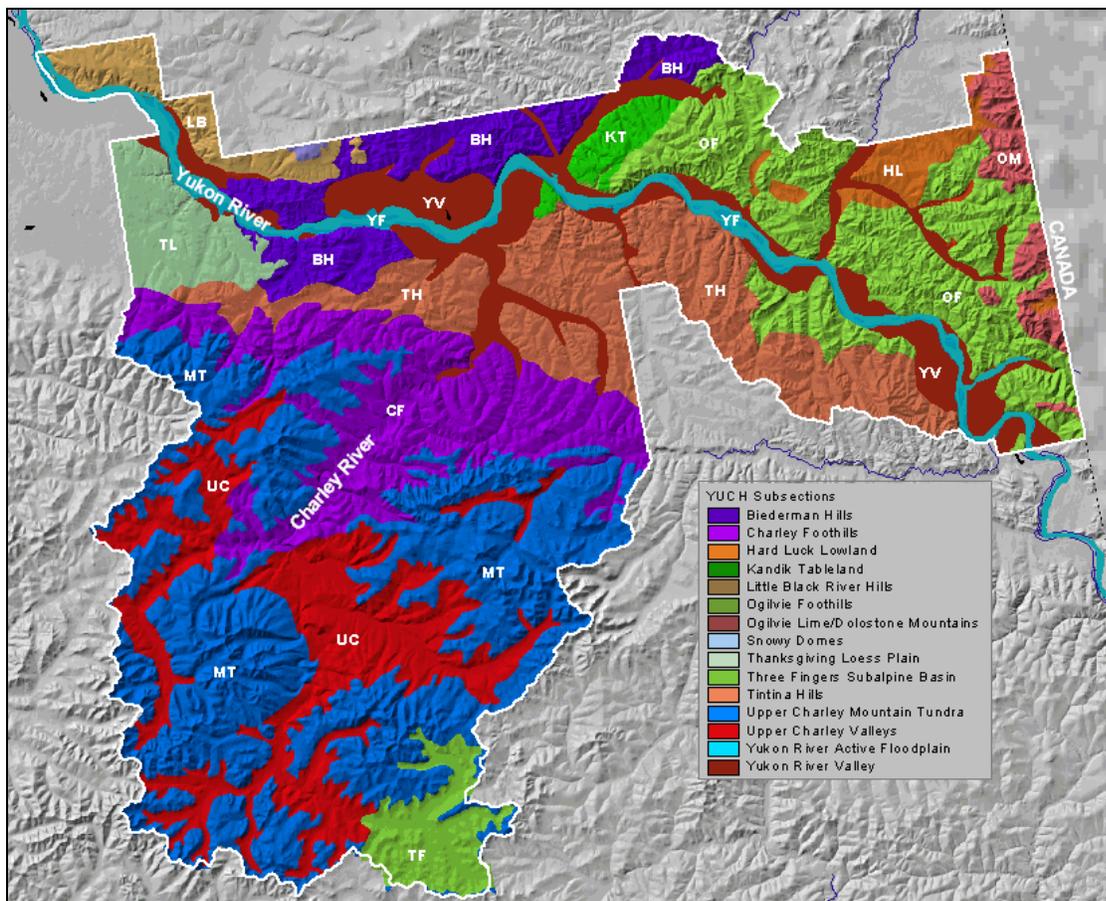


Figure 5. Subsections of Yukon-Charley Rivers National Preserve (Swanson 2001).

Table 2. The actual versus expected number of plots—based on weighting by area—per subsection.

<b>Sym- bol</b>	<b>Subsection</b>	<b>Detailed subsection</b>	<b>Acres</b>	<b>Total pre- 2003 plots</b>	<b>Expected # plots</b>	<b>2003 transects</b>
BH1	Biederman Hills	Biederman Hills	134,336	15	17.7	1
BH2		Biederman Hills bluffs	6,979	3	0.9	0
CF	Charley Foothills	Charley Foothills	280,775	41	37.1	1.5
HL	Hard Luck Lowland	Hard Luck Lowland	39,819	1	5.3	1
KT	Kandik Tableland	Kandik Tableland	28,628	1	3.8	0
LB1	Little Black River Hills	Little Black River Hills	42,507	5	5.6	2
LB2		Little Black River Hills bluffs	16,676	3	2.2	0
OF1	Ogilvie Foothills	Ogilvie Foothills	291,222	23	38.4	1
OF2		Ogilvie Foothills bluffs	8,783	2	1.2	0
OM	Ogilvie Lime/Dolostone Mtns	Ogilvie Lime/Dolostone Mountains	51,504	3	6.8	0.5
SD	Snowy Domes	Snowy Domes	2,860	5	0.4	0
TL	Thanksgiving Loess Plain	Thanksgiving Loess Plain	74,442	8	9.8	1
TF	Three Fingers Subalpine Basin	Three Fingers Subalpine Basin	67,741	3	8.9	1
TH	Tintina Hills	Tintina Hills	286,869	33	37.9	0.5
MT1	Upper Charley Mountain Tundra	High and rugged	30,151	0	4.0	0.5
MT2		Barren domes	323,220	13	42.7	0.5
MT3		Gentle vegetated ridges	257,908	45	34.0	1
UC1	Upper Charley Valleys	Subalpine valleys	44,217	6	5.8	0
UC2		Beverly/Copper/East Fork mountain slopes	212,032	43	28.0	0
UC3		Copper Creek tussock slopes	23,741	13	3.1	0
UC4		Upper Charley plain	9,119	6	1.2	0
YV1	Yukon River Valley	Yukon River active floodplain	32,334	5	4.3	1.5
YV2		Wet terraces with oxbows	11,700	1	1.5	1
YV3		Wet terraces with few ponds	80,873	20	10.7	1
YV4		Wet terraces with thermokarst lakes	3,425	1	0.5	0
YV5		High terraces, undulating	223	12	0.0	0
YV6		Nation/Kandik/Bonanza valleys	52,119	13	6.9	0.5
YV7		Tatonduk Valley	4,152	0	0.5	0
YV8		Yukon River	36,188	0	4.8	0.5
<b>Total</b>			<b>2,454,543</b>	<b>324</b>	<b>324</b>	<b>16</b>

Fire history maps were also used for placement of transects. The NPS FireScar GIS layer (U.S. National Park Service Alaska Support Office, State of Alaska Department of Forestry, Alaska Fire Service Bureau of Land Management 2002) provides a complete fire history for fires over 100 acres in size since 1950 (Figure 6). The NPS ParkFire GIS layer provides a point representation of all fires in Yukon-Charley Rivers NP regardless of size. We chose to sample within the larger burn areas using the FireScar layer. This is because small burns are difficult to locate when in the field, whereas large burned areas are easier to find. We sampled the following fire scar ages in order to sample a breadth of site ages: younger than 1950, 1950, 1954, 1957, 1969, 1971, 1977, 1986, 1991, 1993 and 1999. The “younger than 1950” represents forested areas not burned since 1950. Based on the FireScar GIS layer, approximately half of the forested portion of the Preserve has burned since 1950 and we consequently placed half of the plots in the “burned since 1950” portions. We then evaluated whether each fire scar age (Figure 6) was adequately represented in the sampling scheme based on weighting by area (Table 3) and existing plot information. In order to adequately sample plots in each burn age, the transects were moved or additional transects were systematically selected.

Additional refinement to transect placement was based on the following environmental factors. All aspects (north, south, east, and west) on mountain slopes were included. Private in-holdings were avoided. The landcover map was reviewed and distinct landcover signatures were sampled. Typically, in the mountains, each transect extended from a ridge top to valley bottom. In some areas, such as level or rolling topography, transects were very large in order to encompass its full environmental variability.

Figure 6. Polygons depicting post-1950 fire history within the Preserve (U.S. National Park Service et al. 2004).

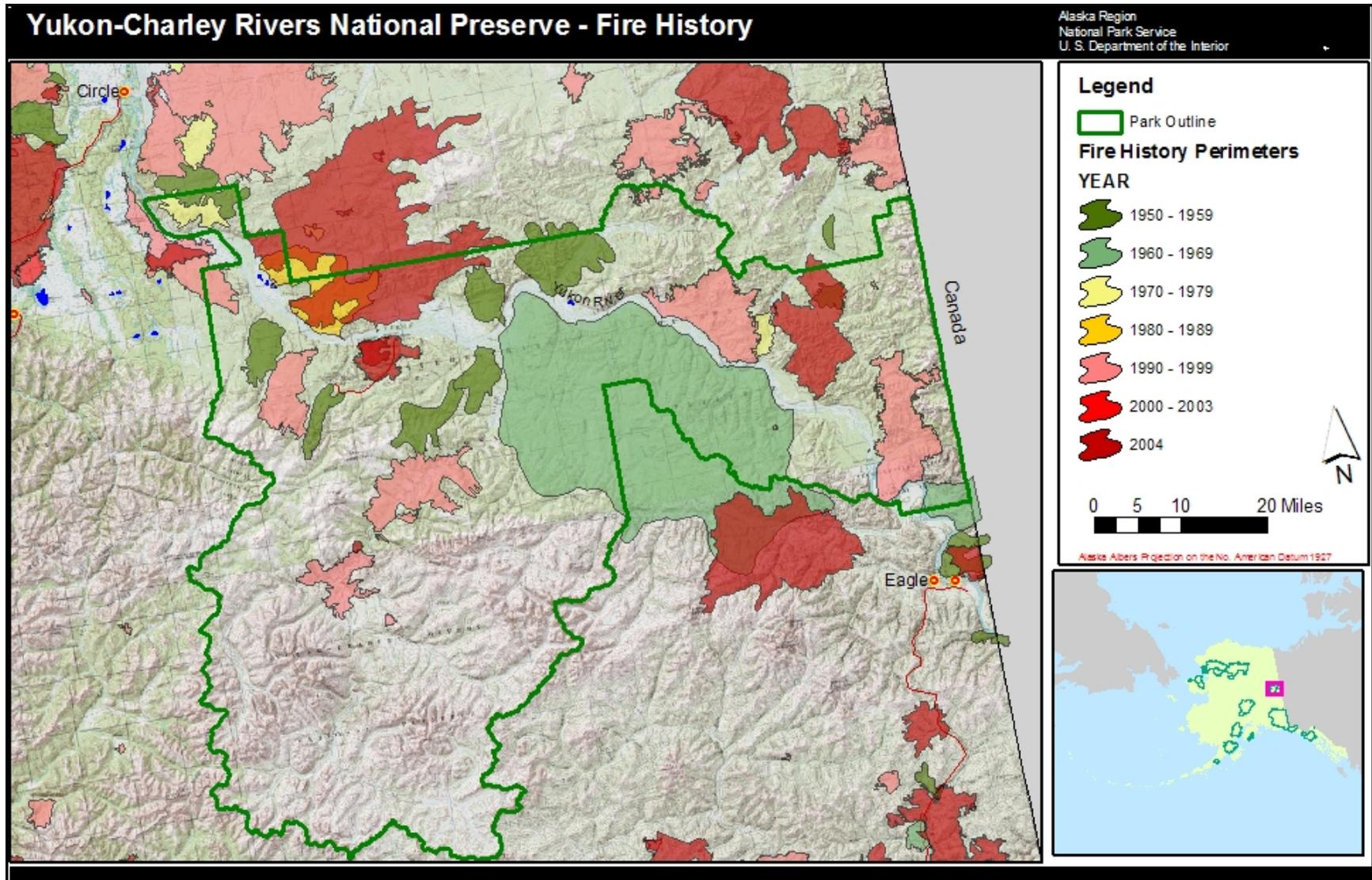


Table 3. The actual versus expected number of plots—based on weighting by area—per age of burn.

Age of burn	Total pre-2003 plots	Expected number of plots	2003 transects
0	8		
3	3	4	1
6	3	4	1
9	3	4	1
11	3	3	1
16	3	7	1
17	15	1	0
25	3	10	1
33	6	10	2
36	13	4	0
45	3	12	1
48	3	4	1
52	3	7	1

For field use, transect shape files were preloaded into the GPS units used in the field in addition to delineating transects on 1:63,360 USGS topographic maps. Color-infrared aerial photographs (1:60,000 scale, 1979 to 1984) were also used for field orientation. The final 2003 transect/plot locations are shown in Figure 7 and the pre-2003 sample locations are shown in Figures 8 and 9. Locations are not available for the 76 USDA Forest Service Forest Health Monitoring plots collected in 1979 and 1980.

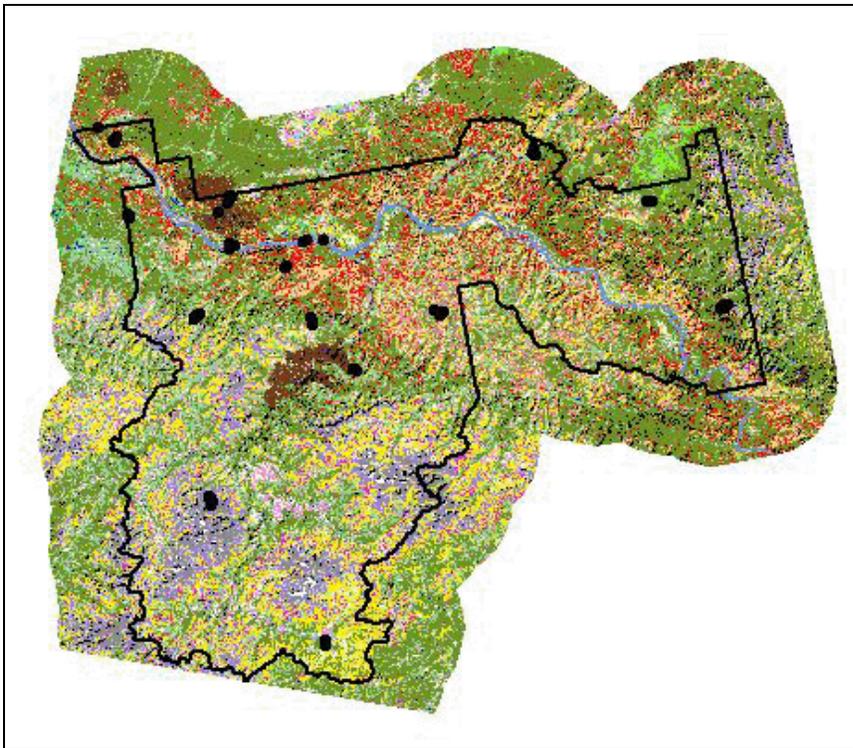


Figure 7. The 69 plot locations collected by AKNHP and AKSO in 2003.

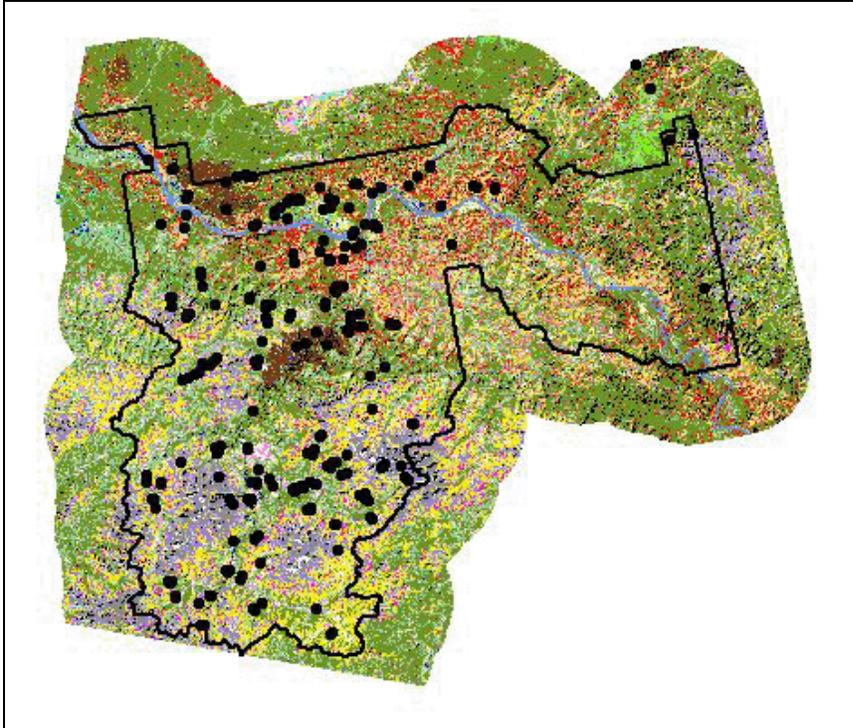


Figure 8. The National Park Service Firepro ground truth plots collected from 1984 through 1988.

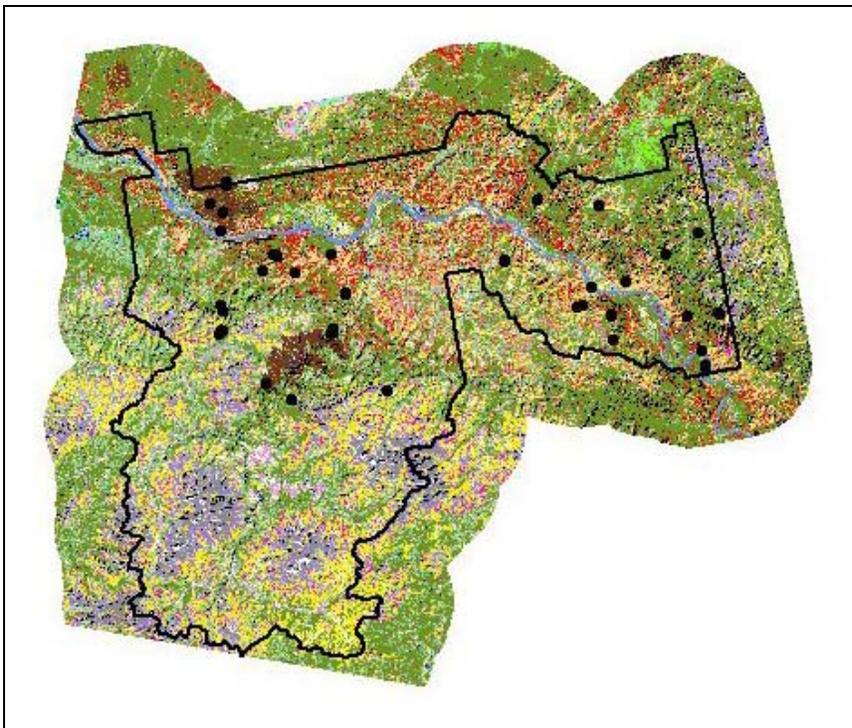


Figure 9. The National Park Service Firepro paired plots originally sampled in 1983.

### **Plot Field Data Collection**

In summer 2003, two crews of two personnel each sampled a total of 69 plots within the 16 transects. At each transect, one field crew was let off on a ridge by helicopter and walked down slope sampling all the different plant associations the crew encountered. Air photos and the landcover map were used to help identify unique communities. Selection of plant associations to sample was similar to the approach termed "subjective sampling without preconceived bias" as described by Mueller-Dombois and Ellenberg (1974). Plant association selection was based on homogeneous vegetation, and associations were not chosen with regard to their position in any classification, extant or envisioned, or by applicability to specific management considerations.

A single 10 by 10 meter plot was used to sample each plant association. Plot size was altered for narrow or small communities. A ground site description form (Figure 10) was used to record plant association information. Vascular and nonvascular species within the plots were recorded, and six letter codes were used to abbreviate species names. The six-letter code for a species combines the first three letters from the genus and specific epithet, and was based on Hultén (1968). In most cases a full species list was obtained, however, if time was insufficient, only the dominant species from each structural layer were recorded. Canopy cover was ocularly estimated (Brown 1954) for each species and could sum to greater than 100%. Canopy height and strata were estimated for the dominant species. A minimum of one of the largest trees was cored per plot. Tree rings were counted and, if time allowed, recorded on site. Otherwise they were collected in straws and the rings were counted in the office using a stereoscope. Species not identified in the field were collected and identified in the AKNHP office or identified by C. L. Parker at the University of Alaska Museum Herbarium.

Site variables included slope, aspect, landform, hydrologic regime, biome, depth of soil peat, A, B and C-horizons, depth to water, and depth to permafrost. Other variables include air photo number, land cover class name, date, surveyors, photos, latitude and longitude, and environmental and disturbance comments. Photographs and a GPS point were taken for each plot. Field crews downloaded the GPS points and photographs to a computer on a daily basis.

### **Field Information Compilation and Entry**

The 2003 field data sheets were double checked for accuracy, completeness, and legibility. All species information was standardized using the Integrated Taxonomic Information System (<http://www.itis.usda.gov/index.html>). All field data was entered into the Yukon-Charley Field Data Viewer (an Access/ArcView database) maintained by the AKSO personnel and each sample point or polygon was linked to the georeferenced sample site by a unique id. Photos were linked to sample points via the same id. At the end of the project, data sheets, field notes, maps, slides and all associated project files were accessioned by the NPS and items cataloged. The NPS Firepro paired plots, and Firepro ground truth plots had already been entered into the ACCESS database. Seventy-six USDA Forest Service Forest Health Monitoring plots sampled from 1979 to 1980 were also entered into the same database as used for the 2003 data.



### **Determination of Plant Associations**

Plant associations were defined using 348 plots from the following sources:

- 44 National Park Service Firepro paired plots, originally sampled in 1983
- 159 National Park Service Firepro ground truth plots, 1984 - 1988
- 76 USDA Forest Service Forest Health Monitoring plots, 1979 - 1980
- 69 AKNHP/AKSO plots, 2003

The scientific names and corresponding canopy cover values—already entered in Access—were converted to Association Tables and Constancy-coverage tables. The program was used to help group the plots into plant associations. A stepwise procedure of successive approximations was used to classify the plant associations (Pfister and Arno 1980). Association tables of the preliminary dominance-type groupings were created by using the species and cover data. A dichotomous key was developed during the process of successive approximations. Typically, the presence or absence of the dominant species representing each plant association was used as the indicator species within the key. South-facing bluff and dry steep sideslope associations were defined using the above data plus the review of verbal descriptions by Roland (1990) and Wesser and Devoe (1987).

A plant association description was prepared for each type. The descriptions were based on species lists, canopy cover, structure, and site information. Constancy-coverage tables were created for each defined association. Naming of the community type followed the frequently used system of a binomial with the dominant overstory species separated from the dominant or diagnostic indicator of the undergrowth by a slash (e.g., the *Picea glauca* / *Betula nana* plant association; Mueller-Dombois and Ellenberg 1974). In dwarf shrub and herbaceous communities, however, structure is sometimes limited to a single layer; we consider this the overstory and either ignore all references to additional layers (e.g., the *Calamagrostis canadensis* plant association), or designate a codominant species with a dash (e.g., the *Dryas octopetala* - *Cassiope tetragona* plant association).

## **FIRE INDUCED VEGETATION SUCCESSION**

Within Yukon-Charley Rivers NP the boreal forest fire induced successional sequences were subjectively described at a coarse scale. A chronosequence approach was used for describing succession. The seral sequences were determined using a literature review and qualitative and quantitative field information including a map of fire distribution and age (FireScar database), and 94 of the plots used for the plant association classification. These plots were of known age since fire, and contained detailed compositional and structural information.

The literature review and field observations indicated that a site's slope, aspect and hydrology are good indicators of its successional trajectory. To address succession, the plot information was divided into the following coarse scale categories based on slope, aspect or hydrology:

- South-facing slopes: the expected late seral association is *Populus tremuloides* or *Picea glauca*
- East- and west-facing slopes: the expected late seral association is *Picea glauca*
- North-facing slopes: the expected late seral association is *Picea mariana*
- Wet level or low angle slopes: the expected late seral association is *Picea mariana* and tussock tundra
- Mesic level or low angle slopes: the expected late seral association is *Picea mariana*

Diagrams and matrices of the plots were then developed contrasting species cover and height with post-fire site age and abiotic characteristics. A floodplain boreal forest sere is also described for the Preserve using the same methods but it is not fire induced.

## **TAXONOMY**

Note that *Ledum palustre* ssp. *decumbens* within this document is synonymous with both *Ledum palustre* and *Ledum palustre* ssp. *decumbens*.

## POST-FIRE BOREAL FOREST SUCCESSION

### LITERATURE REVIEW OF POST-FIRE BOREAL FOREST SUCCESSION

Fire is the primary disturbance factor in the boreal forests of Yukon-Charley Rivers NP and interior Alaska. Approximately half of Yukon-Charley Rivers NP's boreal forest has burned within the past 54 years based on the NPS FireScar data set. Nearly all has likely burned in the last 200 - 250 years based on other boreal forest studies in Alaska (Foote 1983, Viereck 1973). Yarie (1981) reports a fire interval of 113 years for *Picea glauca* and 43 years for *Picea mariana* for the Porcupine River drainage north of the study area.

In a typical year, most fires occur during mid summer. The risk of fire is reduced in early summer because the soils are wet from snowmelt and in late summer precipitation increases. During long, hot, dry summers the percentage of the landscape burned increases (Kasischke et al. 2002). In Yukon-Charley Rivers NP, lightning likely accounts for most of the fires, and human ignitions are probably not a major factor due to the sparse human usage of the Preserve.

Vegetation succession following fire has been described for the boreal forests of Alaska and the dominant seral trees are *Picea mariana*, *Picea glauca*, *Populus tremuloides* and *Betula papyrifera*. Most *Picea* and *Betula papyrifera* seedlings establish within the first 20 years after fire. *Picea mariana*, however, may continue to germinate after 20 years (Fastie et al. 2002, Johnson 1992, Johnstone and Chapin 2003). A variety of factors affect the success of tree seedling establishment after fire. Intense fires may burn off the organic mat, often killing seeds in the soil and most of the underground reproductive parts of resprouting vegetation (Boucher 2003). *Picea mariana*, however, has serotinous cones and germinates on site. Even though *Picea glauca* seeds typically do not survive fires, an intense burn often exposes mineral soil that in turn provides an ideal seed bed for *Picea glauca* seeds that arrive from off the site (Cater and Chapin 2000, Johnstone and Chapin 2003, Mann and Plug 1999, Viereck 1973, Zasada et al. 1992). Severe burns also favor recolonization by *Chamerion angustifolium* ssp. *angustifolium* (Dryness and Norum 1983).

A light burn typically leaves the organic mat wholly or partially intact and may only kill the trees and shrubs. It favors those species that reproduce from rhizomes, crown sprouts, or root sprouts such as *Calamagrostis canadensis* (Boucher 2003, Viereck and Schandelmeier 1980). It has also been demonstrated that a thick covering of *Calamagrostis canadensis* reduces the success of *Picea* seedling establishment (Cater and Chapin 2000).

Aspect and permafrost are important factors in determining vegetation succession. Permafrost is generally absent on the warmer drier sites of the region such as south-facing slopes, and is discontinuous on east- and west-facing slopes. On these south-, east- and west-facing slopes where permafrost is discontinuous or absent *Betula papyrifera*, *Populus tremuloides* or *Picea glauca* initially invade and dominate or codominate sites following fire. *Picea glauca* eventually dominates the forest, however, *Populus tremuloides* may remain dominant on the driest sites (Osterkamp and Romanovsky 1999, Sazonova and Romanovsky 2003). On the colder and wetter sites of the region—such as north-facing slopes, level terraces, and rounded ridges where permafrost dominates—late seral communities are typically dominated by *Picea mariana*. Tussock forming graminoids such as *Carex bigelowii* and *Eriophorum vaginatum* may be absent on moist sites, yet dominate the understory on the wetter sites. *Picea mariana* is better adapted than *Picea glauca* to cold ground and quickly recolonizes sites following severe fire. This is also largely due to *Picea mariana* having serotinous cones. In lower intensity fires, the tussock grasses and many shrubs often survive leading to a rapid recovery of the sites original understory species composition and structure. *Picea mariana* stands are also more vulnerable to fire, with burn intervals of less than half that of *Picea glauca* stands (Foote 1983, Viereck 1973, Yarie 1981). This vulnerability to fire is partially due to the branches of *Picea mariana* extending to ground level giving fire an easy step

ladder from the forest floor into the canopy. The needles are also covered by a waxy substance that readily burns.

On colder and wetter sites, permafrost is typically present and its relationship with fire is an important factor that strongly influences vegetation succession. The presence of permafrost is, in turn, strongly influenced by multiple factors including aspect, slope, time since fire, and changes in insulation by snow, moss, and the surface organic mat (Osterkamp and Romanovsky 1999, Sazonova and Romanovsky 2003). Intense fires that burn off the surface organic mat causes a dramatic decline in soil insulation, the soils warm and the permafrost melts resulting in a thicker soil active layer (Dyrness 1982, Viereck 1982, Viereck and Dyrness 1979, Viereck et al. 1979). During succession, as the insulation layer (organic mat) increases, the permafrost layer also starts to reform. An unfrozen layer (talik) may form between the newly developed upper permafrost layer and the lowered surface of original permafrost (Yoshikawa et al. 2003). Water drains laterally through the talik resulting in drier surface soils. Eventually, as the permafrost layer continues to expand, the water will flow through the surface layer resulting in much wetter soils. On terraces, thermokarst may form if ice-rich permafrost thaws causing subsidence of the ground surface. Water may accumulate in these new depressions forming ponds or saturated soils (Yoshikawa et al. 2003).

## SUCCESSIONAL SEQUENCE RESULTS

A distinct pattern observed from the air in Yukon-Charley Rivers NP is that late seral landscapes appear as a continuous cover of *Picea* with variations in cover, except on some south facing slopes that may support deciduous trees or bluff communities. Late seral landscapes do not appear patchy. In contrast, landscapes burned within the last 50 years are patchy due to burn perimeters and fire severity. These areas are typically a mosaic of *Picea*, *Populus tremuloides*, *Betula papyrifera*-*Picea*, *Betula papyrifera* and herbaceous dominated seral stages. The fires can also leave some late seral *Picea* stands that contribute to the overall patchy appearance of the landscape.

This section describes five major post-fire boreal forest vegetation successional sequences plus a floodplain sere in the Preserve. The major successional sequences are named using their slope, aspect or hydrology and the late seral vegetation stage. Using slope, aspect or hydrology provides a general concept of the successional patterns but does not reduce the importance of other factors such as permafrost depth, elevation, soil temperature, soil moisture, etc. Note that these successional sequences can be divided into finer defined seres.

The following are the generalized fire induced boreal forest seres in the Preserve:

- South-facing slopes / Late seral *Populus tremuloides* or *Picea glauca*
- East- and west-facing slopes / Late seral *Picea glauca*
- North-facing slopes / Late seral *Picea mariana*
- Wet level or low angle slopes / Late seral *Picea mariana* and tussock tundra
- Mesic level or low angle slopes / Late seral *Picea mariana*

A Floodplain / Late seral *Picea mariana* sere is also described for the Preserve, but it is not fire induced.

As stated in the methods, the seral sequences were determined using a literature review and qualitative and quantitative field information including a map of fire distribution and age (NPS GIS FireScar layer), and 94 of the plots used for the plant association classification. These plots were of known age since fire and contain detailed compositional and structural information. Unfortunately soils information and permafrost depth were not recorded in this subset of plots.

This chronosequence approach for describing succession presents certain problems in accuracy. Studies have shown that a consistent stepwise progression in seral stages is not an accurate portrayal of succession on any given surface (Boggs and Weaver 1994, Fastie 1995, Johnstone 2003, Payette 1992). Multiple pathways occur and are likely a function of landscape characteristics and species life history. Some factors that may alter a typical fire successional sequence include herbivory by mammals, insect infestations, windthrow, climate cycles and flooding on floodplains. Mammalian herbivores such as moose (*Alces alces*) consume early successional species such as *Alnus* species and *Salix* species. This reduction in early seral species often allows the less palatable, slower growing late successional species to dominate (Bryant and Chapin 1986, Kielland and Bryant 1998). Insect outbreaks can also alter succession by reducing an insect's host species. For example, the spruce bark beetle (*Dendroctonus rufipennis*) outbreak has greatly reduced mature *Picea* trees in extensive areas of south-central Alaska (Boucher 2003, McCullough et al. 1998). Wind, in turn, may alter succession by blowing down patches of mature forest or individual trees.

### **South-facing slopes / Late seral *Populus tremuloides* or *Picea glauca***

On forested south-facing slopes, late seral communities tend to be either *Populus tremuloides* or *Picea glauca* (Figure 11, Table 4). The understory of both the *Populus tremuloides* and *Picea glauca* communities reflects a dry environment consisting of *Rosa acicularis*, and a reduced cover of *Ledum palustre* ssp. *decumbens*, *Betula nana* and *Vaccinium uliginosum*.

*Populus tremuloides* dominated sites appear to occupy the driest forest sites, and are often found next to or mixed in with dry herbaceous slope communities (such as *Festuca altaica* - *Calamagrostis* species) and bluff communities. One late seral *Populus tremuloides* community (*Populus tremuloides* / *Rosa acicularis*) is described for the Preserve. Following fire, *Populus tremuloides* may rapidly resprout leading directly to self-replacement. We speculate that it may also convert to a bluff or dry herbaceous slope association that may, in time, revert back to a *Populus tremuloides* community.

*Picea glauca* dominated sites are the other late seral forest community on south-facing slopes within the Preserve. These sites are often found next to or mixed in with *Populus tremuloides* communities and next to bluff or dry herbaceous slope associations. Two late seral *Picea glauca* communities on south-facing slopes are described for the Preserve (*Picea glauca* / *Rosa acicularis*, *Picea glauca* / *Vaccinium uliginosum*). Based on the plot data, *Picea glauca* and *Betula papyrifera* invade simultaneously (Table 4). They develop into a *Picea glauca* / *Betula papyrifera* forest. *Betula papyrifera* eventually dies out and *Picea glauca* dominates 60 years post-fire. *Picea mariana* was not recorded in any of the associations that occur on south-facing slopes.

According to Roland (1990) and Wesser and Devoe (1987), these are dry to moist sites with no permafrost and no or only limited organic matter buildup on the soil surface and within the soil profile. Soil information was only recorded in four of the 14 sites. The age of the four sites ranges from 12 to 49 years. Organic matter depth ranges from 5 to 15 cm. Permafrost was not recorded. The mineral soil consists of silt, sand and gravel, and rock or bedrock is often shallow (7 to 36 cm deep). The pH at 10 cm deep ranges from 4.7 to 6.6. These measured soil characteristics did not exhibit a distinct pattern of change through succession.

Figure 11. Two typical successional pathways following fire on south-facing slopes. The 'years post-fire' columns give the actual ages of the plots.

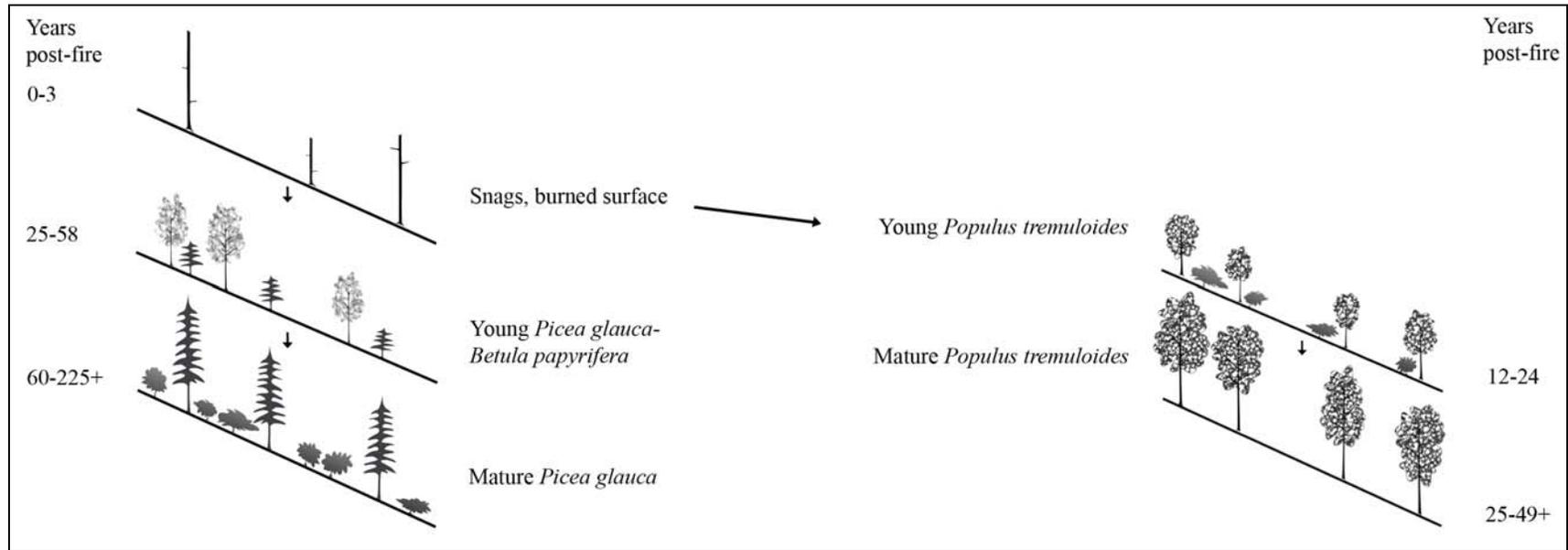


Table 4. Cover of dominant species on sites of increasing age following fire on south-facing slopes. Slope ranges from 14 to 45 degrees.

Site age post- fire	Percent cover by species																Soils data									
	Pima*	Pigl		Bepa		Potr											Tuss- ocks (% or yes)	Depth (cm)				pH at 10 cm				
	Ht Cov	Ht Cov	Ht Cov	Ht Cov	Alnus	Bena	Legr	Lepa	Vaul	Cabi	Erva	Caca	Chan	Total moss	Elev (m)	Orga- nic		Min- eral soil	Perma- frost	Rock	Soil tex- ture ***					
3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	37	533	0	**						
12	--	--	1	0.3	1	1.7	2	1.3	--	22	--	--	1	--	--	--	75	966	0	5	3	--	8	Si, sa, gr	6.6	
16	--	--	--	--	--	--	30	5	--	--	--	--	--	--	--	4	2	867	0							
16	--	--	--	--	--	--	25	5	--	--	--	0.1	--	--	--	0	1	833	0							
24	--	--	--	--	--	--	50	10	--	--	--	--	--	--	14	3	--	267	0							
25	--	--	8	1.7	10	6.7	75	8.3	--	--	--	--	--	--	3	2	1	605	0	15	5	--	20	Sa, gr	6.4	
25	--	--	15	4.3	40	8.3	--	--	--	--	1	--	--	--	--	2	2	610	0	10	26	--	36	Sa, gr	4.7	
25	--	--	20	10	20	10	--	--	--	--	0.5	--	--	--	--	0.3	22	500	0							
36	--	--	10	3.3	15	5	--	--	--	--	--	--	0.1	--	--	2	46	383	0							
49	--	--	5	0.7	5	5	45	3.3	--	--	--	--	5	--	--	1	1	10	751	0	5	2	--	7	Silt	6.6
58	--	--	10	5.7	30	5	--	--	6	--	--	18	2	--	--	0.2	34	833	0							
60	--	--	40	13	--	--	--	--	12	--	--	16	2	--	--	1	60	833	0							
119	--	--	20	10	--	--	--	--	--	1	--	4	7	--	--	--	17	1,133	0							
225	--	--	20	10	--	--	--	--	--	15	--	3	0.5	--	--	--	17	1,333	0							

\* Pima = *Picea mariana*, Pigl = *Picea glauca*, Bepa = *Betula papyrifera*, Potr = *Populus tremuloides*, Alnus = *Alnus*, Bena = *Betula nana*, Legr = *Ledum groenlandicum*, Lepa = *Ledum palustre* ssp. *decumbens*, Vaul = *Vaccinium uliginosum*, Cabi = *Carex bigelowii*, Erva = *Eriophorum vaginatum*, Caca = *Calamagrostis canadensis*, Chan = *Chamerion angustifolium* ssp. *angustifolium*.

\*\* Shaded boxes indicate that no data was collected in field

\*\*\* Si = Silt, Sa = Sand, Gr = Gravel

### **East- and west-facing slopes / Late seral *Picea glauca***

On east- and west-facing slopes (9 to 50 degrees), late seral sites are dominated by *Picea glauca* communities (Figure 12, Table 5). Some of the drier sites such as slope breaks may also support late seral *Populus tremuloides*. Several late seral *Picea glauca* communities on east- and west-facing slopes are described for the Preserve (*Picea glauca* / *Betula nana*, *Picea glauca* / Bryophyte, *Picea glauca* / *Rosa acicularis*, *Picea glauca* / *Vaccinium uliginosum*). The *Picea glauca* understory consists of tall *Alnus viridis* ssp. *crispa*, and a lower shrub strata of *Betula nana*, *Ledum palustre* ssp. *decumbens* and *Vaccinium uliginosum*. Tussocks and tussock forming graminoids such as *Carex bigelowii* are uncommon.

Following fire a variety of herbaceous communities dominate; primarily *Chamerion angustifolium* ssp. *angustifolium* and *Calamagrostis canadensis*. On sites with permafrost, the permafrost layer probably drops and the surface organic matter dries. Table 5 suggests that *Betula papyrifera*, *Populus tremuloides* or *Picea glauca* may individually invade and dominate sites. *Betula papyrifera* and *Picea glauca* may also colonize the site together developing into a *Picea glauca* / *Betula papyrifera* forest. *Picea glauca* eventually invades all the forested sites, and *Betula papyrifera* and *Populus tremuloides* eventually die out. *Picea glauca* dominates approximately 104 years post-fire. Permafrost may reform on some sites. *Picea mariana* is uncommon throughout succession.

On some east- and west-facing slopes, late seral *Populus tremuloides* stands when killed by fire quickly reestablish on site. *Populus tremuloides* appears to have a high growth rate and often expands beyond the borders of its previous sites. This site response is similar to some south facing slopes.

Soil information was only recorded in five of the 17 sites. The age of the 5 sites ranges from 4 to 170 years. Organic matter depth ranges from 3 to 68 cm. Permafrost was recorded only once on an older site (150 years old), the same site that supported the deepest organic layer (68 cm). Mineral soil texture is silt, sand and gravel, and rock or bedrock may be shallow (7 to 25 cm deep). The pH at 10 cm deep ranges from 6.3 to 6.9. These measured soil characteristics did not exhibit a distinct pattern of change through succession.

Figure 12. Two typical successional pathways following fire on east- and west-facing slopes. The ‘years post-fire’ columns give the actual ages of the plots.

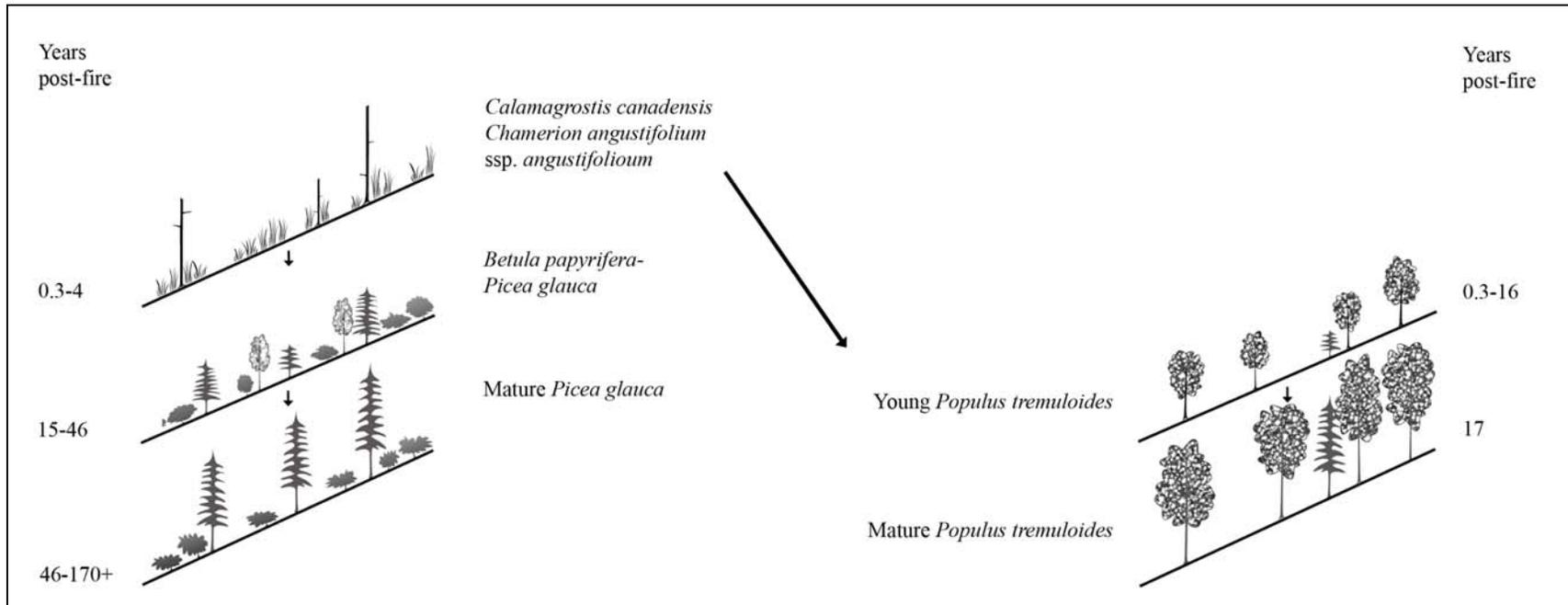


Table 5. Cover of dominant species on sites of increasing age following fire on east- and west-facing slopes. Slope ranges from 9 to 50 degrees.

Site age post- fire	Percent cover by species																Soils data									
	Pima*		Pigl		Bepa		Potr										Total moss	Elev (m)	Tuss- ocks (% or yes)	Depth (cm)			Soil texture ***	pH at 10 cm		
	Cov	Ht (m)	Cov	Ht (m)	Cov	Ht (m)	Cov	Ht (m)	Alnus	Bena	Legr	Lepa	Vaul	Cabi	Erva	Caca				Chan	Orga- nic	Min- eral soil			Perma- frost	Rock
0.3	--	--	--	--	--	--	33	0.7	3	--	--	3	--	3	--	3	67	2	400	0	**					
0.3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5	500	0						
1	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	0	800	0						
1	--	--	--	--	--	--	5	1.7	--	--	--	--	--	--	--	--	3	1	47	833	0					
2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11	98	533	0						
4	1	0.2	--	--	1	0.2	--	--	1	--	--	2	1	--	--	15	40	10	720	0	25	--	--	25	--	6.3
7	--	--	--	--	--	--	--	--	--	8	--	--	9	--	--	--	--	25	800	0						
15	--	--	67	13	--	--	--	--	0	--	--	--	--	--	--	--	--	56	833	0						
15	--	--	--	--	20	3.3	--	--	--	--	--	--	--	--	--	--	1	16	600	0						
16	--	--	--	--	10	3.3	--	--	--	--	--	1	0.01	--	--	--	12	15	433	0						
17	1	0.2	1	0.3	--	--	90	5	--	--	--	1	2	--	--	--	50	831	0	3	4	--	7	Silt	6.4	
17	--	--	15	--	85	--	--	--	18	--	--	--	--	--	--	--	--	54	267	0						
46	--	--	40	5.7	5	--	--	--	10	--	--	30	10	--	--	--	5	562	0	10	22	--	--	Si, sa, gr	6.9	
104	--	--	50	13	--	--	--	--	--	--	--	1	1	--	--	--	2	57	800	0						
110	--	--	35	8.3	--	--	--	--	--	--	0.1	--	1	--	--	--	53	767	0							
150	--	--	25	8.3	--	--	--	--	20	10	--	10	10	15	--	1	--	50	922	0	68	--	68	--	--	6.6
170	--	--	15	15	--	--	--	--	40	25	--	5	2	--	--	--	1	90	1,101	0	18	32	--	--	Si, sa, gr	6.5

\* Pima = *Picea mariana*, Pigl = *Picea glauca*, Bepa = *Betula papyrifera*, Potr = *Populus tremuloides*, Alnus = *Alnus*, Bena = *Betula nana*, Legr = *Ledum groenlandicum*, Lepa = *Ledum palustre* ssp. *decumbens*, Vaul = *Vaccinium uliginosum*, Cabi = *Carex bigelowii*, Erva = *Eriophorum vaginatum*, Caca = *Calamagrostis canadensis*, Chan = *Chamerion angustifolium* ssp. *angustifolium*.

\*\* Shaded boxes indicate that no data was collected in field

\*\*\* Si = Silt, Sa = Sand, Gr = Gravel

### **North-facing slopes / Late seral *Picea mariana***

On north-facing slopes, late seral sites are dominated by *Picea mariana* (Figure 13, Table 6). Several late seral *Picea mariana* communities on north-facing slopes are described for the Preserve (Dwarf *Picea mariana* / *Betula nana* – *Eriophorum vaginatum*, Dwarf *Picea mariana* / *Ledum palustre* ssp. *decumbens*, Dwarf *Picea mariana* / *Vaccinium vitis-idaea*, *Picea mariana* / *Alnus viridis* ssp. *crispa*, *Picea mariana* / *Ledum palustre* ssp. *decumbens*, Young *Picea mariana* - *Betula papyrifera*). Late seral understory species include *Ledum palustre* ssp. *decumbens* and *Vaccinium uliginosum*. The tussock sedge *Eriophorum vaginatum* occurs intermittently throughout the late seral stands. On the lower slopes and toe slopes, the sites are moister and a thicker organic mat develops.

After an intense fire, all vascular plant species are often killed, including *Picea mariana*. The peat layer may or may not burn, resulting in a mosaic of burned and unburned patches. The permafrost depth drops dramatically due to a loss in organic matter insulation and the soils are drier and warmer.

*Picea mariana* invades the sites and sometimes *Betula papyrifera* invades. *Betula papyrifera* eventually dies out (Table 6). *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Eriophorum vaginatum* appear to rapidly reinvade the sites, but this is likely a function of the original burn intensity which, unfortunately, could not be evaluated with the given data.

Soil information was only recorded in two of the six sites. Organic matter depth ranges from 5 to 8 cm. Permafrost was not encountered. Mineral soil texture is silt, sand and gravel, and rock or bedrock may be shallow (6 cm deep). The pH at 10 cm deep ranges from 5.4 to 6.1. These measured soil characteristics did not exhibit a distinct pattern of change through succession.

Figure 13. Typical succession following fire on north-facing slopes. The 'years post-fire' column gives the actual ages of the plots.

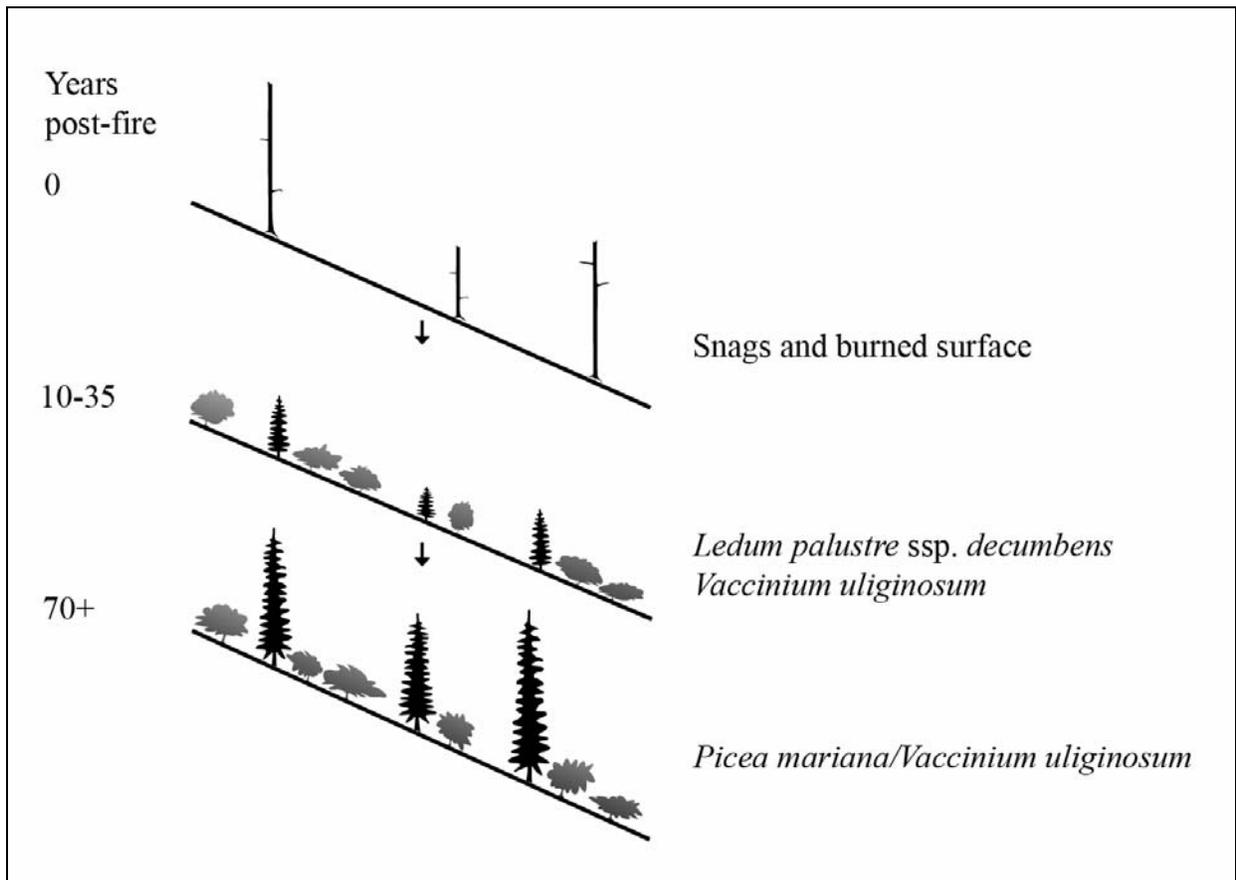


Table 6. Cover of dominant species on sites of increasing age following fire on north-facing slopes. Slope ranges from 15 to 27 degrees.

Site age post-fire	Pima* Pigl Bepa Potr				Percent cover by species													Soils data								
	Ht		Ht		Ht		Ht		Alnus	Bena	Legr	Lepa	Vaul	Cabi	Erva	Caca	Chan	Total moss	Elev (m)	Tuss-ocks (% or yes)	Depth (cm)				pH at 10 cm	
	Cov	(m)	Cov	(m)	Cov	(m)	Cov	(m)													Orga-nic	Min-eral soil	Perma-frost	Rock		Soil tex-ture ***
0.3	2	0.7	--	--	2	0.7	--	--	1	--	3	1	2	--	10	--	--	18	533	yes	**					
10	--	--	2	--	--	--	1	0.2	--	5	--	--	5	--	--	--	--	15	959	5	5	1	--	6	Gravel	6.1
16	2	3.3	--	--	--	--	--	--	1	--	--	13	9	--	18	--	0.2	27	633	yes						
34	5	1.7	--	--	15	3.3	--	--	5	--	--	40	2	--	--	1	--	90	561	0	8	42+	--	--	Si, sa, gr	5.4
35	2	0.7	--	--	2	0.7	--	--	3	--	12	10	29	--	29	--	--	52	533	yes						
70	20	6.7	--	--	--	--	--	--	2	--	--	2	12	--	4	--	--	46	633	0						

\* Pima = *Picea mariana*, Pigl = *Picea glauca*, Bepa = *Betula papyrifera*, Potr = *Populus tremuloides*, Alnus = *Alnus*, Bena = *Betula nana*, Legr = *Ledum groenlandicum*, Lepa = *Ledum palustre* ssp. *decumbens*, Vaul = *Vaccinium uliginosum*, Cabi = *Carex bigelowii*, Erva = *Eriophorum vaginatum*, Caca = *Calamagrostis canadensis*, Chan = *Chamerion angustifolium* ssp. *angustifolium*.

\*\* Shaded boxes indicate that no data was collected in field

\*\*\* Si = Silt, Sa = Sand, Gr = Gravel

### **Mesic level or low angle slopes / Late seral *Picea mariana***

On mesic, level or low angle slopes—such as toeslopes, valley bottoms, terraces, and rounded ridges—late seral sites are dominated by *Picea mariana* communities (Figure 14, Table 7). Several late seral *Picea mariana* communities of mesic low angle slopes are described for the Preserve (*Picea mariana* / *Betula nana*, *Picea mariana* / *Ledum palustre* ssp. *decumbens*, Dwarf *Picea mariana* / *Betula nana*, Dwarf *Picea mariana* / *Ledum palustre* ssp. *decumbens*, Dwarf *Picea mariana* / *Vaccinium vitis-idaea*). The late seral *Picea mariana* understory consists of *Betula nana*, *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. Tussock forming graminoids such as *Carex bigelowii* and *Eriophorum vaginatum* are uncommon.

Following fire, *Calamagrostis canadensis* tends to dominate. *Picea glauca* seedlings appear approximately 3 years post-fire, whereas *Picea mariana* and *Betula papyrifera* invade around 7 years. These species either dominate or codominate the sites by 34 years with the trees reaching heights of 4 to 17 meters. By approximately 103 years *Betula papyrifera* has died out, and *Picea glauca* dies out later, at approximately 125 years. *Picea mariana* persists through late succession but takes on a dwarf stature. *Alnus* species and *Betula nana* increase following fire, but eventually die out in late succession. *Ledum palustre* ssp. *decumbens*, *Ledum groenlandicum* and *Vaccinium uliginosum* all recover quickly following fire and maintain themselves through the late seral stages.

Soil information was recorded in 18 of the 25 sites. Organic matter depth ranges from 2 to 60 cm. Permafrost was encountered in 9 of the 18 sites and the shallowest depth was 5 cm. Mineral soil texture is silt, sand and gravel, and rock or bedrock may be shallow (12 to 20 cm deep). The pH at 10 cm deep ranges from 4.9 to 6.8. These measured soil characteristics did not exhibit a distinct pattern of change through succession.

Figure 14. Two typical successional pathways following fire on mesic level or low angle slopes (0 to 12°). The ‘years post-fire’ columns give the actual ages of the plots.

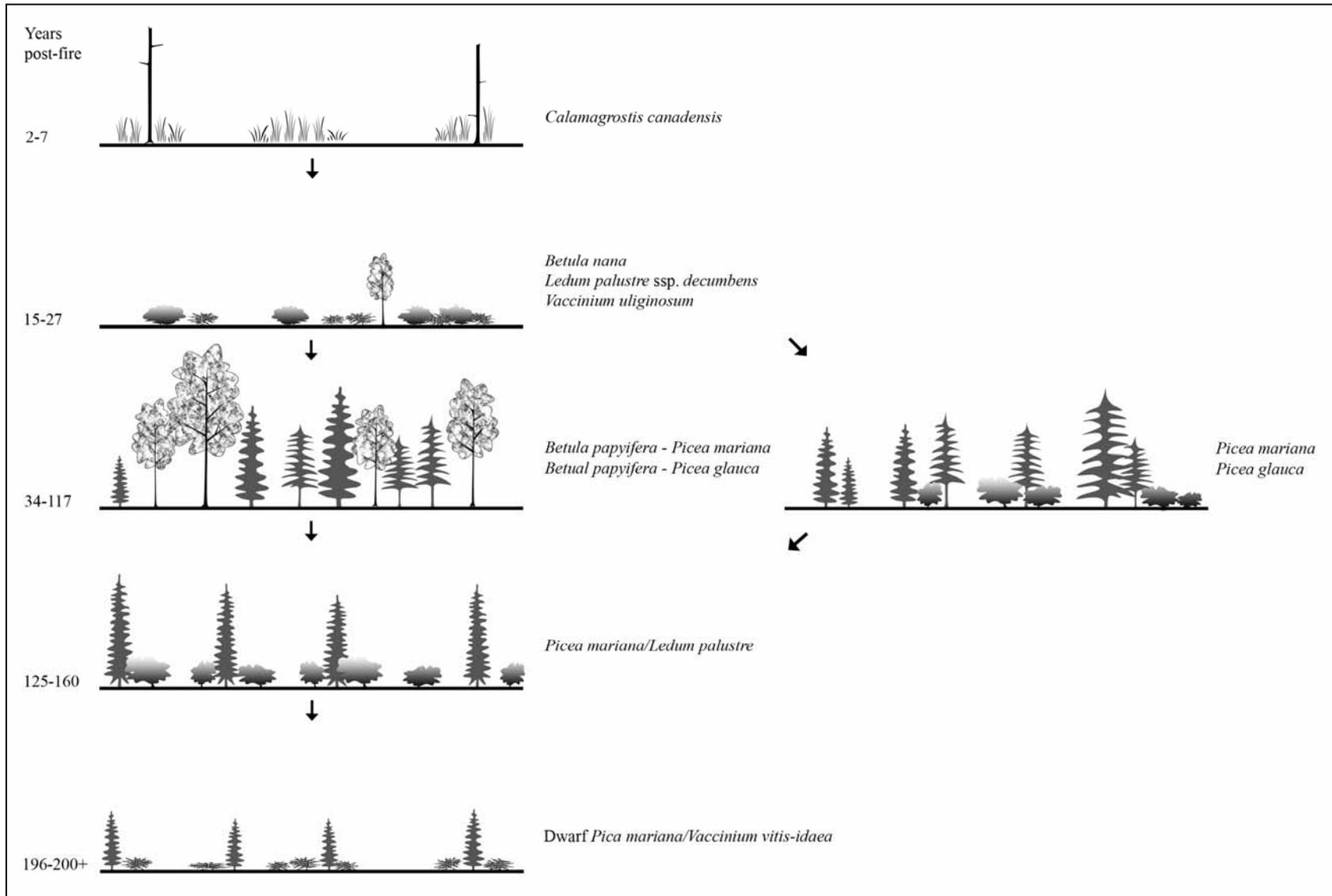


Table 7. Cover of dominant species on sites of increasing age following fire on mesic, level or low angle slopes. Slope ranges from 0 to 12 degrees.

Site age post-fire	Percent cover by species															Soils data									
	Pima*			Pigl		Bepa									Total moss	Elev (m)	Tussocks (% or yes)	Depth (cm)				pH at 10 cm			
	Cov	Ht (m)		Cov	Ht (m)	Cov	Ht (m)	Alnus	Bena	Legr	Lepa	Vaul	Cabi	Erva				Caca	Chan	Organic	Min-eral soil		Perma-frost	Rock	Soil texture ***
2	--	--	--	--	--	--	--	--	--	--	--	1	--	--	--	1	88	692	0	**					
3	--	--	5	2.7	--	--	3	8	--	5	2	3	--	20	3	3	862	0	2	58	--	--	Si, sa, gr	6	
7	--	--	1	0.2	--	--	1	--	20	--	--	--	--	20	1	25	425	0	10	26	36	--	Silt	6	
7	--	--	1	0.3	--	--	--	1	15	--	--	--	5	30	1	15	417	14	23	2	25	--	Silt	5.6	
15	--	--	--	--	--	--	--	1	28	3	0	--	7	--	0	36	633	yes							
17	1	0.3	--	--	1	2.7	2	--	--	15	15	--	--	--	--	40	759	0							
17	2	0.3	--	--	--	--	--	5	--	25	--	--	--	5	--	55	731	0	14	--	14	--	--		
17	1	--	--	--	--	--	--	40	--	30	2	--	--	5	1	50	764	0	10	2	--	12	Silt	5.7	
27	--	--	3	--	63	--	--	--	--	--	--	--	--	--	--	2	267	0							
27	1	0.3	5	2.3	--	--	--	10	--	40	5	--	--	--	--	30	697	0	15	5	--	20	Silt	6.6	
27	1	0.3	--	--	--	--	--	40	--	50	20	--	--	--	--	14	813	0	5	55	--	--	Silt	6.5	
27	1	0.3	5	2.0	1	2.0	10	35	--	--	1	--	--	40	1	20	720	0	4	56	--	--	Silt	6.7	
27	--	--	2	.3	1	0.3	--	30	--	20	15	--	--	--	1	60	831	0	4	3	7	--	Si, gr	6.4	
34	--	--	15	--	38	--	15	--	85	--	--	--	--	--	--	71	467	0							
34	20	5.0	--	--	25	6.7	5	--	--	35	--	--	--	2	1	55	606	0	20	5	25	--	Si, sa	5.4	
34	--	--	15	--	15	--	38	--	--	--	--	--	--	--	--	94	480	0							
53	15	--	--	--	--	--	--	20	--	10	15	1	--	--	--	50	872	0	3	13	--	16	Si, sa, gr	5.2	
75	5	16.7	5	17	60	13.3	20	--	--	--	--	--	--	5	--	30	572	0	10	23	33	--	Si, sa		
103	20	3	15	4.7	--	--	--	9	5	--	15	--	--	--	--	25	1,030	0	8	3	--	12	Si, sa, gr	6.3	
117	2	5.0	13	6.7	--	--	--	55	--	10	3	--	--	--	--	25	1,209	0	60	--	--	--	--	4.9	
125	25	6.7	--	--	--	--	--	5	--	30	10	--	--	1	--	90	682	0	20	3	23	--	Silt	6.8	
150	45	6.7	--	--	--	--	1	5	--	15	15	--	--	--	--	90	728	0	2	3	5	--	Si, gr	5.7	
160	60	5.0	--	--	--	--	--	--	30	--	1	5	--	3	--	50	430	0	18	10	28	--	Silt	5.8	
196	20	2.7	--	--	--	--	0.1	1	6	5	2	--	4	--	--	59	367	0							
200	40	2.7	--	--	--	--	--	1	--	--	--	--	--	--	--	35	401	0	0	46	--	--	--		

\* Pima = *Picea mariana*, Pigl = *Picea glauca*, Bepa = *Betula papyrifera*, Alnus = *Alnus*, Bena = *Betula nana*, Legr = *Ledum groenlandicum*, Lepa = *Ledum palustre* ssp. decumbens, Vaul = *Vaccinium uliginosum*, Cabi = *Carex bigelowii*, Erva = *Eriophorum vaginatum*, Caca = *Calamagrostis canadensis*, Chan = *Chamerion angustifolium* ssp. angustifolium.

\*\* Shaded boxes indicate that no data was collected in field

\*\*\* Si = Silt, Sa = Sand, Gr = Gravel, Co = Cobbles

### Wet level or low angle slopes / Late seral *Picea mariana* and tussock tundra

On wet, level or low angle slopes—such as toeslopes, valley bottoms, terraces and rounded ridges—late seral forests are dominated by a 5 to 33% cover of dwarf *Picea mariana* over *Ledum palustre* ssp. *decumbens* and tussocks of *Eriophorum vaginatum* (Figure 15, Table 8). The late seral plant associations include Dwarf *Picea mariana* / *Eriophorum vaginatum*, and Dwarf *Picea mariana* / *Betula nana* - *Eriophorum vaginatum*.

The sites we sampled were probably of moderate burn intensity where few tussocks burned. The peat layer survived and the permafrost layer did not drop substantially. *Picea mariana* quickly invade or are already present and grow rapidly. *Picea glauca* and *Betula papyrifera* also occur in early succession—up to 15 years post-fire for *Betula papyrifera*—suggesting that drier conditions occurred briefly.

*Alnus species*, *Ledum groenlandicum* and *Betula nana* increased following fire, but eventually die out in late succession. *Ledum palustre* ssp. *decumbens* recovers quickly and maintains itself through the late seral stages. *Vaccinium uliginosum* also recovers rapidly but appears to decrease in late succession.

The thatch associated with sedge tussocks are usually consumed in light to moderate fires, leaving the lower portions alive and able to resprout. They appear to recover rapidly, showing no decrease in cover following fire. *Carex bigelowii* appears to be stimulated by fire but eventually dies out, whereas *Eriophorum vaginatum* recovers quickly and its cover remains relatively stable throughout succession.

Soil information was recorded in five of the 16 sites. The five sites range in age from 7 to 123 years. Organic matter depth ranges from 10 to 26 cm. Permafrost was encountered on all sites the depth ranging from 13 to 26 cm typically occurring within the organic matter layer. Only silt was encountered in the two soil pits that penetrated to mineral soil. This suggests that edaphic factors are creating the wet conditions. The pH at 10 cm deep ranges from 5.1 to 6.9. These measured soil characteristics did not exhibit a distinct pattern of change through succession.

Figure 15. Typical succession following fire on wet level or low angle slopes. The ‘years post-fire’ column gives the actual ages of the plots.

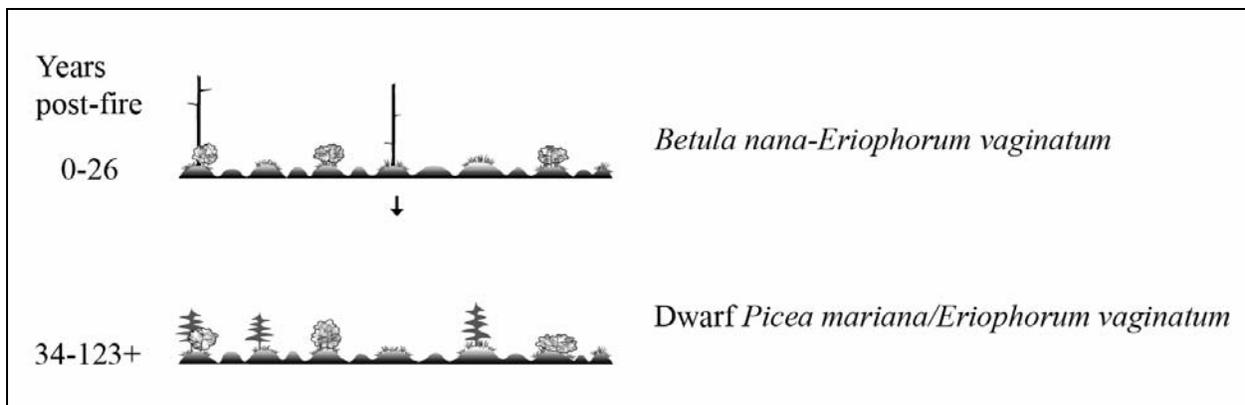


Table 8. Cover of dominant species on sites of increasing age following fire on wet, level or low angle slopes. Slope ranges from 0 to 14 degrees.

Site age post-fire	Percent cover by species													Soils data								
	Pima*		Pigl		Bepa								Depth (cm)			pH at 10 cm						
	Cov	Ht (m)	Cov	Ht (m)	Cov	Ht (m)	Alnus	Bena	Legr	Lepa	Vaul	Cabi	Erva	Total moss	Elev (m)		Tuss-ocks (% or yes)	Organic	Min-eral soil	Perma-frost	Rock	Soil texture
0.2	5	2.0	--	--	--	--	3	--	--	--	--	--	37	12	367	**						
0.3	--	--	33	1.3	--	--	15	15	--	38	38	15	63	63	767	yes						
2	--	--	3	3.3	--	--	--	15	--	63	15	63	85	85	767	yes			yes			
7	--	--	--	--	2	1.3	--	30	10	--	1	30	40	3	418	90	17	6	23	--	Silt	5.6
7	1	0.7	--	--	--	--	--	20	5	--	8	65	--	5	417	75	10	3	13	--	Silt	6
15	1	0.3	--	--	3	1.7	--	--	10	--	7	6	18	13	267	yes						
17	3	--	--	--	--	--	--	15	--	38	3	--	85	72	700							
17	15	--	--	--	--	--	15	38	3	38	3	--	63	68	650	yes						
17	3	--	--	--	--	--	15	15	38	--	38	--	38	33	600	yes						
25	20	0.7	--	--	--	--	--	30	--	20	--	--	15	15	496	yes	13	--	13	--	--	5.1
25	20	0.7	--	--	--	--	--	4	--	16	11	--	38	25	517	yes						
26	--	--	--	--	--	--	--	--	--	31	5	--	40	7	400	yes						
34	5	0.3	--	--	--	--	--	10	--	25	--	--	65	30	598	yes	18	--	18	--	--	5.4
37	33	3.3	--	--	--	--	--	3	--	63	--	--	85	85	600	yes						
43	5	1.0	--	--	--	--	1	--	--	13	17	--	32	53	733	yes						
123	30	3.3	--	--	--	--	--	1	--	10	--	--	60	2	487	yes	26	--	26	--	--	6.9

\* Pima = *Picea mariana*, Pigl = *Picea glauca*, Bepa = *Betula papyrifera*, Alnus = *Alnus*, Bena = *Betula nana*, Legr = *Ledum groenlandicum*, Lepa = *Ledum palustre* ssp. *decumbens*, Vaul = *Vaccinium uliginosum*, Cabi = *Carex bigelowii*, Erva = *Eriophorum vaginatum*.

\*\* Shaded boxes indicate that no data was collected in field

### **Floodplain / Late seral *Picea mariana***

Only one of the floodplain plots had burned and, consequently, we are not able to describe succession following fire (this one burned plot was included in the wet, level or low angle slopes successional sequence). We are, however, able to describe floodplain succession following sediment deposition using the plot data.

Floodplains are fluvial plains consisting of meandering or straight active streams, abandoned channels, oxbows and alluvial terraces. The formation of new land in floodplain ecosystems is well documented (Friedkin 1972, Leopold et al. 1964). Along a meandering river, alluvium typically is deposited on convex curves in the river channel. The opposing concave bank is cut, providing sediment for deposition on convex curves downstream and creating a series of similar bands of alluvial deposits. The channel thus meanders laterally across the floodplain. Vegetation growing on new deposits near the river may be contrasted with that on older deposits inland to recognize and measure successional processes (Lindsey et al. 1961, Stevens and Walker 1970). Alluvium also is deposited on the soil surface during flooding further raising the soil surface height, but because surface height is a function of floodwater height the surface height eventually stabilizes (Leopold et al. 1964).

New alluvial bars or abandoned stream channels are invaded by sapling *Populus balsamifera* ssp. *balsamifera*, *Salix* species, *Alnus* species and *Calamagrostis canadensis* (Figure 16, Table 9). Typically by 12 to 14 years, *Picea glauca* and *Betula papyrifera* also invade the sites. By 50 years they have grown into sparse to closed forests, where *Picea glauca* is codominant with *Betula papyrifera*, *Populus balsamifera* ssp. *balsamifera* or both, sometimes reaching 30 meters tall. *Picea glauca* eventually dominates as *Populus balsamifera* ssp. *balsamifera* and *Betula papyrifera* reach senescence at approximately 120 years. *Alnus* species typically dominates the tall shrub layer through the *Picea glauca* stage. *Calamagrostis canadensis* tends to dominate the herbaceous layer in early seral sites, but is replaced by a rich herbaceous species mixture later in succession. On the oldest terraces, dwarf *Picea mariana* invades along with other moisture tolerant species such as *Betula nana*, *Carex bigelowii*, *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Sphagnum* species.

Soil information was recorded for 12 of the 16 sites. Soil characteristics change on sites of increasing age. During the early seral stages, the sites become progressively drier as they are vertically and horizontally removed from the active channels. This is due to decreased soil water recharge from channel seepage. On older terraces, however, permafrost eventually forms and creates an impermeable layer that, in turn, leads to a wetter environment. Organic matter depth is 0 to 3 cm deep on sites up to 170 years old, then increases dramatically as permafrost forms. The mineral soils are deep alluvial sands or sand with cobble, however, the two oldest sites are silt. This suggests that flooding on the higher terraces deposits silt, that in-turn may create wetter conditions. The pH at 10 cm deep did not exhibit a distinct pattern of change through succession, ranging from 5.8 to 7.7 among all sites.

Figure 16. Idealized cross-section of geomorphic and vegetation succession on a floodplain (adapted from Kreig and Reger 1982).

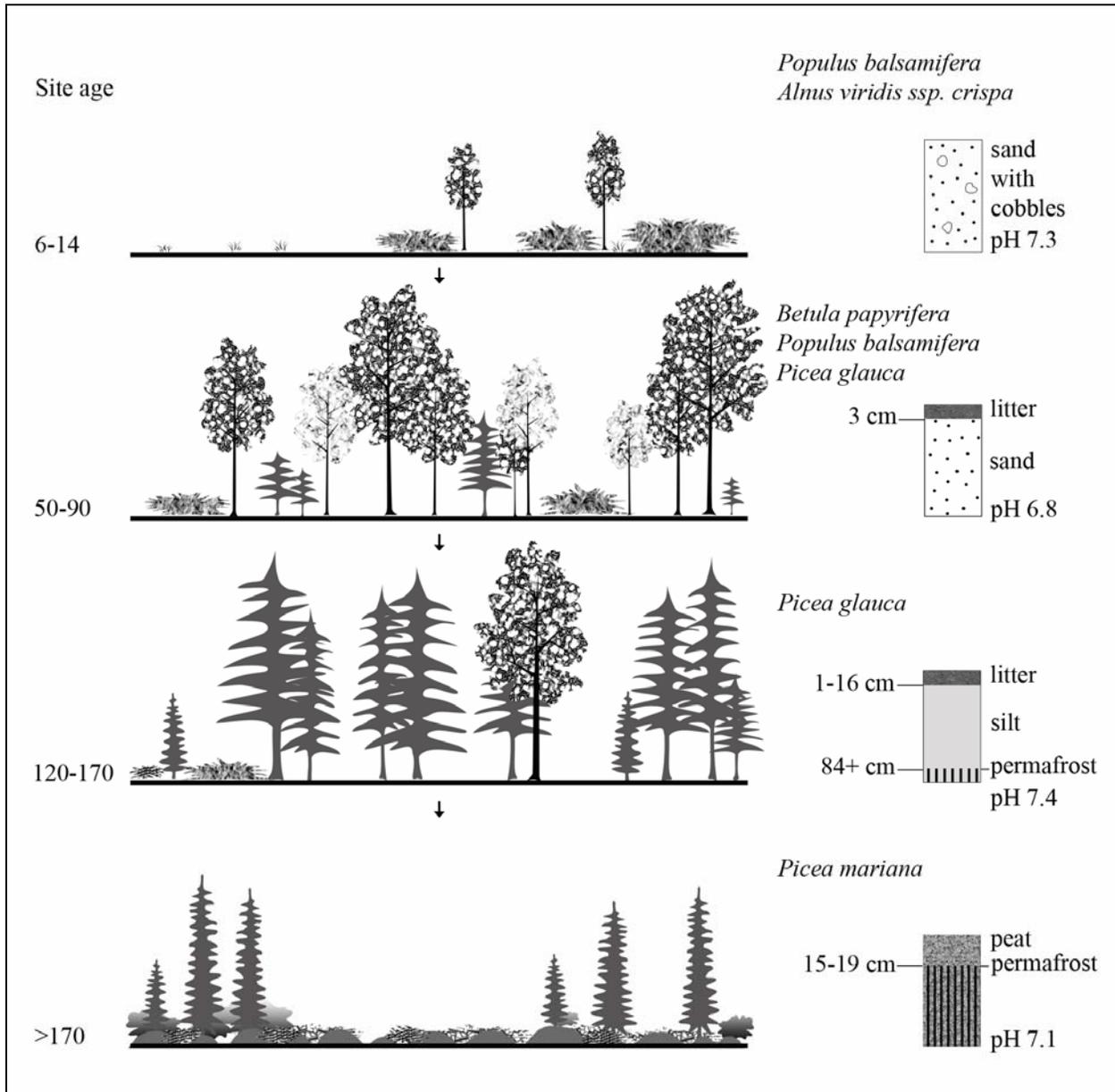


Table 9. Cover of dominant species on sites of increasing age on floodplains. Slope ranges from 0 to 12 degrees.

Site age	Pima* Pigl Bepa Poba				Percent cover by species												Soils data										
	Ht		Ht		Ht		Ht		Alnus	Bena	Legr	Lepa	Vaul	Cabi	Erva	Caca	Chan	Total moss	Elev (m)	Tussocks (% or yes)	Depth (cm)			Soil texture ****	pH at 10 cm		
	Cov	(m)	Cov	(m)	Cov	(m)	Cov	(m)													Min-soil	Perma-frost	Rock				
6	--	--	--	--	--	--	1	1	--	--	--	--	--	--	--	5	--	--	231	0	0	64	no	64	Sand	7.4	
10	--	--	--	--	--	--	15	5	63	--	--	--	--	--	--	--	--	3	263	0	0	50	--	--	Sand		
12	--	--	1	0.7	--	--	40	1	10	--	--	--	--	--	--	20	15	--	350	0	0	10	--	10	Sa, co	7.2	
14	--	--	--	--	15	3.3	--	--	--	--	--	--	--	--	--	--	5	16	267	0	***						
50	--	--	5	6.7	20	8.3	50	20	15	--	--	--	--	--	--	35	5	--	351	0	3	122	--	--	Sand	5.8	
80	10	6.7	10	10	20	9.3	--	--	5	--	--	2	--	--	--	1	--	--	254	0	3	47	--	--	Sand	6.9	
90	--	--	8	6.7	--	--	35	23	20	--	--	--	--	--	--	10	--	1	267	0	3	89	--	--	Sand	7.6	
120	--	--	40	33	--	--	--	--	23	--	--	--	--	--	1	3	--	20	348	0	1	84	84	--	Sand	7.7	
120	--	--	50	10	--	--	--	--	0	--	--	T	T	--	--	--	--	34	267	0							
121	20	6.7	--	--	--	--	--	--	--	3	12	--	2	--	33	--	--	55	267	yes							
170	--	--	5	17	--	--	--	--	95	--	--	--	--	--	--	--	--	15	243	0	1	10	--	10	Silt	7.3	
170	--	--	40	23	--	--	--	--	50	--	--	--	--	--	--	--	--	90	249	0	16	34	--	--	Silt	7.2	
Unk**	1	0.8	--	--	--	--	--	--	1	20	--	8	3	--	--	--	--	10	229	100	15	--	15	--	--		7.4
Unk	15	3.3	--	--	--	--	--	--	--	6	--	--	2	23	4	4	--	4	233	yes							
Unk	15	4.3	--	--	--	--	--	--	2	1	--	10	5	20	--	1	--	90	234	20	19	--	19	--	--		7.0
Unk	25	5	--	--	--	--	--	--	5	4	--	20	15	--	--	--	--	25	233	100	18	--	18	--	--		7.0

\* Pima = *Picea mariana*, Pigl = *Picea glauca*, Bepa = *Betula papyrifera*, Poba = *Populus balsamifera*, Alnus = *Alnus*, Bena = *Betula nana*, Legr = *Ledum groenlandicum*, Lepa = *Ledum palustre* ssp. *decumbens*, Vaul = *Vaccinium uliginosum*, Cabi = *Carex bigelowii*, Erva = *Eriophorum vaginatum*, Caca = *Calamagrostis canadensis*, Chan = *Chamerion angustifolium* ssp. *angustifolium*.

\*\* Unk = Unknown. These sites could not be aged, but are known to be significantly older than the other floodplain sites.

\*\*\* Shaded boxes indicate that no data was collected in field

\*\*\*\* Sa = Sand, Co = Cobbles

## PLANT ASSOCIATIONS

This section is divided into three parts: 1) the system used to rank the rarity of each plant association, 2) the key to plant associations, and 3) plant association descriptions. Plant associations are arranged alphabetically in the following groupings: *Picea glauca*, *Picea mariana*, *Picea glauca-Picea mariana*, deciduous forest, needleleaf-deciduous forest, tall and low shrub, dwarf shrub, and herbaceous. All plot and aerial data used for this classification are available in the Yukon-Charley Rivers Field Data Viewer.

### NATURAL HERITAGE PROGRAM PLANT ASSOCIATION RANKS

The international network of Natural Heritage Programs employs a standardized rarity ranking system for plant associations to denote **global** (range-wide) and **state** status (<http://www.natureserve.org/explorer/ranking.htm>). Once community types are identified, they are ranked based on their abundance, health and/or level of risk. Ranking helps managers determine which communities or habitat types may be most in need of attention, and can also help focus future surveys or studies to inform management.

<b>Rank</b>	<b>Definition</b>
G1 S1	Critically imperiled because of extreme rarity and/or other factors making it highly vulnerable to extinction.
G2 S2	Imperiled because of rarity and/or other factors making it vulnerable to extinction.
G3 S3	Vulnerable because of rarity or restricted range and/or other factors, even though it may be abundant at some of its locations.
G4 S4	Apparently secure, though it may be quite rare in parts of its range, especially at the periphery.
G5 S5	Demonstrably secure, though it may be quite rare in parts of its range, especially at the periphery.
GU SU	Possibly imperiled, but status uncertain; more information needed.
GA SA	Native in nearby states.
GH SH	Historical, known only from records over 50 year ago; may be rediscovered.
GX SX	Believed to be extinct; historical records only.
?	Denotes uncertainty or for numeric ranks, inexactness.

Most plant associations in this classification were assigned ranks of G5 S5 due to the low level of anthropogenic disturbance in Alaska and especially in Yukon-Charley Rivers NP. However, those with a high fidelity to uncommon landscapes were typically given lower ranks. Specifically, plant associations occurring on dry south-facing bluffs were given ranks of G4 S4.

## KEY TO PLANT ASSOCIATIONS

### Instructions

1. Use this key for identifying plant associations in Yukon-Charley Rivers National Preserve.
2. Locate a representative portion of the site in question. The vegetation and environment within the site should be relatively homogeneous.
3. Estimate the canopy cover for all indicator species. The indicator species are those species used in the key. These indicator species are also given in Appendix 2.
4. While in the plot, use the key literally to identify the plant association. Start with the key to “Life Form Groups”, couplet number 1.
5. To ensure accuracy, compare the written description of the plant association with the composition, structure, and site characteristics of the site. If the written description and site characteristics are not compatible, some level of additional site data collection is advised.

### Life Form Groups

1. Tree foliar cover is 10% or more for needleleaf trees, or 25% or more for deciduous or needleleaf-deciduous mix..... 2
1. Tree foliar cover is less than 10% for needleleaf trees, or less than 25% for deciduous or needleleaf-deciduous mix..... 6
2. Needleleaf trees make up 75% or more of the total tree cover..... 3
2. Needleleaf tree cover is less than 75% of the total tree cover..... 5
3. *Picea mariana* makes up 75% or more of the total tree cover ..... *Picea mariana* plant associations
3. *Picea mariana* cover is less than 75% of the total tree cover..... 4
4. *Picea glauca* makes up 75% or more of the total tree cover ..... *Picea glauca* plant associations
4. *Picea glauca* and *Picea mariana* each contribute 25% or more to the total tree cover.....  
.....*Picea glauca* - *Picea mariana* / *Vaccinium uliginosum* plant association
5. Deciduous tree cover is 75% or more of the total tree cover..... Deciduous forest plant associations
5. Needleleaf and deciduous trees each contribute 25% or more to the total tree cover .....  
..... Needleleaf - deciduous forest plant associations
6. Shrub cover is 25% or more ..... 7
6. Shrub cover is less than 25%, and herbaceous cover is 25% or more..... Herbaceous plant associations
7. Average shrub height is greater than 20 centimeters..... Tall and Low shrub plant associations
7. Average shrub height is less than 20 centimeters..... Dwarf shrub plant associations

### *Picea glauca* Plant Associations

1. *Carex bigelowii* cover is 20% or greater ..... 2
1. *Carex bigelowii* cover is less than 20%..... 3
2. The combined cover of *Salix* species greater than 20 centimeters tall is 25% or greater.....  
..... *Picea glauca* / *Salix* species / *Carex bigelowii*
2. The combined cover of *Ledum groenlandicum*, *L. palustre*, *Vaccinium uliginosum* and *Betula nana* is 25% or greater ..... *Picea glauca* / *Betula nana* / *Carex bigelowii*

3. Total tree cover is 10 to 25% and the combined cover of *Ledum groenlandicum*, *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Betula nana* is 25% or greater ..... Woodland *Picea glauca* / *Betula nana*
3. Total tree cover is 25% or greater ..... 4
4. The combined cover of *Alnus* species is 25% or greater AND the site occurs on a floodplain or alluvial terrace ..... *Picea glauca* / *Alnus viridis* ssp. *crispa* Floodplain
4. The combined cover of *Alnus* species is less than 25% OR the site does not occur on a floodplain or alluvial terrace ..... 5
5. The combined cover of *Ledum groenlandicum*, *L. palustre*, *Vaccinium uliginosum* and *Betula nana* is 25% or greater ..... *Picea glauca* / *Vaccinium uliginosum*
5. The combined cover of *Ledum groenlandicum*, *L. palustre*, *Vaccinium uliginosum* and *Betula nana* is less than 25% ..... 6
6. The combined cover of shrubs 20 centimeters tall or greater is 25% or greater ..... *Picea glauca* / *Rosa acicularis*
6. The combined cover of shrubs 20 centimeters tall or greater is less than 25% ..... 7
7. The combined cover of shrubs less than 20 centimeters tall is less than 25%, and the total cover of all shrubs is less than 35% ..... *Picea glauca* / Bryophyte
7. Not as above ..... unclassified *Picea glauca* plant association

***Picea mariana* Plant Associations**

1. *Alnus* species cover is 15% or greater ..... *Picea mariana* / *Alnus viridis* ssp. *crispa*
1. *Alnus* species cover is less than 15% ..... 2
2. *Carex bigelowii* cover is 25% or greater and is the dominant sedge species ..... Dwarf *Picea mariana* / *Betula nana* - *Carex bigelowii*
2. *Carex bigelowii* cover is less than 25% and is not the dominant sedge species ..... 3
3. *Eriophorum vaginatum* cover is 25% or greater and is the dominant sedge species ..... 4
3. *Eriophorum vaginatum* cover is less than 25% and is not the dominant sedge species ..... 5
4. The combined cover of tall and low shrubs is less than 25% ..... Dwarf *Picea mariana* / *Eriophorum vaginatum*
4. The combined cover of tall and low shrubs is 25% or greater ..... Dwarf *Picea mariana* / *Betula nana* - *Eriophorum vaginatum*
5. *Carex lugens* cover is 20% or greater and is the dominant sedge species ..... Dwarf *Picea mariana* / *Carex lugens*
5. *Carex lugens* cover is less than 20% and is not the dominant sedge species ..... 6
6. Average height of *Picea mariana* upper canopy is less than 3 meters tall ..... 7
6. Average height of *Picea mariana* upper canopy is 3 meters tall or greater ..... 9
7. The combined cover of tall and low shrubs is less than 25% ..... Dwarf *Picea mariana* / *Vaccinium vitis-idaea*
7. The combined cover of tall and low shrubs is 25% or greater ..... 8

- 8. Site is codominated by *Betula nana* and one or both of the following species: *Ledum groenlandicum*, *L. palustre* or *Vaccinium uliginosum*..... Dwarf *Picea mariana* / *Betula nana*
- 8. Site is dominated or codominated by *Ledum groenlandicum*, *L. palustre* and *Vaccinium uliginosum*....  
.....Dwarf *Picea mariana* / *Ledum palustre* ssp. *decumbens*
- 9. The combined cover of tall and low shrubs is less than 25%.....*Picea mariana* / Bryophyte
- 9. The combined cover of tall and low shrubs is 25% or greater ..... 10
- 10. Site is codominated by *Betula nana* and one or both of the following species: *Ledum groenlandicum*, *L. palustre* or *Vaccinium uliginosum*..... *Picea mariana* / *Betula nana*
- 10. Site is dominated or codominated by *Ledum groenlandicum*, *L. palustre* and *Vaccinium uliginosum*...  
.....*Picea mariana* / *Ledum palustre* ssp. *decumbens*

**Deciduous Forest Plant Associations**

- 1. *Betula papyrifera* dominates the tallest canopy layer ..... 2
- 1. *Betula papyrifera* does not dominate the tallest canopy layer..... 3
- 2. The average height of *Betula papyrifera* in the tallest canopy layer is 7 meters or greater .....  
.....*Betula papyrifera* / *Rosa acicularis*
- 2. The average height of *Betula papyrifera* in the tallest canopy layer is less than 7 meters.....  
..... Young *Betula papyrifera*
- 3. *Populus balsamifera* ssp. *balsamifera* dominates the tallest canopy layer ..... 4
- 3. *Populus tremuloides* dominates the tallest canopy or codominates with other deciduous species ..... 5
- 4. The average height of *Populus balsamifera* ssp. *balsamifera* in the tallest canopy layer is 7 meters or greater.....  
..... *Populus balsamifera* ssp. *balsamifera* / *Alnus viridis* ssp. *crispa* Floodplain
- 4. The average height of *Populus balsamifera* ssp. *balsamifera* in the tallest canopy layer is less than 7 meters .....  
..... Young *Populus balsamifera* ssp. *balsamifera* Floodplain
- 5. The average height of *Populus tremuloides* in the tallest canopy layer is 7 meters or greater.....  
..... *Populus tremuloides* / *Rosa acicularis*
- 5. The average height of *Populus tremuloides* in the tallest canopy layer is less than 7 meters .....  
..... Young *Populus tremuloides*

**Needleleaf - Deciduous Forest Plant Associations**

- 1. *Picea mariana* and *Betula papyrifera* codominate in the tallest canopy layer ..... 2
- 1. *Picea glauca* and deciduous trees codominate in the tallest canopy ..... 3
- 2. Average tree height in the tallest canopy layer is 7 meters or greater .....  
.....*Picea mariana* - *Betula papyrifera* / *Alnus viridis* ssp. *crispa*
- 2. Average tree height in the tallest canopy layer is less than 7 m.....  
..... Young *Picea mariana* - *Betula papyrifera*
- 3. *Picea glauca* and *Populus tremuloides* codominate.....*Picea glauca* - *Populus tremuloides*
- 3. *Picea glauca* and *Betula papyrifera* codominate ..... 4
- 4. *Picea glauca* and *Betula papyrifera* codominate and the average tree height in the tallest canopy layer is 7 meters or greater ..... *Picea glauca* - *Betula papyrifera* / *Rosa acicularis*

4. *Picea glauca* and *Betula papyrifera* codominate and the average tree height in the tallest canopy layer is less than 7 meters..... Young *Picea glauca* - *Betula papyrifera*

**Tall and Low Shrub Plant Associations**

1. *Alnus viridis* ssp. *crispa* cover is 25% or greater ..... 2
1. *Alnus viridis* ssp. *crispa* cover is less than 25%..... 3
2. The combined cover of *Eriophorum vaginatum* and *Carex bigelowii* is 25% or greater .....  
..... *Alnus viridis* ssp. *crispa* / *Eriophorum vaginatum*
2. The combined cover of *Eriophorum vaginatum* and *Carex bigelowii* is less than 25%, and the site occurs on a floodplain ..... *Alnus viridis* ssp. *crispa* Floodplain
3. *Salix alaxensis* cover is 25% or greater ..... 4
3. *Salix alaxensis* cover is less than 25% ..... 5
4. Site on a floodplain..... *Salix alaxensis* Floodplain
4. Site not on a floodplain ..... *Salix alaxensis* Sideslope
5. *Salix pulchra* is dominant or codominant with *Betula nana* in the tallest layer.....  
..... *Salix pulchra* - *Betula nana*
5. *Salix pulchra* not dominant or codominant with *Betula nana* in the tallest layer ..... 6
6. The combined cover of *Eriophorum vaginatum* and *Carex bigelowii* is 25% or greater ..... 7
6. The combined cover of *Eriophorum vaginatum* and *Carex bigelowii* is less than 25% ..... 9
7. *Eriophorum vaginatum* is the dominant sedge species and *Ledum palustre* ssp. *decumbens* is the dominant low shrub ..... *Ledum palustre* ssp. *decumbens* / *Eriophorum vaginatum*
7. *Carex bigelowii* is the dominant sedge species ..... 8
8. *Betula nana* is dominant or codominant with *Ledum palustre* ssp. *decumbens* or *Vaccinium uliginosum* ..... *Betula nana* / *Carex bigelowii*
8. *Vaccinium uliginosum* is dominant or codominant with *Betula nana* or *Ledum palustre* ssp. *decumbens* ..... *Vaccinium uliginosum* / *Carex bigelowii*
9. Site is codominated by *Betula nana* and one or both of the following species: *Ledum palustre* ssp. *decumbens* or *Vaccinium uliginosum* .....  
..... *Betula nana* - *Ledum palustre* ssp. *decumbens* - *Vaccinium uliginosum*
9. Site is not codominated by *Betula nana* and one or both of the following species: *Ledum palustre* ssp. *decumbens* or *Vaccinium uliginosum* ..... 10
10. Site is codominated by *Ledum palustre* ssp. *decumbens* and *Vaccinium uliginosum* .....  
..... *Ledum palustre* ssp. *decumbens* - *Vaccinium uliginosum*
10. Site is not codominated by *Ledum palustre* ssp. *decumbens* and *Vaccinium uliginosum* ..... 11
11. *Artemisia frigida* codominates with either *Calamagrostis purpurascens* or *Pseudoroegneria spicata* ssp. *spicata* .....  
..... *Artemisia frigida* - *Calamagrostis purpurascens* - *Pseudoroegneria spicata* ssp. *spicata*
11. Not as above ..... 12
- 12a. *Amelanchier alnifolia* is the dominant species in the tallest shrub layer..... *Amelanchier alnifolia*

- 12b. *Artemisia frigida* is the dominant species in the tallest shrub layer .....*Artemisia frigida*
- 12c. *Juniperus communis* is the dominant species in the tallest shrub layer..... *Juniperus communis*
- 12d. *Betula nana* is the dominant species in the tallest shrub layer .....*Betula nana*
- 12e. *Ledum palustre* ssp. *decumbens* is the dominant species in the tallest shrub layer.....  
..... *Ledum palustre* ssp. *decumbens*
- 12f. *Ledum groenlandicum* is the dominant species in the tallest shrub layer .... *Ledum groenlandicum*
- 12g. *Myrica gale* is the dominant species in the tallest shrub layer .....*Myrica gale*

### Dwarf Shrub Plant Associations

1. *Salix pulchra* dominates or codominates the dwarf shrub layer.....*Salix pulchra*
1. *Salix pulchra* does not dominate or codominate the dwarf shrub layer ..... 2
2. The combined cover of *Eriophorum vaginatum* and *Carex bigelowii* is 25% or greater and *Ledum palustre* ssp. *decumbens*, *Vaccinium vitis-idaea*, *Betula nana* or *Vaccinium uliginosum* codominate .. 3
2. The combined cover of *Eriophorum vaginatum* and *Carex bigelowii* is less than 25% ..... 4
3. *Eriophorum vaginatum* is the dominant sedge.....  
.....*Ledum palustre* ssp. *decumbens* - *Vaccinium uliginosum* - *Eriophorum vaginatum*
3. *Carex bigelowii* is the dominant sedge.....*Betula nana* - *Vaccinium uliginosum* - *Carex bigelowii*
4. Mosaic of small patches of *Carex stylosa* at 20% cover or greater and *Dryas octopetala* present.....  
.....*Dryas octopetala* / *Carex stylosa*
4. *Carex stylosa* cover is less than 20% ..... 5
5. *Dryas octopetala* is the dominant species .....*Dryas octopetala*
5. *Dryas octopetala* is not the dominant species ..... 6
6. *Dryas octopetala* codominates with other dwarf shrubs ..... *Dryas octopetala* - *Cassiope tetragona*
6. *Dryas octopetala* does not codominate with other dwarf shrubs ..... 7
- 7a. *Arctostaphylos rubra* dominates or codominates in the dwarf shrub layer .....*Arctostaphylos rubra*
- 7b. *Cassiope tetragona* dominates or codominates in the dwarf shrub layer ..... *Cassiope tetragona*
- 7c. *Dryas integrifolia* dominates or codominates in the dwarf shrub layer..... *Dryas integrifolia*
- 7d. Site codominated by 2 or more dwarf shrubs .....*Empetrum nigrum* - *Vaccinium vitis-idaea*

### Herbaceous Plants Plant Associations

- 1a. *Carex aquatilis* has the greatest cover, or is codominant with *Calamagrostis canadensis*.....  
..... *Carex aquatilis*
- 1b. *Carex rostrata* has the greatest cover .....*Carex rostrata*

- 1c. *Carex bigelowii* has the greatest cover .....*Carex bigelowii*
- 1d. *Eriophorum vaginatum* has the greatest cover .....*Eriophorum vaginatum*
- 1e. *Chamerion angustifolium* ssp. *angustifolium* dominates or codominates the site.....  
..... *Chamerion angustifolium* ssp. *angustifolium*
- 1f. *Bromus inermis* var. *arcticus* has the greatest cover or codominates the site with other herbaceous  
species .....*Bromus inermis* var. *arcticus*
- 1g. *Artemisia alaskana* has the greatest cover..... *Artemisia alaskana*
- 1h. *Artemisia frigida* codominates with either *Calamagrostis purpurascens* or *Pseudoroegneria spicata*  
ssp. *spicata* ... *Artemisia frigida* - *Calamagrostis purpurascens* - *Pseudoroegneria spicata* ssp. *spicata*
- 1i. *Calamagrostis purpurascens* has the greatest cover or codominates the site with other herbaceous  
species .....*Calamagrostis purpurascens*
- 1j. Dry mountain slopes or river bluffs dominated by a variety of herbaceous species including *Festuca*  
*altaica* and *Calamagrostis* species ..... *Festuca altaica* - *Calamagrostis* species
- 1k. Does not occur on a dry mountain slope or river bluff; *Calamagrostis canadensis* with at least 10%  
cover. Typically occurs on sites burned within past 20 years ..... *Calamagrostis canadensis*
- 1l. Not as above.....Unclassified herbaceous plant association

## PLANT ASSOCIATION DESCRIPTIONS

The cover values given in the tables do not always reflect what is described in the text. The text includes field observations or comments from the data sheets in addition to what is quantified in the tables. Also, the field data used for this study comes from four different sources and cover estimation techniques vary significantly between studies.

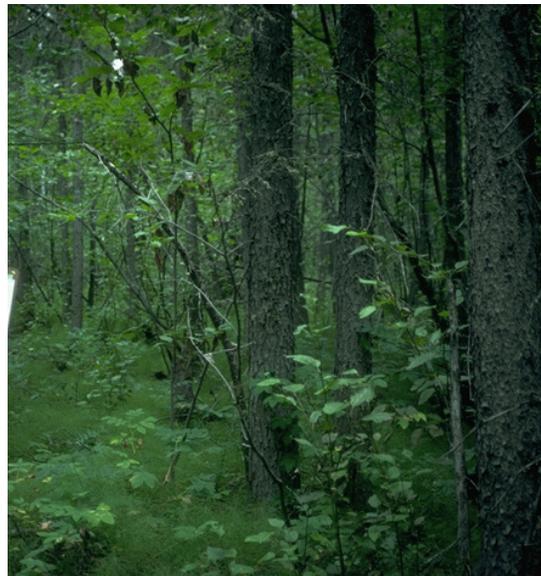
### *PICEA GLAUCA* PLANT ASSOCIATIONS

#### *Picea glauca* / *Alnus viridis* ssp. *crispa* Floodplain Plant Association White spruce / Mountain alder Floodplain

Plots sampled: 9.  
Rank: G5; S5.  
Other Studies: Yarie 1983a, Yarie 1983b.

#### **Environmental Characteristics**

Distribution: Minor but widespread association in Yukon-Charley Rivers NP.  
Patch size: Small to moderate.  
Elevation (meters): 198 to 591.  
Slope (deg): 0 to 3.  
Landform position: Floodplain, alluvial terrace.  
Hydrology: Mesic; some sites are inundated during high river flows.  
Soils: Derived from fluvial deposition. Typically a thin layer of litter over a mixture of silt, sand, and gravel. pH 7.2 to 7.7.  
Landcover class: Open needleleaf forest.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Ogilvie Foothills; Yukon River Valley: Wet terraces with few ponds; Yukon River Valley: Yukon River active floodplain.  
Successional stage: Mid seral association within the floodplain seral sequence.



## Vegetation

The cover of *Picea glauca* ranges from 25 to 63%. Height ranges to over 30 meters in mature stands (170 years old) with a dbh of 37 centimeters. The stands are often even-aged although young *Picea glauca* may occur. Mature and decadent *Populus balsamifera* ssp. *balsamifera* may also occur. *Alnus viridis* ssp. *crispa* cover ranges from 26 to 63% and 4.6 meters tall. Other common species include *Equisetum arvense*, *Equisetum pratense*, *Ledum groenlandicum*, *Rosa acicularis*, *Vaccinium vitis-idaea* and *Viburnum edule*. *Hylocomium splendens* and *Rhytidiadelphus* species are the dominant moss species and often blanket the ground. Lichen cover is low.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	100	39	25-63	>3.1-30.5
<i>Populus balsamifera</i>	22	1	3-10	>3.1
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	100	45	26-63	0.9-4.6
<i>Ledum groenlandicum</i>	11	2	18	0.3
<i>Rosa acicularis</i>	89	15	3-38	<0.2-0.8
<i>Vaccinium uliginosum</i>	11	6	53	<0.2-0.9
<i>Vaccinium vitis-idaea</i>	22	3	14-15	<0.2
<i>Viburnum edule</i>	44	5	3-38	0.3-0.9
<b>Herbaceous</b>				
<i>Angelica lucida</i>	11	4	38	–
<i>Calamagrostis canadensis</i>	33	3	3-15	<0.2-0.3
<i>Equisetum arvense</i>	33	8	15-38	0.9
<i>Equisetum pratense</i>	11	3	23	<0.2-0.3
<i>Equisetum variegatum</i>	11	4	38	<0.2
<i>Linnaea borealis</i>	44	3	4-15	0.1
<b>Non-vascular</b>				
Feathermoss	22	16	63-85	–
<i>Hylocomium</i> sp.	11	3	29	0.1
<i>Hylocomium splendens</i>	44	20	25-85	<0.2
Moss	33	1	1-3	<0.2
<i>Ptilium</i> sp.	11	4	38	<0.2
<i>Rhytidiadelphus</i> spp.	22	12	38-70	<0.2

***Picea glauca* / *Betula nana* / *Carex bigelowii* Plant Association**  
**White spruce / Dwarf birch / Bigelow's sedge Plant Association**

Plots sampled: 5.  
Rank: G5; S5.  
Other Studies: Yarie 1983a, 1983b.

**Environmental Characteristics**

Distribution: Widespread association within the boreal forest zone in Yukon-Charley Rivers NP.  
Patch size: Small to large and often mosaiced with other forest associations.  
Elevation (meters): 831 to 1,128.  
Slope (deg): 8 to 25.  
Landform position: Valley bottoms, footslopes, sideslopes, and rounded ridges.  
Hydrology: Mesic.  
Soils: No information.  
Landcover class: Open needleleaf forest; Woodland needleleaf forest  
Sampled sites occur in the following detailed subsections: Upper Charley Valley: Beverly / Copper / East Fork mountain slopes; Snowy Domes.  
Successional stage: Probably mid seral on sites successional to *Picea mariana*.



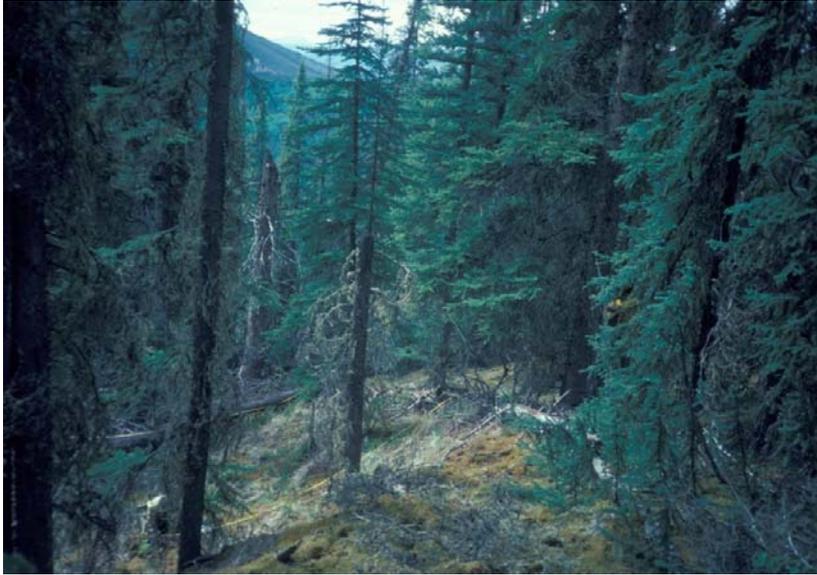
**Vegetation**

*Picea glauca* cover is typically between 15 and 41% and the height ranges to over 5 meters tall. It may form krumholtz. *Carex bigelowii* dominates the herbaceous layer. Shrub cover typically exceeds 40% and includes *Betula nana*, *Empetrum nigrum*, *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. Moss cover ranges from 59 to 90% and the common species include *Hylocomium splendens*, *Pleurozium schreberi* and *Sphagnum* species. Lichen cover is typically low.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	80	22	15-41	>5
<b>Shrubs</b>				
<i>Betula nana</i>	100	29	15-41	<0.2-2.25
<i>Empetrum nigrum</i>	100	15	3-38	<0.2
<i>Ledum palustre</i> ssp. <i>decumbens</i>	60	11	3-38	<0.2
<i>Salix arbusculoides</i>	20	3	15	0.9
<i>Salix pulchra</i>	100	13	3-30	0.9-2.3
<i>Salix reticulata</i>	40	1	3	<0.2
<i>Vaccinium uliginosum</i>	80	24	3-63	<0.2-0.9
<i>Vaccinium vitis-idaea</i>	100	12	3-38	<0.2
<b>Herbaceous</b>				
<i>Carex bigelowii</i>	100	43	38-63	<0.2
<i>Hedysarum alpinum</i>	20	3	15	–
<i>Petasites frigidus</i> var. <i>nivalis</i>	20	3	15	–
<b>Non-vascular</b>				
<i>Hylocomium splendens</i>	80	24	3-63	<0.2
Lichen	40	11	15-38	<0.2
Moss	20	17	85	–
<i>Pleurozium</i> sp.	20	8	38	–
<i>Pleurozium schreberi</i>	60	14	15-38	<0.2
<i>Sphagnum</i> spp.	60	21	3-63	<0.2

***Picea glauca* / Bryophyte Plant Association**  
**White spruce / Bryophyte Association**

Plots sampled: 8.  
Rank: G5; S5.  
Other Studies: Yarie 1983a, Young and Racine 1976, Farjon and Bogaers 1985.



**Environmental Characteristics**

Distribution: Widespread association in boreal forest zone of Yukon-Charley Rivers NP.  
Patch size: Small to large.  
Elevation (meters): 244 to 732 meters, and one plot at 945 meters.  
Slope (deg): 0 to 50.  
Landform position: Valley bottoms, footslopes, sideslopes, and rounded ridges.  
Hydrology: Mesic.  
Soils: No information.  
Landcover class: Open needleleaf lichen forest; Woodland needleleaf moss forest.  
Sampled sites occur in the following detailed subsections: Charley Foothills; Yukon River Valley: Nation / Kandik / Bonanza valleys; Ogilvie Foothills; Tintina Hills; Upper Charley Mountain  
Tundra: Gentle vegetated ridges; Yukon River Valley: Wet terraces with few ponds.  
Successional stage: Probably mid seral on sites successional to other *Picea glauca* associations.

**Vegetation**

*Picea glauca* cover ranges from 25 to 63% and canopy height ranges to over 15 meters tall. Shrub cover is less than 25%. Common species include *Geocaulon lividum*, *Mertensia paniculata*, *Rosa acicularis* and *Vaccinium vitis-idaea*. *Hylocomium splendens* typically blankets the ground and other common moss species include *Pleurozium schreberi* and *Rhytidium rugosum*. Lichen cover is typically sparse.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	25	1	3	–
<i>Picea glauca</i>	100	46	25-63	5.3-15.2
<b>Shrubs</b>				
<i>Rosa acicularis</i>	50	2	1-15	<1
<i>Rosa woodsii</i>	13	1	9	<1
<i>Vaccinium vitis-idaea</i>	50	2	<1-12	<1
<b>Herbaceous</b>				
<i>Equisetum pratense</i>	13	2	15	<1
<i>Festuca rubra</i>	13	1	9	<1
<i>Geocaulon lividum</i>	88	2	1-3	<1
Grass	38	3	8-15	<1
<i>Linnaea borealis</i>	13	1	10	<1
<i>Mertensia paniculata</i>	50	1	<1-6	<1
<b>Non-vascular</b>				
<i>Cladonia</i> spp.	38	1	<1-4	<1
Moss	38	22	5-85	–
<i>Hylocomium splendens</i>	63	24	20-56	<1
Lichen	25	7	15-38	–
<i>Pleurozium schreberi</i>	25	2	<1-19	<1
<i>Rhytidium rugosum</i>	13	5	40	<1

***Picea glauca* / *Rosa acicularis* Plant Association**  
**White spruce / Prickly rose Plant Association**

Plots sampled: 5.  
Rank: G5; S5.  
Other Studies: Batten, Murray and Dawe 1979, Yarie 1983a, 1983b, Young and Racine 1976.

**Environmental Characteristics**

Distribution: Widespread within the boreal forest zone of Yukon-Charley Rivers NP.  
Patch size: Small to matrix forming.  
Elevation (meters): 213 to 762.  
Slope (deg): 0 to 27.  
Landform position: Floodplains, river terraces, valley bottoms, footslopes and sideslopes.  
Hydrology: Mesic.  
Soils: No information.  
Landcover class: Open needleleaf forest; Closed needleleaf forest.  
Sampled sites occur in the following detailed subsections: Charley Foothills; Yukon River Valley: High terraces, undulating; Yukon River Valley: Wet terraces with few ponds.  
Successional stage: Mid seral association within the floodplain seral sequence. Mid to late seral following fire on uplands.



**Vegetation**

*Picea glauca* cover ranges from 32 to 63% and its height ranges to over 12 meters tall and 24 centimeters dbh. Mature *Betula papyrifera* and *Populus balsamifera* ssp. *balsamifera* also occur. Shrub cover exceeds 25% and is usually dominated by *Rosa acicularis*, although other shrubs are common including *Alnus viridis* ssp. *crispa*, *Ledum palustre* ssp. *decumbens*, *Vaccinium vitis-idaea* and *Viburnum edule*. Common herbaceous species are *Calamagrostis canadensis* and *Mertensia paniculata*. Moss cover ranges from 35 to 91%; typically *Hylocomium splendens*. Lichen cover ranges up to 2%.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	50	5	3-15	>3.1
<i>Picea glauca</i>	100	46	32-63	>3.1-12.2
<i>Populus balsamifera</i>	33	2	5-6	>3.1
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	50	6	3-15	2.3-<1
<i>Arctostaphylos uva-ursi</i>	17	3	15	<0.2
<i>Empetrum nigrum</i>	33	3	2-15	<1
<i>Ledum palustre</i>	17	3	16	<1
<i>Rosa acicularis</i>	100	16	2-32	<1
<i>Vaccinium vitis-idaea</i>	33	4	1-18	<1
<i>Viburnum edule</i>	33	6	14-15	0.5-0.7
<b>Herbaceous</b>				
<i>Calamagrostis canadensis</i>	33	14	5-63	0.5-0.9
<i>Equisetum pratense</i>	33	8	3-35	0.2-0.3
Grass	17	3	15	–
<i>Linnaea borealis</i>	33	6	1-28	0.1
<i>Mertensia paniculata</i>	100	4	1-9	<1
<i>Pyrola chlorantha</i>	17	3	15	<0.2
<b>Non-vascular</b>				
Feathermoss	17	17	85	–
<i>Hylocomium</i> spp.	33	12	18-43	0.1
<i>Hylocomium splendens</i>	33	29	60-85	<1
Moss	33	3	3-13	0.1

***Picea glauca* / *Salix* species / *Carex bigelowii* Plant Association**  
**White spruce / *Salix* species / Bigelow's sedge Plant Association**

Plots sampled: 2.  
Rank: G?; S?  
Other Studies: Johnson and Vogel 1966, Yarie 1983a.

**Environmental Characteristics**

Distribution: Incidental association within the boreal forest zone of Yukon-Charley Rivers NP.  
Patch size: Small to large and often mosaiced with other forest associations.  
Elevation (meters): 1,000 to 1,036.  
Slope (deg): 15 to 20.  
Landform position: Valley bottoms, footslopes, sideslopes, and rounded ridges.  
Hydrology: Mesic.  
Soils: No information.  
Landcover class: Woodland needleleaf forest.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly /Copper /East Fork mountain slopes; Charley Foothills.  
Successional stage: Mid to late seral following fire.



**Vegetation**

*Picea glauca* cover is typically less than 25% and its height is 0.9 to 4 meters. *Carex bigelowii* dominates the herbaceous layer. *Salix* species dominate the shrub layer and include *Salix alaxensis*, *S. arbusculoides*, *S. barclayi* and *S. pulchra*. Other common species include *Alnus viridis* ssp. *crispa*, *Empetrum nigrum*, *Salix reticulata* and *Vaccinium uliginosum*. Moss cover ranges from 76 to 81% primarily *Hylocomium splendens*. Lichen cover is typically low.

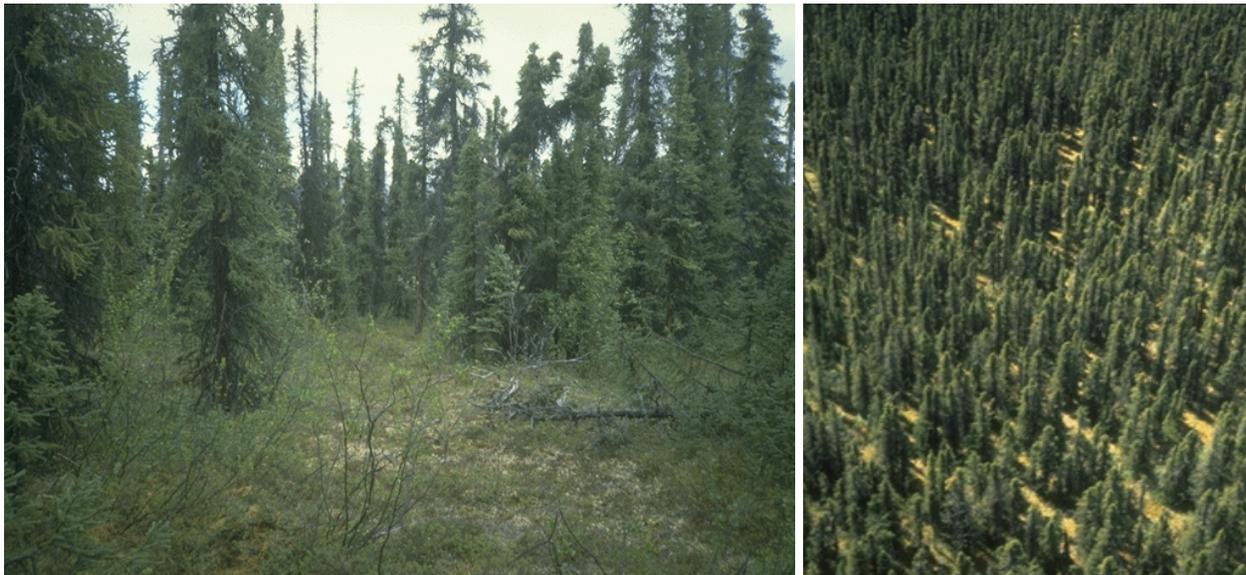
Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	100	17	15-18	0.9-4
<b>Shrubs</b>				
<i>Alnus viridis ssp. crispa</i>	50	9	18	0.9-2.3
<i>Arctostaphylos rubra</i>	50	8	15	<0.2
<i>Cassiope tetragona</i>	100	9	3-15	<0.2
<i>Empetrum nigrum</i>	50	8	15	<0.2
<i>Ledum groenlandicum</i>	100	3	3	0.9
<i>Salix alaxensis</i>	50	19	38	0.9
<i>Salix arbusculoides</i>	50	19	38	0.9
<i>Salix barclayi</i>	50	19	38	0.9
<i>Salix pulchra</i>	50	19	38	0.9
<i>Salix reticulata</i>	50	8	15	0.2
<i>Vaccinium uliginosum</i>	50	9	18	0.2-0.9
<b>Herbaceous</b>				
<i>Carex bigelowii</i>	100	38	38	<0.2
<b>Non-vascular</b>				
<i>Hylocomium splendens</i>	100	63	63	<0.2
<i>Pleurozium schreberi</i>	50	8	15	<0.2
<i>Ptilium crista-castrensis</i>	50	8	15	<0.2

***Picea glauca* / *Vaccinium uliginosum* Plant Association**  
**White spruce / Bog blueberry Plant Association**

Plots sampled: 7.  
Rank: G5; S5.  
Other Studies: Yarie 1983a.

**Environmental Characteristics**

Distribution: Widespread association within the boreal forest zone of Yukon-Charley Rivers NP.  
Patch size: Small to matrix forming.  
Elevation (meters): 514 to 1,036.  
Slope (deg): 3 to 26.  
Landform position: Valley bottoms, footslopes, sideslopes, and rounded ridges.  
Hydrology: Mesic.  
Soils: The one soil pit measured consists of 12 centimeters of organic matter over silt, sand, and gravel. No permafrost was encountered and the pH is 6.9.  
Landcover class: Open needleleaf forest.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Hard Luck Lowland; Ogilvie Foothills; Upper Charley Valleys: Copper Creek tussock slopes; Upper Charley Mountain Tundra: Gentle vegetated ridges; Upper Charley Valleys: Subalpine valleys.  
Successional stage: Mid to late seral following fire.



**Vegetation**

*Picea glauca* cover ranges from 36 to 63% and its height ranges from less than 5 meters tall to 10 meters. Shrub cover exceeds 25% and is usually dominated by *Vaccinium uliginosum* in association with *Betula nana*, *Empetrum nigrum*, *Ledum groenlandicum*, *Ledum palustre* ssp. *decumbens*, *Salix pulchra*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. Moss cover ranges from 5 to 96%; typically *Hylocomium splendens*. Lichen cover ranges from 38 to 63%.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	100	46	36-63	0.9->5
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	43	6	10-15	2.3-3.1
<i>Betula nana</i>	86	15	3-38	0.9-2.3
<i>Cassiope tetragona</i>	14	5	38	<0.2
<i>Empetrum nigrum</i>	86	18	3-63	<0.2
<i>Ledum groenlandicum</i>	57	9	15	<0.2
<i>Ledum palustre</i>	14	4	30	–
<i>Ledum palustre</i> ssp. <i>decumbens</i>	43	3	3-15	<0.2
<i>Salix alaxensis</i>	14	3	18	0.9-2.3
<i>Salix planifolia</i>	14	5	38	–
<i>Salix pulchra</i>	57	7	3-38	0.9-2.3
<i>Vaccinium uliginosum</i>	100	34	10-63	<0.2
<i>Vaccinium vitis-idaea</i>	100	26	3-38	<0.2
<b>Herbaceous</b>				
<i>Carex bigelowii</i>	29	3	3-15	–
<i>Equisetum arvense</i> L.	14	12	85	–
<i>Equisetum sylvaticum</i> L.	14	4	25	–
<b>Non-vascular</b>				
<i>Cladina</i> spp.	29	6	3-38	<0.2
<i>Hylocomium</i> sp.	14	9	63	–
<i>Hylocomium splendens</i>	43	17	15-63	<0.2
Lichen	43	20	38-63	<0.2
Moss	29	21	63-85	<0.2
<i>Pleurozium</i> spp.	29	11	38	–
<i>Pleurozium schreberi</i>	14	5	38	<0.2
<i>Sphagnum</i> spp.	29	3	3-15	<0.2

**Woodland *Picea glauca* / *Betula nana* Plant Association**  
**Woodland White spruce / Dwarf birch Plant Association**

Plots sampled: 12.  
Rank: G5; S5.  
Other Studies: Yarie 1983a.

**Environmental Characteristics**

Distribution: Widespread association within the boreal forest zone of Yukon-Charley Rivers NP.  
Patch size: Small to matrix forming.  
Elevation (meters): 877 to 1,219.  
Slope (deg): 0 to 44.  
Landform position: Valley bottoms, footslopes, sideslopes, and rounded ridges.  
Hydrology: Mesic.  
Soils: The soils are highly variable. The driest are a thin layer of litter and organic matter over a mixture of silt, sand, and gravel. Wetter soils are peat 18 to 53 centimeters thick. The pH ranges from 4.9 to 6.5. Permafrost was not encountered.  
Landcover class: Woodland needleleaf forest; Woodland needleleaf lichen forest; Woodland needleleaf moss forest.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Charley Foothills; Ogilvie Lime / Dolostone Mountains; Three Fingers Subalpine Basin; Upper Charley Mountain Tundra: Gentle vegetated ridges.  
Successional stage: Mid to late seral following fire.



**Vegetation**

*Picea glauca* cover ranges from 10 to 25% and its height ranges up to 15 meters tall. Shrub cover typically exceeds 25% and is dominated by *Betula nana* with *Empetrum nigrum*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. Moss cover ranges from 1 to 90% and the common species include *Hylocomium splendens* and *Pleurozium schreberi*. Lichen cover ranges from 0 to 40%.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	100	15	5-25	0.9-13.7
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	33	6	2-40	0.9-2.4
<i>Betula</i> sp.	8	4	53	–
<i>Betula nana</i>	92	25	1-63	0.9-2.3
<i>Empetrum nigrum</i>	75	17	5-50	<1
<i>Ledum groenlandicum</i>	33	3	3-15	0.9-<0.2
<i>Ledum palustre</i>	33	2	3-10	<1
<i>Ledum palustre</i> ssp. <i>decumbens</i>	8	1	15	<0.2
<i>Salix arbusculoides</i>	17	2	3-15	2.3
<i>Salix pulchra</i>	33	3	3-15	0.9-2.3
<i>Salix sitchensis</i>	33	3	3-15	0.9-2.3
<i>Vaccinium uliginosum</i>	92	15	1-38	<1
<i>Vaccinium vitis-idaea</i>	92	10	<1-38	<1
<b>Herbaceous</b>				
<i>Carex microchaeta</i>	17	2	10-15	<0.2
<i>Festuca altaica</i>	17	2	3-15	–
<b>Non-vascular</b>				
<i>Cetraria richardsonii</i>	25	2	3-15	<0.2
<i>Cladina</i> spp.	25	2	1-15	<0.2
<i>Cladonia</i> spp.	25	6	3-38	<1
<i>Hylocomium splendens</i>	75	23	3-80	<1
Lichen	25	5	15-25	<0.2
Moss	17	1	2-15	<0.2
<i>Pleurozium schreberi</i>	58	12	3-63	<0.2
<i>Sphagnum</i> spp.	17	9	40-63	<0.2

## **PICEA MARIANA PLANT ASSOCIATIONS**

### **Dwarf *Picea mariana* / *Betula nana* Plant Association Dwarf black spruce / Dwarf birch Plant Association**

Plots sampled: 5.  
Rank: G5; S5.  
Other Studies: Buckley and Libby 1957, Yarie 1983a, 1983b.

#### **Environmental Characteristics**

Distribution: Common in the forested portions of Yukon-Charley Rivers NP.  
Patch size: Small to large.  
Elevation (meters): 930 to 1,100 meters, but may also occur at mid to low elevations.  
Slope (deg): 10 to 22.  
Landform position: Sideslopes and rounded ridges.  
Hydrology: Not recorded, but likely mesic to wet (peatlands).  
Soils: Not recorded, but likely a thick moss matt over an organic layer over silt, sand, and gravel.  
Landcover class: Open needleleaf lichen forest; Woodland needleleaf lichen forest.  
Sampled sites occur in the following detailed subsections: Charley Foothills; Upper Charley Mountain  
Tundra: Gentle vegetated ridges.  
Successional stage: Mid to late seral following fire.



#### **Vegetation**

This is a woodland to open (10 to 38%), uneven-aged dwarf *Picea mariana* dominated forest. Average tree height is less than 2 meters tall. The shrub layer has greater than 25% cover and is dominated or codominated by *Betula nana*, *Ledum groenlandicum*, *Ledum palustre* ssp. *decumbens* and *Vaccinium uliginosum*. Additional common species include *Equisetum sylvaticum*, *Salix pulchra*, and *Vaccinium vitis-idaea*. Common mosses are *Polytrichum* species and *Sphagnum* species. Common lichens are *Cladonia* species.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea mariana</i>	100	21	10-38	0.5-2.25
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	20	3	15	–
<i>Betula nana</i>	100	32	20-63	0.5-1.2
<i>Empetrum nigrum</i>	40	2	3-5	0.2
<i>Ledum groenlandicum</i>	20	8	38	–
<i>Ledum palustre</i>	60	9	9-18	0.2-0.3
<i>Salix</i> sp.	20	8	38	–
<i>Salix pulchra</i>	20	8	38	0.9
<i>Vaccinium uliginosum</i>	80	12	3-38	0.2-0.9
<i>Vaccinium vitis-idaea</i>	100	19	9-38	<0.2
<b>Herbaceous</b>				
<i>Carex</i> sp.	20	3	15	<0.2
<i>Equisetum sylvaticum</i>	20	2	9	0.2
<b>Non-vascular</b>				
<i>Cladonia</i> spp.	40	4	2-17	0.2
<i>Cladonia rangiferina</i>	40	2	1-10	0.2
Lichen	20	3	15	–
Moss	40	3	<1-15	0.2
<i>Pleurozium schreberi</i>	20	3	15	<0.2
<i>Polytrichum</i> spp.	40	9	8-38	0.2
<i>Sphagnum</i> spp.	60	10	4-38	<0.2

**Dwarf *Picea mariana* / *Betula nana* - *Carex bigelowii* Plant Association**  
**Dwarf black spruce / Dwarf birch - Bigelow's sedge Plant Association**

Plots sampled: 8.  
Rank: G5; S5.  
Other Studies: Yarie 1983, 1983b.

**Environmental Characteristics**

Distribution: Widespread association within the boreal forest zone of Yukon-Charley Rivers NP.  
Patch size: Small to large and often mosaiced with other forest associations.  
Elevation (meters): 213 to 655.  
Slope (deg): 0 to 5.  
Landform position: Alluvial plains, footslopes and valley bottoms.  
Hydrology: Mesic to wet.  
Soils: Tussocks up to 0.7 meters tall are common and standing water occurs between tussocks. The pH ranges from 6.4 to 7.1 and permafrost occurs at all sites.  
Landcover class: Open needleleaf forest; Woodland needleleaf forest.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Copper Creek tussock slopes; Yukon River Valley: Nation / Kandik / Bonanza valleys; Thanksgiving Loess Plain; Yukon River Valley: Wet terraces with oxbows; Yukon River Valley: Wet terraces with few ponds.  
Successional stage: This is a late seral association following intense fire that burns tussocks; or early seral following light fire that does not burn tussocks.



**Vegetation**

*Picea mariana* cover is typically between 10 and 40% and the height is typically less than 3 meters tall, but ranges up to 4.6 meters. A variety of low shrubs may codominate including *Betula nana*, *Ledum groenlandicum*, *Ledum palustre* ssp. *decumbens*, *Salix barclayi*, *Salix pulchra*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. *Carex bigelowii* is the dominant sedge although *Eriophorum vaginatum* is common. Their combined cover typically exceeds 50%. Moss cover ranges from 15 to 90% and the common species include *Hylocomium splendens* and *Sphagnum* species. Lichen cover is low and exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	13	<1	3	–
<i>Picea mariana</i>	100	24	10-40	0.9-4.6
<b>Shrubs</b>				
<i>Arctostaphylos rubra</i>	25	2	3-15	<0.2
<i>Betula nana</i>	100	19	1-63	0.3-<1
<i>Chamaedaphne calyculata</i>	25	1	2-5	–
<i>Empetrum nigrum</i>	13	2	15	–
<i>Ledum</i> sp.	25	4	15	–
<i>Ledum groenlandicum</i>	63	7	3-15	<0.2-0.9
<i>Ledum palustre</i>	13	1	10	0.5
<i>Salix barclayi</i>	38	4	15	<1
<i>Salix glauca</i>	25	1	3-5	–
<i>Salix pulchra</i>	38	6	3-40	0.3-0.9
<i>Vaccinium uliginosum</i>	100	6	1-15	<0.2-<1
<i>Vaccinium vitis-idaea</i>	75	7	3-15	<0.2
<b>Herbaceous</b>				
<i>Carex bigelowii</i>	100	57	20-85	<0.2-<1
<i>Eriophorum vaginatum</i>	50	4	1-15	<0.2-<1
<i>Geocaulon lividum</i>	25	1	3-5	–
<b>Non-vascular</b>				
<i>Aulacomnium</i> sp.	50	5	1-35	<1
<i>Cetraria cucullata</i>	13	2	15	–
<i>Cladonia mitis</i>	13	3	20	–
<i>Hylocomium</i> sp.	13	2	15	–
<i>Hylocomium splendens</i>	50	14	15-38	<0.2
Lichen	25	1	3	–
Moss	50	15	5-63	<0.2
<i>Sphagnum</i> sp.	63	11	3-38	<0.2

**Dwarf *Picea mariana* / *Betula nana* - *Eriophorum vaginatum* Plant Association**  
**Dwarf black spruce / Dwarf birch - Tussock cottongrass Plant Association**

Plots sampled: 14.  
Rank: G5; S5.  
Other Studies: Yarie 1983a.

**Environmental Characteristics**

Distribution: Widespread association within the boreal forest zone of Yukon-Charley Rivers NP.  
Patch size: Small to large and often mosaiced with other forest associations.  
Elevation (meters): 213 to 640.  
Slope (deg): 0 to 15.  
Landform position: Alluvial plains, valley bottoms, toeslopes, sideslopes, and rounded ridges.  
Hydrology: Mesic to wet; standing water is common between tussocks.  
Soils: Soil profile includes tussocks over peat and mineral soil. Permafrost probably occurs at all sites.  
Landcover class: Open needleleaf forest; Woodland needleleaf forest.  
Sampled sites occur in the following detailed subsections: Charley Foothills; Tintina Hills; Yukon River Valley: Wet terraces with few ponds; Yukon River Valley: Wet terraces with oxbows.  
Successional stage: This is a late seral association following intense fire that burns tussocks; or early seral following light fire that does not burn tussocks.



**Vegetation**

*Picea mariana* cover is typically between 15 and 45% and its height ranges from 0.6 to 4 meters tall. The combined cover of tall and low shrubs is greater than 25%, and a variety of shrubs may codominate including *Betula nana*, *Ledum groenlandicum*, *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. *Eriophorum vaginatum* is the dominant sedge with cover typically exceeding 38%. Moss cover ranges up to 98% and *Sphagnum* species are common. Lichen cover is low and exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	23	1	3	2.3
<i>Picea mariana</i>	100	27	15-45	0.6-4
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	38	4	3-15	0.9
<i>Betula nana</i>	100	15	2-66	<0.2-<1
<i>Ledum</i> sp.	23	3	3-15	–
<i>Ledum groenlandicum</i>	23	6	3-66	0.9
<i>Ledum palustre</i>	8	1	16	<1
<i>Ledum palustre</i> ssp. <i>decumbens</i>	62	20	15-63	<0.2-0.9
<i>Salix</i> sp.	15	1	3-15	–
<i>Salix barclayi</i>	8	1	15	0.9
<i>Salix bebbiana</i>	8	1	15	2.3
<i>Vaccinium uliginosum</i>	69	5	3-38	<0.2-<1
<i>Vaccinium vitis-idaea</i>	54	10	3-38	<0.2-<1
<b>Herbaceous</b>				
<i>Carex</i> sp.	15	3	3-38	<0.2
<i>Carex bigelowii</i>	31	2	3-15	<0.2
<i>Equisetum sylvaticum</i>	8	1	15	–
<i>Eriophorum vaginatum</i>	100	64	38-85	<0.2-<1
<i>Rubus chamaemorus</i>	38	5	5-15	<0.2
<b>Non-vascular</b>				
<i>Cetraria</i> sp.	8	1	15	–
<i>Cetraria cucullata</i>	15	1	<1-15	<1
<i>Cladonia</i> sp.	15	1	2-15	<1
Lichen	46	4	3-15	–
Moss	31	11	15-85	–
<i>Polytrichum juniperinum</i>	23	4	3-38	<0.2
<i>Sphagnum</i> sp.	69	39	15-98	<0.2

**Dwarf *Picea mariana* / *Carex lugens* Plant Association**  
**Dwarf black spruce / Spruce muskeg sedge Plant Association**

Plots sampled: 2.  
Rank: G?; S?  
Other Studies: Yarie 1983a.

**Environmental Characteristics**

Distribution: Incidental association within the boreal forest zone of Yukon-Charley Rivers NP.  
Patch size: Small to moderate and often mosaiced with other forest associations.  
Elevation (meters): 214 to 451.  
Slope (deg): 0 to 4.  
Landform position: Alluvial plains, valley bottoms and sideslopes.  
Hydrology: Mesic to wet; standing water is common between tussocks.  
Soils: Soil profile includes tussocks over thick peat. The pH ranges from 5.1 to 7.0 and permafrost occurs at 15 to 18 centimeters.  
Landcover class: Woodland needleleaf forest.  
Sampled sites occur in the following detailed subsections: Ogilvie Foothills; Yukon River Valley: Wet terraces with few ponds.  
Successional stage: This is a late seral association following intense fire that burns tussocks; or early seral following light fire that does not burn tussocks.



**Vegetation**

*Picea mariana* cover is typically between 20 and 25% and ranges in height up to 2.7 meters. A variety of shrubs may codominate including *Betula nana*, *Ledum palustre* ssp. *decumbens* and *Vaccinium uliginosum*. *Carex lugens* is the dominant sedge although *Eriophorum vaginatum* is common. Their combined cover typically exceeds 25%. Moss cover ranges from 15 to 25%, lichen cover is low, and exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea mariana</i>	100	23	20-25	0.6-2.7
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	50	3	5	1.5
<i>Andromeda polifolia</i>	100	2	1-2	–
<i>Arctostaphylos rubra</i>	50	8	15	–
<i>Betula nana</i>	100	17	4-30	0.3-0.5
<i>Chamaedaphne calyculata</i>	100	3	1-4	0.3
<i>Ledum palustre</i> ssp. <i>decumbens</i>	100	20	20	0.2
<i>Vaccinium uliginosum</i>	50	8	15	0.3
<i>Vaccinium vitis-idaea</i>	100	6	1-10	–
<b>Herbaceous</b>				
<i>Calamagrostis lapponica</i>	50	3	5	0.2
<i>Carex lugens</i>	100	35	30-40	0.3-0.5
<i>Eriophorum vaginatum</i> var. <i>vaginatum</i>	50	8	15	0.2
Grass	50	2	3	0.3
<i>Rubus chamaemorus</i>	100	6	2-10	–
<b>Non-vascular</b>				
Moss	100	6	3-8	–
<i>Sphagnum</i> sp.	50	1	2	–

**Dwarf *Picea mariana* / *Eriophorum vaginatum* Plant Association**  
**Dwarf Black spruce / Tussock cottongrass Plant Association**

Plots sampled: 3.  
Rank: G5; S5.  
Other Studies: Yarie 1983a.

**Environmental Characteristics**

Distribution: Widespread association within the boreal forest zone of Yukon-Charley Rivers NP.  
Patch size: Small to moderate and often mosaiced with other forest associations.  
Elevation (meters): 335 to 411.  
Slope (deg): 0 to 13.  
Landform position: Alluvial plains, valley bottoms, toeslopes, sideslopes, and rounded ridges.  
Hydrology: Mesic to wet, and standing water is common between tussocks.  
Soils: Soil profile includes tussocks over peat and mineral soil. The one pH measured is 6.9 and permafrost probably occurs at all sites.  
Landcover class: Open needleleaf forest; Woodland needleleaf forest.  
Sampled sites occur in the following detailed subsections: Hard Luck Lowland; Tintina Hills.  
Successional stage: Late seral association.



**Vegetation**

*Picea mariana* cover is between 12 and 68% and its height ranges up to 5 meters tall. The combined cover of tall and low shrubs is less than 25% and includes *Betula* species, *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. *Eriophorum vaginatum* is the dominant sedge, whose cover typically exceeds 25%. Moss cover ranges from 2 to 85%, lichen cover is typically low (ranging up to 38%) and exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea mariana</i>	100	37	12-68	0.6->5m
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	33	1	3	-
<i>Betula</i> sp.	33	1	3	-
<i>Ledum palustre</i>	33	4	11	<1
<i>Ledum palustre</i> ssp. <i>decumbens</i>	33	3	10	0.2
<i>Salix glauca</i>	33	1	3	<1
<i>Spiraea stevenii</i>	33	1	2	<1
<i>Vaccinium uliginosum</i>	33	1	3	<1
<i>Vaccinium vitis-idaea</i>	33	5	16	<1
<b>Herbaceous</b>				
<i>Eriophorum vaginatum</i>	67	20	22-38	<1
<i>Eriophorum vaginatum</i> var. <i>vaginatum</i>	33	20	60	-
<i>Rubus chamaemorus</i>	67	3	1-9	<1
<b>Non-vascular</b>				
<i>Cladonia</i> sp.	33	3	9	<1
<i>Hylocomium splendens</i>	33	14	41	<1
Lichen	33	13	38	-
Moss	33	28	85	-

**Dwarf *Picea mariana* / *Ledum palustre* ssp. *decumbens* Plant Association**  
**Dwarf black Spruce / Marsh Labrador Tea Plant Association**

Future sampling may justify splitting this association based on moist versus wet site conditions.

Plots sampled: 14.  
Rank: G5; S5.  
Other Studies: Buckley and Libby 1957, Young and Racine 1976, Yarie 1983a, 1983b.

**Environmental Characteristics**

Distribution: Common in the forested portions of Yukon-Charley Rivers NP.  
Patch size: Small to matrix forming.  
Elevation (meters): 213 to 625.  
Slope (deg): 0 to 9.  
Landform position: Alluvial terraces, toeslopes, sideslopes, and rounded ridges.  
Hydrology: Not recorded, but likely mesic to wet (peatlands).  
Soils: Although not measured, the soil profile is likely a thick moss mat over an organic layer over silt, sand, and gravel.  
Landcover class: Open needleleaf forest; Woodland needleleaf forest.  
Sampled sites occur in the following detailed subsections: Biederman Hills; Tintina Hills; Yukon River Valley: Wet terraces with few ponds.  
Successional stage: This is a mid to late seral association following fire.



**Vegetation**

This is a woodland to open (10 to 33%), uneven-aged dwarf *Picea mariana* dominated forest. Average tree height is less than 3 meters tall but most trees are over 1.5 meters tall. The shrub layer has greater than 25% cover and is dominated or codominated by *Ledum groenlandicum*, *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. Common moss species are *Hylocomium splendens*, *Polytrichum* species and *Sphagnum* species. Common lichen species are *Cetraria cuculatta* and *Cladonia rangiferina*. Exposed mineral soil is uncommon.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea mariana</i>	100	20	10-33	0.9-3
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	29	1	1-7	0.3-2.3
<i>Andromeda polifolia</i>	29	2	<1-17	<1
<i>Betula nana</i>	64	2	<1-9	0.1-1.8
<i>Chamaedaphne calyculata</i>	50	1	1-8	<1
<i>Empetrum nigrum</i>	29	1	1-6	<1
<i>Ledum groenlandicum</i>	29	9	15-63	0.2-0.9
<i>Ledum palustre</i>	29	4	4-26	0.2-0.7
<i>Ledum palustre</i> ssp. <i>decumbens</i>	50	11	1-63	0.2
<i>Vaccinium uliginosum</i>	64	9	1-38	0.1-0.9
<i>Vaccinium vitis-idaea</i>	93	12	1-38	<0.2
<b>Herbaceous</b>				
<i>Carex bigelowii</i>	29	3	3-24	<1
<i>Equisetum sylvaticum</i>	14	3	4-38	0.3-0.9
<i>Eriophorum vaginatum</i>	14	2	15-18	<1
<i>Rubus chamaemorus</i>	86	4	<1-12	<0.2
<b>Non-vascular</b>				
<i>Aulacomnium palustre</i>	14	2	7-14	<1
<i>Cetraria</i> spp.	64	1	<1-6	<1
<i>Cetraria cucullata</i>	43	4	<1-21	<1
<i>Cladonia</i> spp.	71	4	<1-15	<1
<i>Cladonia rangiferina</i>	64	7	1-34	<1
<i>Dicranum</i> spp.	29	1	<1-15	<0.2
<i>Hylocomium</i> spp.	36	10	1-85	<0.2
<i>Hylocomium splendens</i>	14	3	2-30	<1
<i>Polytrichum</i> spp.	50	2	<1-6	0.1-0.2
<i>Sphagnum</i> spp.	86	31	2-98	<1

**Dwarf *Picea mariana* / *Vaccinium vitis-idaea* Plant Association**  
**Dwarf black spruce / Lingonberry Plant Association**

Plots sampled: 7.  
Rank: G5; S5.  
Other Studies: Yarie 1983a.

**Environmental Characteristics**

Distribution: Widespread association within the boreal forest zone of Yukon-Charley Rivers NP.  
Patch size: Small to large and often mosaiced with other forest associations.  
Elevation (meters): 297 to 367.  
Slope (deg): 3 to 9.  
Landform position: Valley bottoms, toeslopes, sideslopes, and rounded ridges.  
Hydrology: Water table is at 43 centimeters.  
Soils: The one soil profile sampled is fibric-peat down to permafrost at 46 centimeters.  
Landcover class: Open needleleaf forest; Woodland needleleaf forest.  
Sampled sites occur in the following detailed subsections: Charley Foothills; Ogilvie Foothills.  
Successional stage: Mid to late seral following fire.



**Vegetation**

*Picea mariana* cover is typically between 15 and 40%. Average tree height is less than 3 meters; however, most trees are over 1.5 meters tall. The combined cover of tall and low shrubs is less than 25%. Common shrubs include *Alnus viridis* ssp. *crispa*, *Ledum palustre* ssp. *decumbens*, *Rosa acicularis*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. Moss cover ranges up to 35% and the common species include *Hylocomium splendens* and *Sphagnum* species. Lichen cover is low (although one site had 59% cover) and exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	43	2	4	1.2->3.1
<i>Picea mariana</i>	100	25	15-40	0.1-3.1
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	57	2	<1-6	0.1->3.1
<i>Ledum groenlandicum</i>	43	3	3-14	0.1-0.3
<i>Ledum palustre</i>	43	2	3-5	0.1-0.3
<i>Ledum palustre</i> ssp. <i>decumbens</i>	43	1	<1-3	0.1-0.3
<i>Rosa acicularis</i>	71	1	<1-3	0.1-3.1
<i>Vaccinium uliginosum</i>	57	2	2-5	0.1-0.3
<i>Vaccinium vitis-idaea</i>	100	10	1-20	0.1-<1
<b>Herbaceous</b>				
<i>Carex bigelowii</i>	29	1	3-6	<1
<i>Equisetum sylvaticum</i>	43	3	<1-16	0.1-0.3
<i>Geocaulon lividum</i>	29	1	<1-6	0.1-3.1
<i>Rubus chamaemorus</i>	71	5	<1-30	0.1-<1
<b>Non-vascular</b>				
<i>Aulacomnium turgidum</i>	29	2.4	7-10	<1
<i>Cladina stellaris</i>	14	1.2	8	<1
<i>Cladonia</i> sp.	43	4	<1-26	0.1-<1
<i>Cladonia rangiferina</i>	43	2	<1-11	0.1-<1
<i>Hylocomium</i> sp.	29	4	5-21	0.1
<i>Hylocomium splendens</i>	29	3	3-21	<1
Lichen	43	2	<1-10	0.1-0.3
Moss	43	5	<1-35	0.1-<1
<i>Pleurozium schreberi</i>	29	6	13-30	<1
<i>Sphagnum</i> sp.	57	8	3-26	0.1-<1

***Picea mariana* / *Alnus viridis* ssp. *crispa* Plant Association**  
**Black spruce / Mountain alder Plant Association**

Plots sampled: 5.  
Rank: G5; S5.  
Other Studies: Johnson and Vogel 1966, Young and Racine 1976, Yarie 1983a.

**Environmental Characteristics**

Distribution: Common in the forested portions of Yukon-Charley Rivers NP.  
Patch size: Small to moderate.  
Elevation (meters): 457 to 1,067.  
Slope (deg): 25 to 54.  
Landform position: Valley bottoms and sideslopes.  
Hydrology: Mesic.  
Soils: The one soil profile sampled is a thick layer of organic matter and permafrost was found at 48 centimeters. The pH is 6.6.  
Landcover class: Open needleleaf forest; Woodland needleleaf forest.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Ogilvie Foothills; Tintina Hills; Upper Charley Mountain Tundra: Barren domes.  
Successional stage: Unknown.



**Vegetation**

This is a woodland to open (15 to 38%), uneven-aged forest dominated by *Picea mariana*. Average tree height ranges from 0.7 to 8 meters tall. *Alnus viridis* ssp. *crispa* cover is greater than 15%, and other shrubs dominate the understory including *Betula nana*, *Ledum groenlandicum*, *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. Moss cover ranges from 50 to 88% and

common species include *Hylocomium splendens*, *Pleurozium schreberi* and *Sphagnum* species. Lichen cover ranges from 7 to 20%, and exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea mariana</i>	100	22	15-38	0.7-7.6
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	80	13	15-18	0.5
<i>Alnus viridis</i> ssp. <i>sinuata</i>	20	4	20	2.1
<i>Arctostaphylos rubra</i>	40	4	5-15	–
<i>Betula nana</i>	80	18	3-63	0.3-1.5
<i>Dryas integrifolia</i>	20	3	15	–
<i>Empetrum nigrum</i>	40	10	10-38	–
<i>Ledum groenlandicum</i>	40	16	38-40	0.3
<i>Ledum palustre</i>	20	2	10	–
<i>Ledum palustre</i> ssp. <i>decumbens</i>	40	11	15-38	–
<i>Salix</i> sp.	20	1	7	0.7
<i>Salix glauca</i>	40	2	2-10	0.7
<i>Salix pulchra</i>	40	4	3-15	–
<i>Salix sitchensis</i>	20	3	15	–
<i>Vaccinium uliginosum</i>	80	26	10-63	–
<i>Vaccinium vitis-idaea</i>	100	14	5-19	0.1
<b>Herbaceous</b>				
<i>Carex</i> sp.	20	3	15	–
<i>Carex bigelowii</i>	40	4	3-15	–
<i>Equisetum</i> sp.	20	2	9	0.3-1.5
<i>Equisetum arvense</i>	20	2	10	–
<i>Rubus chamaemorus</i>	20	2	8	0.1
<b>Non-vascular</b>				
<i>Aulacomnium turgidum</i>	20	3	15	–
<i>Cladina rangiferina</i>	40	4	5-15	–
<i>Hylocomium splendens</i>	80	20	15-38	–
<i>Pleurozium schreberi</i>	60	20	25-38	–
<i>Sphagnum</i> sp.	60	7	3-15	–

***Picea mariana* / *Betula nana* Plant Association**  
**Black spruce / Dwarf birch Plant Association**

Plots sampled: 5.  
Rank: G5; S5.  
Other Studies: Batten, Murray and Dawe 1979, Yarie 1983a.

**Environmental Characteristics**

Distribution: Common in the forested portions of Yukon-Charley Rivers NP.  
Patch size: Small to matrix forming.  
Elevation (meters): 579 to 869.  
Slope (deg): 5 to 13.  
Landform position: Alluvial terraces, toeslopes, sideslopes, and rounded ridges.  
Hydrology: Mesic to dry.  
Soils: The single soil profile measured is a thin layer (3 centimeters) of organic matter over 12 centimeters of silt, sand, and gravel then rock at 15 centimeters deep, and a pH of 5.2.  
Landcover class: Open needleleaf forest; Woodland needleleaf forest.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Biederman Hills; Charley Foothills.  
Successional stage: Mid to late seral following fire.



**Vegetation**

This is a woodland to open (15 to 63%), uneven-aged forest dominated by *Picea mariana*. Average tree height in the overstory is greater than 3 meters tall. The shrub layer has greater than 25% cover and *Betula nana* dominates or codominates with *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. Additional species include *Empetrum nigrum* and *Salix* species. Moss cover ranges from 50 to 88% and common species include *Hylocomium splendens* and *Pleurozium schreberi*. Lichen cover ranges from 0 to 63% and common genera include *Cetraria* and *Cladina*. Exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea mariana</i>	100	38	15-63	4->5
<b>Shrubs</b>				
<i>Betula nana</i>	100	25	15-38	1.2
<i>Empetrum nigrum</i>	60	11	3-38	–
<i>Ledum</i> sp.	20	3	15	–
<i>Ledum groenlandicum</i>	20	1	3	–
<i>Ledum palustre</i> ssp. <i>decumbens</i>	60	3	3-10	–
<i>Salix</i> sp.	40	6	15	–
<i>Vaccinium uliginosum</i>	100	17	3-38	–
<i>Vaccinium vitis-idaea</i>	80	7	3-15	–
<b>Herbaceous</b>				
<i>Geocaulon lividum</i>	40	1	3	–
<b>Non-vascular</b>				
<i>Cetraria</i> sp.	20	3	15	–
<i>Cladina</i> sp.	20	8	38	<0.2
<i>Cladina rangiferina</i>	20	3	15	–
<i>Cladina stellaris</i>	20	2	10	–
<i>Cladonia</i> sp.	20	3	15	–
<i>Dicranum elongatum</i>	20	3	15	<0.2
Feathermoss	20	17	85	<0.2
<i>Hylocomium</i> sp.	20	3	15	<0.2
<i>Hylocomium splendens</i>	20	5	25	–
Lichen	60	26	3-63	<0.2
Moss	40	34	85	<0.2
<i>Pleurozium schreberi</i>	40	8	15-25	<0.2

***Picea mariana* / Bryophyte Plant Association**  
**Black spruce / Bryophyte Plant Association**

Plots sampled: 11.  
Rank: G5; S5.  
Other Studies: Batten, Murray and Dawe 1979, Yarie 1983a.

**Environmental Characteristics**

Distribution: Common in the forested portions of Yukon-Charley Rivers NP.  
Patch size: Small to large.  
Elevation (meters): 244 to 632.  
Slope (deg): 0 to 40.  
Landform position: Valley bottoms, alluvial terraces, toeslopes and sideslopes.  
Hydrology: Mesic to dry.  
Soils: Soil information was not recorded, but is likely a moss mat over organic matter over silt, sand, and gravel. Shallow permafrost is likely uncommon.  
Landcover class: Open needleleaf lichen forest; Woodland needleleaf lichen forest; Woodland needleleaf moss forest.  
Sampled sites occur in the following detailed subsections: Biederman Hills; Little Black River Hills; Ogilvie Foothills; Yukon River Valley: Wet terraces with few ponds.  
Successional stage: Mid to late seral following fire.



**Vegetation**

This is a woodland to open (11 to 40%), uneven-aged forest dominated by *Picea mariana*. Average tree height is greater than 3 meters tall and ranges up to 9 meters tall. *Betula papyrifera* may also occur as a minor component in both the understory and overstory. The combined cover of tall and low shrubs is less than 25% and *Alnus viridis* ssp. *crispa*, *Ledum groenlandicum*, *Ledum palustre* ssp. *decumbens*, and *Vaccinium vitis-idaea* codominate. Moss cover ranges from 33 to 88% and common species include *Hylocomium splendens*, *Pleurozium* species and *Sphagnum* species. Lichen cover ranges from 5 to 54%; primarily *Cladonia* and *Cladina* species.

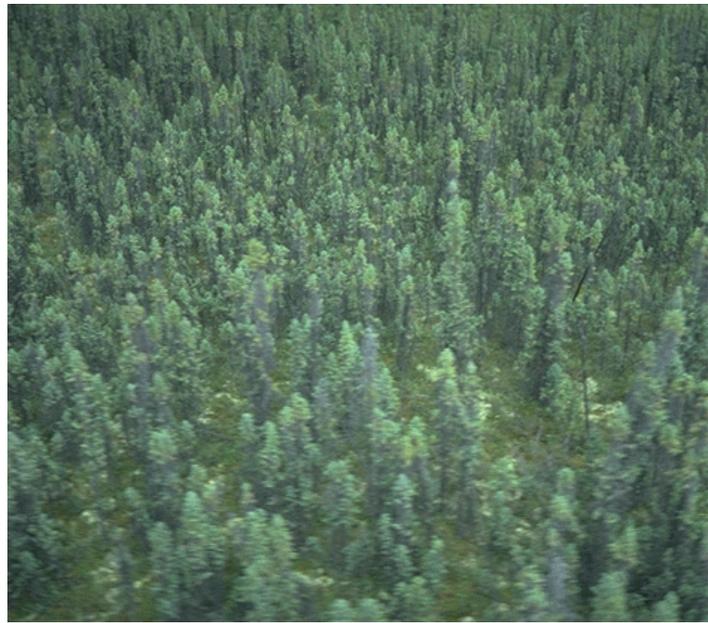
Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	45	1	<1-3	0.1->3.1
<i>Picea mariana</i>	100	25	11-40	0.1-9.1
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	45	2	1-8	<1
<i>Ledum groenlandicum</i>	64	5	<1-17	<1
<i>Ledum palustre</i>	45	2	<1-10	<1
<i>Vaccinium uliginosum</i>	55	2	<1-12	<1
<i>Vaccinium vitis-idaea</i>	91	10	1-23	0.1
<b>Herbaceous</b>				
<i>Equisetum sylvaticum</i>	27	2	<1-15	<1
<i>Eriophorum vaginatum</i>	27	2	4-8	<1
<i>Geocaulon lividum</i>	73	2	<1-8	<1
<b>Non-vascular</b>				
<i>Aulacomnium palustre</i>	18	2	1-18	<1
<i>Aulacomnium</i> spp.	18	4	9-38	<1
<i>Cladina</i> spp.	36	7	1-63	<1
<i>Cladonia</i> spp.	73	6	<1-24	<1
<i>Hylocomium</i> spp.	27	8	15-49	0.1
<i>Hylocomium splendens</i>	45	20	3-88	<1
Moss	27	2	1-10	0.1
<i>Nephroma</i> spp.	18	3	13-15	<1
<i>Peltigera</i> spp.	73	2	<1-6	<1
<i>Pleurozium</i> spp.	45	5	<1-22	0.1
<i>Sphagnum</i> spp.	55	9	<1-59	<1

***Picea mariana* / *Ledum palustre* ssp. *decumbens* Plant Association**  
**Black spruce / Marsh Labrador Tea Plant Association**

Plots sampled: 14.  
Rank: G5; S5.  
Other Studies: Yarie 1983a, 1983b.

**Environmental Characteristics**

Distribution: Common in the forested portions of Yukon-Charley Rivers NP.  
Patch size: Small to matrix forming.  
Elevation (meters): 291 to 671.  
Slope (deg): 0 to 30.  
Landform position: Alluvial terraces, toeslopes, sideslopes, and rounded ridges.  
Hydrology: Mesic to dry.  
Soils: Moss mat over 3 to 20 centimeters of organic matter over silt, sand, and gravel. Permafrost was recorded once at 23 centimeters. The pH ranges from 5.7 to 6.8.  
Landcover class: Open needleleaf forest; Woodland needleleaf forest.  
Sampled sites occur in the following detailed subsections: Yukon River Valley: High terraces, undulating; Little Black River Hills; Thanksgiving Loess Plain; Tintina Hills.  
Successional stage: Mid to late seral following fire.



**Vegetation**

This is a woodland to open (12 to 60%), uneven-aged forest dominated by *Picea mariana*. Average tree height is greater than 3 meters tall. The shrub layer has greater than 25% cover and is dominated or codominated by *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. *Ledum groenlandicum* occasionally dominates the understory. Additional species include *Alnus viridis* ssp. *crispa*, *Empetrum nigrum* and *Rubus chamaemorus*. Moss cover ranges from 28 to 98% and common species include *Hylocomium splendens*, *Pleurozium schreberi* and *Sphagnum* species. Lichen cover ranges from 0 to 50% and common species include *Cladina rangiferina* and *Cladonia* species. Exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea mariana</i>	100	29	12-60	0.7-7.6
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	21	2	1-15	1.5-2
<i>Betula nana</i>	57	2	<1-7	0.3-1.8
<i>Empetrum nigrum</i>	50	2	<1-14	0.1-0.2
<i>Ledum palustre</i>	50	10	6-31	0.2-0.5
<i>Ledum palustre</i> ssp. <i>decumbens</i>	14	6	38-50	–
<i>Ledum groenlandicum</i>	36	6	10-30	0.3
<i>Vaccinium uliginosum</i>	93	10	<1-20	0.1-0.3
<i>Vaccinium vitis-idaea</i>	93	13	3-30	0.1
<b>Herbaceous</b>				
<i>Equisetum sylvaticum</i>	36	18	<1-10	0.1-0.3
Sedge	36	3	2-15	0.1-0.3
<i>Rubus chamaemorus</i>	71	4	1-15	0.1
<b>Non-vascular</b>				
<i>Cladina</i> sp.	21	4	<1-50	0.1
<i>Cladonia</i> sp.	36	2	<1-11	0.1
<i>Cladonia rangiferina</i>	43	5	2-19	0.1
<i>Hylocomium</i> sp.	29	7	5-60	–
<i>Hylocomium splendens</i>	36	11	5-60	–
Lichen	21	1	<1-15	0.1
Moss	29	11	7-90	0.1
<i>Pleurozium</i> sp.	36	5	1-32	0.1
<i>Pleurozium schreberi</i>	21	10	15-85	–
<i>Sphagnum</i> sp.	64	13	3-60	0.1

## **PICEA GLAUCA - PICEA MARIANA PLANT ASSOCIATIONS**

### ***Picea glauca* - *Picea mariana* / *Vaccinium uliginosum* White Spruce - Black Spruce / Bog Blueberry Plant Association**

Further sampling may justify splitting this association into more types.

Plots sampled: 5.  
Rank: G5; S5.  
Other Studies: Yarie 1983a, 1983b.

#### **Environmental Characteristics**

Distribution: Widespread association within the boreal forest zone of Yukon-Charley Rivers NP.  
Patch size: Small to moderate.  
Elevation (meters): 274 to 945.  
Slope (deg): 12 to 65.  
Landform position: Valley bottoms, sideslopes, and rounded ridges.  
Hydrology: Mesic.  
Soils: The one soil pedon measured is a thin layer of litter and organic matter over a mixture of silt, sand and gravel. The pH is 6.3 and permafrost was not encountered.  
Landcover class: Open needleleaf forest.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Charley Foothills.  
Successional stage: Unknown.



#### **Vegetation**

*Picea glauca* cover ranges from 13 to 15% and *Picea mariana* cover ranges from 10 to 38%. Their heights are similar and range from 3 to 10 meters tall. Shrub cover typically exceeds 25% and dominance is variable including *Alnus viridis* ssp. *crispa*, *Arctostaphylos alpina*, *Betula nana*, *Empetrum nigrum*, *Ledum groenlandicum*, *Salix glauca*, *Vaccinium uliginosum* or *Vaccinium vitis-idaea*. Moss cover ranges from 24 to 77% and includes *Hylocomium splendens* and *Sphagnum* species. Lichen cover ranges from 9 to 25% and includes *Cetraria* species, *Cladina* species, *Cladonia rangiferina* and *Peltigera canina*.

Species	Constancy	Foliar cover (%)		Height range (m)
		average	range	
<b>Trees</b>				
<i>Picea glauca</i>	100	15	13-15	4.3->5
<i>Picea mariana</i>	100	30	10-38	3.1->5
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	25	4	15	–
<i>Arctostaphylos alpina</i>	25	10	38	–
<i>Betula nana</i>	50	3	3-8	0.6-1.8
<i>Empetrum nigrum</i>	75	13	<1-38	–
<i>Ledum groenlandicum</i>	75	6	3-15	–
<i>Salix glauca</i>	25	4	15	–
<i>Vaccinium uliginosum</i>	75	12	15-20	0.1
<i>Vaccinium vitis-idaea</i>	100	10	3-18	<0.2
<b>Herbaceous</b>				
<i>Equisetum palustre</i>	25	16	63	–
<i>Equisetum scirpoides</i>	50	4	<1-15	0.1
<i>Geocaulon lividum</i>	25	4	15	–
Grass	25	4	15	–
<b>Non-vascular</b>				
<i>Cetraria</i> sp.	25	2	8	–
<i>Cladina</i> sp.	75	7	3-15	<0.2
<i>Cladonia rangiferina</i>	25	1	5	0.1
Feathermoss	25	4	15	<0.2
<i>Hylocomium</i> sp.	100	35	10-85	<0.2
<i>Peltigera canina</i>	25	2	9	0.2
<i>Sphagnum</i> sp.	25	10	38	<0.2

## DECIDUOUS PLANT ASSOCIATIONS

### *Betula papyrifera* / *Rosa acicularis* Plant Association Paper birch / Prickly rose Plant Association

Plots sampled: 10.  
Rank: G5; S5.  
Other Studies: Buckley and Libby 1957.

#### Environmental Characteristics

Distribution: Common and widespread association of Yukon-Charley Rivers NP.  
Patch size: Small to large patches.  
Elevation (meters): 213 to 701.  
Slope (deg): 0 to 50.  
Landform position: Valley bottoms, toeslopes, sideslopes and drainage sideslopes.  
Hydrology: Mesic.  
Soils: The soils are typically a thin layer of litter and organic matter over a mixture of silt, sand, and gravel. Permafrost is often present.  
Landcover class: Closed deciduous forest.  
Sampled sites occur in the following detailed subsections: Charley Foothills; Yukon River Valley: Nation / Kandik / Bonanza valleys; Tintina Hills; Yukon River Valley: High terraces, undulating; Yukon River Valley: Wet terraces with few ponds.  
Successional stage: This association is fire dependent and follows the Young *Betula papyrifera* association that in turn is dependent on fires in *Picea glauca* - *Betula papyrifera* forests or *Picea glauca* and *Picea mariana* dominated forests. Consequently, the distribution of the *Betula papyrifera* / *Rosa acicularis* association reflects the fire pattern in the Preserve.



## Vegetation

The cover of *Betula papyrifera* ranges from 55 to 100% and its height ranges from 7 meters in young stands to greater than 12 meters tall in older stands with a dbh up to 20 centimeters. The stands are even- or uneven-aged, and young or mature *Picea glauca* are common. The mature *Picea glauca* likely predate the fire that burned the stand. *Picea mariana* is less common. Shrubs are common and include *Alnus viridis* ssp. *crispa* from 0 to 38% cover, and, *Rosa acicularis* and *Salix bebbiana*. *Equisetum* species and *Linnaea borealis* are common and often dominate the herbaceous layer. Total moss and lichen cover is typically less than 30% and the cover of litter is often high.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	100	83	55-100	2.3-12.2
<i>Picea glauca</i>	80	9	3-18	2.3-10.1
<i>Picea mariana</i>	20	1	5-8	0.5->3.1
<i>Populus tremuloides</i>	30	1	3-6	0.2->5
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	80	12	3-38	0.9-4
<i>Ledum</i> sp.	10	2	15	–
<i>Ribes triste</i>	30	2	3-15	0.3-0.9
<i>Rosa acicularis</i>	100	21	3-63	0.2-0.9
<i>Salix arbusculoides</i>	10	2	15	4
<i>Salix bebbiana</i>	30	4	4-18	>3.1
<b>Herbaceous</b>				
<i>Calamagrostis canadensis</i>	30	2	2-15	0.1
<i>Cornus canadensis</i>	40	3	1-15	0.1
<i>Equisetum arvense</i>	20	5	15-38	0.9-<0.2
<i>Equisetum palustre</i>	10	9	85	–
<i>Equisetum sylvaticum</i>	30	10	3-63	0.3-0.9
Grass	40	9	3-38	0.9
<i>Gymnocarpium dryopteris</i>	10	2	15	<0.2
<i>Linnaea borealis</i>	40	7	4-38	<0.2
<i>Mertensia paniculata</i>	40	2	1-15	<0.2
<b>Non-vascular</b>				
Feathermoss	20	5	15-38	–
<i>Hylocomium</i> sp.	30	8	6-63	0.1
<i>Hylocomium splendens</i>	30	5	1-35	<0.2
Moss	20	6	15-38	<0.2

***Populus balsamifera* ssp. *balsamifera* / *Alnus viridis* ssp. *crispa* Floodplain Plant Association  
Balsam poplar / Mountain alder Floodplain Plant Association**

Plots sampled: 6.  
Rank: G5; S5.  
Other Studies: Johnson and Vogel 1966.

**Environmental Characteristics**

Distribution: Minor but widespread association of Yukon-Charley Rivers NP.  
Patch size: Small to moderate size patches.  
Elevation (meters): 206 to 320.  
Slope (deg): Typically level.  
Landform position: Floodplains throughout the Preserve.  
Hydrology: Mesic and also inundated during high river flows.  
Soils: Derived from fluvial deposition. Typically has a thin layer of litter over a mixture of silt, sand and gravel. The pH ranges from 5.8 to 7.6.  
Landcover class: Closed deciduous forest; Open deciduous forest.  
Sampled sites occur in the following detailed subsections: Ogilvie Foothills; Yukon River; Active Floodplain; Yukon River Valley: Wet terraces with few ponds.  
Successional stage: Mid seral to *Picea glauca* associations on alluvial deposits.



**Vegetation**

The cover of *Populus balsamifera* ssp. *balsamifera* ranges from 35 to 85%, and its height ranges from 7 meters tall in young stands to 21 meters in mature stands with a dbh of 38 centimeters and 90 years old. The stands are even- or uneven-aged, and young *Picea glauca* occurs in some stands. Tall shrubs are common and include *Alnus* species (*Alnus incana* ssp. *tenuifolia*, *Alnus viridis* ssp. *crispa*, *Alnus viridis* ssp. *sinuata*) with a combined cover from 15 to 64%, and *Salix arbusculoides*, *S. scouleriana* and

*Viburnum edule*. Other species include *Calamagrostis canadensis*, *Equisetum arvense*, *Equisetum pratense* and *Rosa acicularis*.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	17	3	20	7.6
<i>Picea glauca</i>	33	2	5-8	3.4-6.1
<i>Populus balsamifera</i>	100	53	35-85	>3.1-21.3
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	67	10	5-38	1.2-3.1
<i>Alnus viridis</i> ssp. <i>sinuata</i>	17	10	57	2
<i>Alnus incana</i> ssp. <i>tenuifolia</i>	67	12	10-35	0.7-3.8
<i>Cornus sericea</i> ssp. <i>sericea</i>	83	5	3-15	0.3-0.9
<i>Rosa acicularis</i>	83	20	5-63	0.5-1.1
<i>Salix alaxensis</i>	33	2	5	0.7-3.7
<i>Salix arbusculoides</i>	17	3	20	7.6
<i>Salix scouleriana</i>	33	3	5-10	3.5-4.6
<i>Viburnum edule</i>	67	13	3-33	<0.2-1.1
<b>Herbaceous</b>				
<i>Calamagrostis canadensis</i>	50	8	<1-35	0.1-0.7
<i>Equisetum arvense</i>	50	12	5-50	0.3
<i>Equisetum pratense</i>	50	4	<1-15	0.1-<0.2
<b>Non-vascular</b>				
Moss	50	3	<1-15	–

***Populus tremuloides* / *Rosa acicularis* Plant Association**  
**Quaking aspen / Prickly rose Plant Association**

Plots sampled: 4.  
Rank: G5; S5.  
Other Studies: Batten, Murray and Dawe 1979.

**Environmental Characteristics**

Distribution: Common and widespread association of Yukon-Charley Rivers NP.  
Patch size: Small to large patches.  
Elevation (meters): 244 to 823.  
Slope (deg): 27 to 70.  
Landform position: Typically south-facing, but range from east to west. On river bluffs, valley bottoms, toeslopes and sideslopes.  
Hydrology: Relatively dry.  
Soils: Thin layer of litter and organic matter over a mixture of silt, sand, and gravel over rock. The one pH measured is 6.4.  
Landcover class: Closed deciduous forest; Open deciduous forest.  
Sampled sites occur in the following detailed subsections: Ogilvie Foothills; Ogilvie Foothills bluffs.  
Successional stage: This association follows the Young *Populus tremuloides* association that in turn follows fire on dry sites supporting mature *Populus tremuloides*, and also *Picea glauca* / *Betula papyrifera*, *Picea glauca* or *Picea mariana* dominated forests.



**Vegetation**

The cover of *Populus tremuloides* ranges from 31 to 100%, and height ranges from 7 to 10 meters with a dbh up to 20 centimeters. The stands are even-aged and young *Betula papyrifera*, *Picea mariana* and *Picea glauca* may occur. Other species include *Calamagrostis canadensis*, *Chamerion angustifolium* ssp. *angustifolium*, *Linnaea borealis*, *Mertensia paniculata*, *Rosa acicularis* and *Viburnum edule*. Moss and lichen cover are low and the cover of litter is often high.

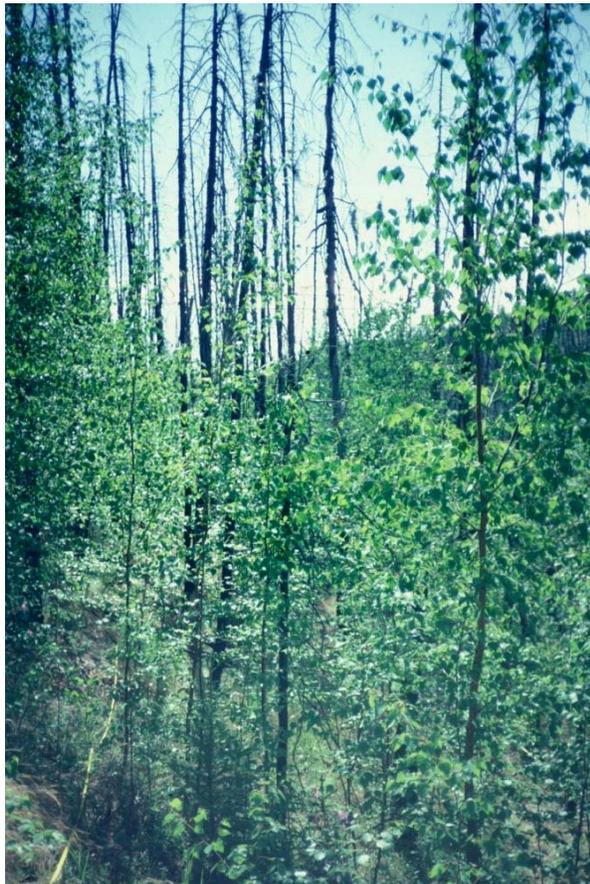
Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	50	3	1-10	0.3-5.3
<i>Picea glauca</i>	25	2	8	1.7
<i>Picea mariana</i>	25	2	8	>3.1
<i>Populus tremuloides</i>	100	64	31-100	0.7-9.1
<b>Shrubs</b>				
<i>Rosa acicularis</i>	100	6	<1-19	<1
<i>Vaccinium vitis-idaea</i>	50	3	3-10	<0.2
<i>Viburnum edule</i>	75	11	2-38	<1
<b>Herbaceous</b>				
<i>Calamagrostis canadensis</i>	50	4	3-14	<1
<i>Cornus canadensis</i>	25	2	8	<1
<i>Chamerion angustifolium</i> ssp. <i>angustifolium</i>	100	2	<1-3	<1
<i>Festuca altaica</i>	25	16	63	0.9
<i>Linnaea borealis</i>	75	6	2-19	<1
<i>Mertensia paniculata</i>	75	8	3-15	<1

**Young *Betula papyrifera* Plant Association**  
**Young paper birch Plant Association**

Plots sampled: 5.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Common and widespread association of Yukon-Charley Rivers NP.  
Patch size: Small to moderate size patches.  
Elevation (meters): 232 to 579.  
Slope (deg): 0 to 45.  
Landform position: Valley bottoms, toeslopes, sideslopes and drainage sideslopes.  
Hydrology: Site conditions are variable and range from moist soils supporting sedge tussock to relatively dry sites.  
Soils: Not recorded.  
Landcover class: Open deciduous forest.  
Sampled sites occur in the following detailed subsections: Biederman Hills; Thanksgiving Loess Plain; Tintina Hills; Yukon River Valley: Wet terraces with few ponds.  
Successional stage: This association follows fire in *Picea glauca* - *Betula papyrifera* forests or *Picea glauca*, *Picea mariana* and dwarf *Picea mariana* dominated forests. The distribution of the Young *Betula papyrifera* association, consequently, reflects the fire pattern in the Preserve.



**Vegetation**

The cover of *Betula papyrifera* ranges from 18 to 63%, and its height ranges up to 3.1 meters. The stands are even-aged and young *Picea glauca* is common. Any mature *Picea* predate the fire that burned the stand. Shrubs are common and include *Alnus viridis* ssp. *crispa* from 0 to 59% cover, and *Rosa acicularis* and *Salix* species. *Equisetum sylvaticum* may dominate the herbaceous layer. Total moss cover is typically low but ranges up to 91%. Lichens are uncommon and the cover of litter is often high.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	100	33	18-63	<1-3.1
<i>Picea glauca</i>	80	3	<1-7	<1
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	60	18	15-59	1.8
<i>Betula nana</i>	20	8	38	–
<i>Chamaedaphne calyculata</i>	20	3	3-15	–
<i>Ledum</i> spp.	40	11	15-38	–
<i>Rosa acicularis</i>	60	2	1-4	<1
<i>Salix</i> spp.	80	4	<1-15	3.1
<i>Salix glauca</i>	20	3	17	>3.1
<i>Salix planifolia</i>	20	3	15	>3.1
<i>Vaccinium uliginosum</i>	20	8	38	0.2
<i>Vaccinium vitis-idaea</i>	20	2	11	<1
<b>Herbaceous</b>				
<i>Carex</i> spp.	40	3	2-15	0.2
<i>Cornus canadensis</i>	20	2	8	0.1
<i>Equisetum sylvaticum</i>	40	20	15-85	–
Grass	40	6	3-27	<1
<i>Linnaea borealis</i>	40	3	2-15	<1
<i>Mertensia paniculata</i>	60	2	1-6	<1
<b>Non-vascular</b>				
<i>Ceratodon purpureus</i>	20	2	10	<1
Feathermoss	60	21	3-85	–
<i>Polytrichum juniperinum</i>	20	3	16	–

**Young *Populus balsamifera* ssp. *balsamifera* Floodplain Plant Association**  
**Young balsam poplar Floodplain Plant Association**

Plots sampled: 1.  
Rank: G5; S5.  
Other Studies: Farjon and Bogaers 1985, Young and Racine 1976.

**Environmental Characteristics**

Distribution: Minor association of Yukon-Charley Rivers NP.  
Patch size: Small patches.  
Elevation: Low elevation.  
Slope (deg): Level.  
Landform position: Floodplains throughout Yukon-Charley Rivers NP. It occurs on recently disturbed lands including ice-scoured islands, new alluvial deposits along the edge of a river, and abandoned river channels.  
Hydrology: Well drained although during high river flows they are nearly always inundated.  
Soils: Soils are derived from fluvial deposition and range from silt to sand to gravel.  
Landcover class: Open deciduous forest.  
The sampled site occurs in the Ogilvie Foothills detailed subsection.  
Successional stage: Early seral to the *Populus balsamifera* ssp. *balsamifera* / *Alnus viridis* ssp. *crispa* Floodplain association.



**Vegetation**

This association includes stands dominated by *Populus balsamifera* ssp. *balsamifera* less than 7 meters tall including seedlings. Shrub and herbaceous species composition is highly variable and includes *Alnus* species, *Calamagrostis canadensis*, *Chamerion angustifolium* ssp. *angustifolium*, *Equisetum arvense*, *Galium boreale*, *Hedysarum alpinum* and *Salix alaxensis*.

<b>Species</b>	<b>Foliar cover (%)</b>	<b>Height (m)</b>
<b>Trees</b>		
<i>Populus balsamifera</i>	40	1.1
<b>Shrubs</b>		
<i>Alnus incana</i> ssp. <i>tenuifolia</i>	10	2.1
<i>Salix alaxensis</i>	5	1.2
<b>Herbaceous</b>		
<i>Calamagrostis canadensis</i>	20	0.8
<i>Chamerion angustifolium</i> ssp. <i>angustifolium</i>	15	–
<i>Equisetum arvense</i>	10	–
<i>Festuca rubra</i>	3	0.5
<i>Galium boreale</i>	20	–
<i>Hedysarum alpinum</i>	40	0.4
<i>Poa pratensis</i> ssp. <i>alpigena</i>	5	0.3

**Young *Populus tremuloides* Plant Association**  
**Young quaking aspen Plant Association**

Plots sampled: 6.  
Rank: G5; S5.  
Other Studies: Batten, Murray and Dawe 1979, Buckley and Libby 1957.

**Environmental Characteristics**

Distribution: Common and widespread association of Yukon-Charley Rivers NP.  
Patch size: Small to moderate.  
Elevation (meters): 232 to 792.  
Slope (deg): 16 to 55.  
Landform position: River bluffs, valley bottoms, toeslopes and sideslopes; typically south-facing slopes.  
Hydrology: Relatively dry and are typically south-facing, but range from east to west.  
Soils: The soils are 0 to 4 centimeters of duff over silt and sand, then rock. The pH ranges from 6.4 to 8.0.  
Landcover class: Open deciduous forest.  
Sampled sites occur in the following detailed subsections: Little Black River Hills; Ogilvie Foothills; Yukon River Valley: Wet terraces with few ponds.  
Successional stage: This association follows fire on dry sites supporting mature *Populus tremuloides*, and also *Picea glauca* / *Betula papyrifera*, *Picea glauca* or *Picea mariana* dominated forests.



**Vegetation**

The cover of *Populus tremuloides* ranges from 15 to 90%, and its height ranges up to 4.6 meters. The stands are even-aged, and young *Picea glauca* and *Betula papyrifera* occur. Other species include *Arctagrostis latifolia*, *Arctospahylos uva-ursi*, *Bromus inermis* var. *arcticus*, and *Rosa acicularis*. Total moss cover is typically low but ranges up to 50% cover, lichen ranges up to 40%, and litter cover is often high.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	33	1	1-5	<1-4.6
<i>Picea glauca</i>	33	1	1-5	0.6
<i>Populus tremuloides</i>	100	38	15-90	2.3-4.6
<b>Shrubs</b>				
<i>Arctostaphylos uva-ursi</i>	67	7	3-20	<1
<i>Empetrum nigrum</i>	17	5	30	–
<i>Rosa acicularis</i>	67	4	2-20	<1
<i>Salix glauca</i>	50	2	2-5	<1
<i>Shepherdia canadensis</i>	33	2	3-9	<1
<i>Vaccinium vitis-idaea</i>	67	5	2-10	<1
<b>Herbaceous</b>				
<i>Arctagrostis latifolia</i>	50	6	9-16	<1
<i>Bromus inermis</i> var. <i>pumpellianus</i>	17	3	21	<1
<i>Bromus inermis</i> var. <i>arcticus</i>	17	3	19	<1
<i>Calamagrostis purpurascens</i> var. <i>purpurascens</i>	17	7	40	–
<i>Linnaea borealis</i>	17	2	12	<1
<b>Non-vascular</b>				
<i>Aulacomnium</i> spp.	50	8	1-47	<1
<i>Ceratodon purpureus</i>	17	2	10	–
<i>Cladonia</i> spp.	33	3	1-15	–
<i>Polytrichum</i> spp.	50	9	<1-50	<1

## MIXED NEEDLELEAF - DECIDUOUS FOREST PLANT ASSOCIATIONS

### *Picea glauca* - *Betula papyrifera* / *Rosa acicularis* Plant Association White spruce - Paper birch / Prickly rose Plant Association

Plots sampled: 5.  
Rank: G5; S5.  
Other Studies: Buckley and Libby 1957.

#### Environmental Characteristics

Distribution: Common and widespread in Yukon-Charley Rivers NP.  
Patch size: Small to medium.  
Elevation (meters): 233 to 945.  
Slope (deg): 0 to 60.  
Landform position: Valley bottoms, toeslopes and sideslopes.  
Hydrology: Mesic.  
Soils: The soils are typically a thin layer of litter and organic matter over a mixture of silt, sand, and gravel. The one pH measured is 6.9.  
Landcover class: Closed mixed needleleaf / deciduous forest; Open mixed needleleaf / deciduous forest.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Charley Foothills; Yukon River Valley: High terraces, undulating; Yukon River Valley: Wet terraces with oxbows.  
Successional stage: This association is fire dependent and follows the Young *Picea glauca* - *Betula papyrifera* association that in turn is dependent on fires in *Picea glauca* - *Betula papyrifera* forests or *Picea glauca* and *Picea mariana* dominated forests. Consequently, the distribution of the *Picea glauca* - *Betula papyrifera* / *Rosa acicularis* association reflects the fire pattern in the Preserve.



## Vegetation

*Picea glauca* and *Betula papyrifera* codominate the sites. The cover of *Picea glauca* ranges from 10 to 41% and the cover of *Betula papyrifera* ranges from 20 to 85%. Tree height ranges from 7 meters in young stands to greater than 17 meters tall in older stands with a dbh up to 38 centimeters. The stands are even- or uneven-aged. *Rosa acicularis* is the diagnostic understory species, and other common species include *Alnus viridis* ssp. *crispa*, *Linnaea borealis* and *Mertensia paniculata*. Total moss cover ranges from 15 to 90%, predominantly *Hylocomium splendens*. Lichen cover is typically low and the cover of litter is often high.

	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	100	41	20-85	>5
<i>Picea glauca</i>	100	26	10-41	>3.1
<i>Picea mariana</i>	20	2	10	6.1
<i>Populus balsamifera</i>	20	1	4	>3.1
<i>Populus tremuloides</i>	20	1	3	>5
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	80	6	3-15	2.3-4.6
<i>Alnus incana</i> ssp. <i>tenuifolia</i>	20	2	9	>3.1
<i>Ledum groenlandicum</i>	20	1	3	–
<i>Ledum palustre</i>	20	<1	2	–
<i>Ribes triste</i>	20	1	3	–
<i>Rosa acicularis</i>	100	8	2-15	0.9
<i>Salix bebbiana</i>	40	6	3-25	>3.1
<b>Herbaceous</b>				
<i>Calamagrostis canadensis</i>	40	4	<1-15	0.3
<i>Delphinium glaucum</i>	40	1	1-3	0.5
<i>Equisetum arvense</i>	40	2	3-5	–
<i>Equisetum pratense</i>	20	1	6	0.3
<i>Festuca altaica</i>	20	3	15	–
<i>Geocaulon lividum</i>	60	3	<1-10	0.1
<i>Linnaea borealis</i>	60	4	3-15	<0.2
<i>Mertensia paniculata</i>	60	1	1-3	<0.2-0.5
<b>Non-vascular</b>				
<i>Hylocomium</i> sp.	60	8	9-15	0.1
<i>Hylocomium splendens</i>	40	31	63-90	<0.2

***Picea glauca* - *Populus tremuloides* Plant Association**  
**White spruce - Quaking aspen Plant Association**

Plots sampled: 3.  
Rank: G5; S5.  
Other Studies: Buckley and Libby 1957, Yarie 1983a.

**Environmental Characteristics**

Distribution: Common and widespread of Yukon-Charley Rivers NP.  
Patch size: Small to medium.  
Elevation (meters): 366 to 792.  
Slope (deg): 25 to 35.  
Landform position: Sideslopes and ridges.  
Hydrology: This association may occupy the drier end of the *Picea glauca* alliance, and typically faces south to south southeast.  
Soils: Not sampled.  
Landcover class: Closed mixed needleleaf / deciduous forest; Open mixed needleleaf / deciduous forest.  
Sampled sites occur in the following detailed subsections: Biederman Hills; Ogilvie Foothills.  
Successional stage: Unknown.



**Vegetation**

*Picea glauca* and *Populus tremuloides* codominate the sites. The cover of *Picea glauca* ranges from 10 to 30% and the cover of *Populus tremuloides* ranges from 20 to 40%. Tree height ranges from 7 meters in young stands to greater than 12 meters in older stands. The stands are uneven-aged. Shrub and herbaceous cover is sparse. Total moss cover may be high and dominated by *Hylocomium splendens*. Lichen cover is typically low and the cover of litter is often high.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	33	3	10	3.1
<i>Picea glauca</i>	100	20	10-30	3.1-12.2
<i>Populus tremuloides</i>	100	27	20-40	6.1-12.2
<b>Shrubs</b>				
<i>Arctostaphylos uva-ursi</i>	33	3	8	<1
<i>Empetrum nigrum</i>	33	1	4	<1
<i>Ledum palustre</i>	67	1	<1-2	<1
<i>Vaccinium vitis-idaea</i>	67	7	2-17	<1
<b>Herbaceous</b>				
<i>Astragalus</i> sp.	33	2	5	<1
<i>Bromus inermis</i> var. <i>arcticus</i>	33	2	5	<1
<i>Geocaulon lividum</i>	100	1	<1-4	<1
<i>Linnaea borealis</i>	67	3	1-6	<1
<b>Non-vascular</b>				
<i>Cladonia</i> sp.	100	3	<1-8	<1
<i>Hylocomium splendens</i>	100	20	2-40	<1
Lichen	33	1	3	<1
<i>Peltigera</i> sp.	100	4	2-6	<1
<i>Polytrichum</i> sp.	33	2	7	<1

***Picea mariana* - *Betula papyrifera* / *Alnus viridis* ssp. *crispa* Plant Association**  
**Black spruce - Paper birch / Mountain alder Plant Association**

Plots sampled: 10.  
Rank: G5; S5.  
Other Studies: Yarie 1983a.

**Environmental Characteristics**

Distribution: Common and widespread in Yukon-Charley Rivers NP.  
Patch size: Small to medium.  
Elevation: Low to mid elevations.  
Slope (deg): Not measured.  
Landform position: Typically occurs on poorly drained soils on sideslopes and floodplain terraces.  
Hydrology: Mesic.  
Soils: Not measured.  
Landcover class: Closed mixed needleleaf / deciduous forest; Open mixed needleleaf / deciduous forest.  
Successional stage: This association is fire dependent and follows the *Betula papyrifera* / *Rosa acicularis* association. The slower growing *Picea* eventually reach the *Betula papyrifera* canopy as the *Betula papyrifera* reach senescence. Sometimes *Picea mariana* and *Betula papyrifera* will establish at the same time and mature together. Eventually, *Picea* dominates as the *Betula papyrifera* trees die without replacement (Viereck et al. 1992).

**Vegetation**

*Picea mariana* and *Betula papyrifera* codominate the sites. The cover of *Picea mariana* ranges from 12 to 29% and the cover of *Betula papyrifera* ranges from 4 to 51%. Tree height ranges from 7 meters in young stands to 17 meters tall in older stands with a dbh up to 9 centimeters (Viereck et al. 1992). *Alnus viridis* ssp. *crispa* cover ranges from 4 to 38%. Other common shrubs include *Ledum groenlandicum*, *Ledum palustre* ssp. *decumbens*, *Rosa acicularis* and *Vaccinium vitis-idaea*. Total moss cover ranges from 7 to 84%, predominantly *Hylocomium splendens* and *Sphagnum* species. Lichen cover is typically low and the cover of litter is often high.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	100	20	4-51	0.1->3.1
<i>Picea glauca</i>	10	2	16	>3.1
<i>Picea mariana</i>	100	19	12-29	0.1->3.1
<i>Populus balsamifera</i>	10	1	8	>3.1
<b>Shrubs</b>				
<i>Alnus viridis ssp. crispa</i>	100	22	4-38	0.3->3.1
<i>Ledum groenlandicum</i>	30	2	2-10	0.1-0.3
<i>Ledum palustre</i>	50	4	2-16	0.1-0.7
<i>Rosa acicularis</i>	50	3	<1-10	0.1-0.7
<i>Vaccinium vitis-idaea</i>	100	7	1-12	0.1-0.3
<b>Herbaceous</b>				
<i>Calamagrostis canadensis</i>	50	3	1-22	0.1-0.7
<i>Equisetum pratense</i>	20	4	<1-38	0.1-0.3
Grass	40	2	1-13	0.1-0.3
<b>Non-vascular</b>				
<i>Aulacomnium</i> spp.	50	3	1-23	0.1
<i>Cladonia rangiferina</i>	70	2	1-7	0.1
<i>Hylocomium</i> spp.	80	19	6-69	0.1
Moss	40	5	1-38	0.1
<i>Peltigera</i> spp.	90	4	<1-13	0.1
<i>Sphagnum</i> spp.	70	11	5-27	0.1

**Young *Picea glauca* - *Betula papyrifera* Plant Association**  
**Young white spruce - Paper birch Plant Association**

Plots sampled: 7.  
Rank: G5; S5.  
Other Studies: Yarie 1983a.

**Environmental Characteristics**

Distribution: Common and widespread in Yukon-Charley Rivers NP.  
Patch size: Small to moderate.  
Elevation (meters): 351 to 762.  
Slope (deg): 6 to 40.  
Landform position: Valley bottoms, toeslopes and sideslopes.  
Hydrology: Mesic.  
Soils: The soils are typically a thin layer of litter and organic matter over a mixture of silt, sand, and gravel. The one pH measured is 4.7.  
Landcover class: Closed mixed needleleaf / deciduous forest; Open mixed needleleaf / deciduous forest.  
Sampled sites occur in the following detailed subsections: Charley Foothills; Yukon River Valley; Nation / Kandik / Bonanza valleys; Ogilvie Foothills; Tintina Hills.  
Successional stage: Early seral. This association follows fire in *Picea glauca* - *Betula papyrifera* forests or *Picea glauca* and *Picea mariana* dominated forests. The distribution of the Young *Picea glauca* - *Betula papyrifera* association, consequently, reflects the fire pattern in the Preserve.



**Vegetation**

Young *Picea glauca* and *Betula papyrifera* (less than 7 meters tall) codominate the sites. The cover of *Picea glauca* ranges from 10 to 30% and the cover of *Betula papyrifera* ranges from 15 to 40%. Other common species include *Alnus viridis* ssp. *crispa*, *Chamerion angustifolium* ssp. *angustifolium*, *Ledum palustre* ssp. *decumbens*, *Salix* species, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. Total moss cover is typically low but ranges up to 71%, lichens are uncommon and the cover of litter is often high.

Species	Constancy	Foliar cover %		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	100	29	15-40	4-7.6
<i>Picea glauca</i>	100	17	10-30	2.3-6.1
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	33	7	6-38	<1
<i>Empetrum nigrum</i>	33	3	17	<0.2-<1
<i>Ledum</i> sp.	17	6	38	<0.2
<i>Ledum palustre</i>	17	3	18	<1
<i>Ledum palustre</i> ssp. <i>decumbens</i>	17	11	63	0.9
<i>Salix bebbiana</i>	33	5	2-30	<1-4
<i>Spiraea stevenii</i>	17	3	15	-
<i>Vaccinium uliginosum</i>	50	7	<1-38	<1
<i>Vaccinium vitis-idaea</i>	50	13	15-38	<0.2-<1
<b>Herbaceous</b>				
<i>Chamerion angustifolium</i> ssp. <i>angustifolium</i>	67	1	<1-2	<1
<i>Equisetum</i> sp.	17	6	38	<0.2
<i>Equisetum scirpoides</i>	33	1	1-6	<1
<i>Festuca altaica</i>	17	1	8	<1
<i>Lycopodium</i> sp.	17	3	15	<0.2
<i>Mertensia paniculata</i>	33	2	1-8	<1
<b>Non-vascular</b>				
<i>Brachythecium</i> sp.	17	3	16	<1
<i>Hylocomium splendens</i>	17	5	30	<1
Lichen	33	3	<1-15	<0.2-<1
Moss	33	17	15-85	<0.2
<i>Peltigera</i> spp.	50	3	2-9	<0.2
<i>Polytrichum</i> spp.	33	8	3-45	<1

**Young *Picea mariana* - *Betula papyrifera* Plant Association**  
**Young black spruce - paper birch Plant Association**

Plots sampled: 2.  
Rank: G5; S5.  
Other Studies: Yarie 1983a, 1983b.

**Environmental Characteristics**

Distribution: Common and widespread association in Yukon-Charley Rivers NP.  
Patch size: Small to moderate.  
Elevation (meters): Low to mid elevations (513 to 554).  
Slope (deg): 5 to 30.  
Landform position: Sideslopes and rounded ridges.  
Hydrology: Mesic.  
Soils: The soils are typically a thin layer of litter and organic matter over a mixture of silt, sand, and gravel. The one pH measured is 5.4 and permafrost occurred at a depth of 25 centimeters.

Landcover class: Open mixed needleleaf / deciduous forest.

Sampled sites occur in the following subsection: Tintina Hills.

Successional stage: Early seral. This association follows fire in *Picea glauca* - *Betula papyrifera* forests or *Picea glauca* and *Picea mariana* dominated forests. The distribution of the Young *Picea glauca* - *Betula papyrifera* association, consequently, reflects the fire pattern in the Preserve.



**Vegetation**

Young *Picea mariana* and *Betula papyrifera* less than 7 meters tall codominate the tree layer. The cover of *Picea mariana* ranges from 5 to 20% and the cover of *Betula papyrifera* ranges from 15 to 25%. Other common species include *Alnus viridis* ssp. *crispa*, *Equisetum sylvaticum*, *Ledum palustre* ssp. *decumbens*, *Spiraea stevenii* and *Vaccinium vitis-idaea*. Total moss cover ranges from 55 to 90%, predominantly *Polytrichum* species and *Sphagnum* species. Lichens are uncommon.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Betula papyrifera</i>	100	20	15-25	3.1-6.1
<i>Picea mariana</i>	100	13	5-20	1.7-4.6
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	100	5	5	1.8-3.1
<i>Empetrum nigrum</i>	50	5	10	–
<i>Ledum palustre</i>	50	20	40	0.3-0.5
<i>Ledum palustre</i> ssp. <i>decumbens</i>	50	18	35	–
<i>Rosa acicularis</i>	50	1	2	–
<i>Spiraea stevenii</i>	100	4	2-5	0.6-0.9
<i>Vaccinium uliginosum</i>	50	1	1	0.8
<i>Vaccinium vitis-idaea</i>	100	11	11	–
<b>Herbaceous</b>				
<i>Calamagrostis canadensis</i>	100	2	1-2	–
<i>Equisetum sylvaticum</i>	100	14	2-25	0.3
<i>Polygonum alpinum</i>	100	2	1-2	0.6
<b>Non-vascular</b>				
<i>Cladonia</i> sp.	100	6	1-10	–
<i>Pleurozium schreberi</i>	50	10	20	–
<i>Polytrichum</i> sp.	100	13	5-20	–
<i>Sphagnum</i> sp.	100	30	10-50	–

## TALL AND LOW SHRUB PLANT ASSOCIATIONS

### *Alnus viridis* ssp. *crispa* / *Eriophorum vaginatum* Plant Association Mountain alder / Tussock cottongrass Plant Association

Plots sampled: 1.  
Rank: G?; S?  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

#### Environmental Characteristics

Distribution: Unknown.  
Patch size: Small to large and is found adjacent to boreal forest.  
Elevation (meters): 853.  
Slope (deg): 10.  
Landform position: Sideslope.  
Hydrology: Soils are mesic to wet, and standing water is common between tussocks.  
Soils: The soil profile is probably similar to the *Betula nana* / *Eriophorum vaginatum* association that consists of tussocks forming over peat and then mineral soil. Permafrost is shallow.  
Landcover class: Tall shrub.  
The sampled site occurs in the following subsection: Upper Charley Valleys: Copper Creek tussock slopes.  
Successional stage: Unknown.



#### Vegetation

This association is very similar to the *Betula nana* / *Eriophorum vaginatum* association except that the overstory includes *Alnus viridis* ssp. *crispa*. *Eriophorum vaginatum* is the dominant sedge although *Carex bigelowii* may also occur. A variety of low shrubs codominate including *Betula nana*, *Ledum palustre* ssp. *decumbens* and *Vaccinium uliginosum*. Moss cover is 69%, lichen cover is 3% and exposed mineral soil is rare.

<b>Species</b>	<b>Foliar cover (%)</b>	<b>Height</b>
<b>Trees</b>		
<i>Picea mariana</i>	3	0.9
<b>Shrubs</b>		
<i>Alnus viridis</i> ssp. <i>crispa</i>	38	0.9
<i>Betula nana</i>	41	0.9
<i>Ledum palustre</i> ssp. <i>decumbens</i>	15	<0.2
<i>Vaccinium uliginosum</i>	15	<0.2
<i>Vaccinium vitis-idaea</i>	3	<0.2
<b>Herbaceous</b>		
<i>Carex bigelowii</i>	3	<0.2
<i>Eriophorum vaginatum</i>	63	<0.2
<b>Non-vascular</b>		
Lichen	3	<0.2

***Alnus viridis* ssp. *crispa* Floodplain Plant Association**  
**Mountain alder Floodplain Plant Association**

Plots sampled: 2.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Incidental association of Yukon-Charley Rivers NP.  
Patch size: Small and often linear.  
Elevation (meters): 232 to 241.  
Slope (deg): Level.  
Landform position: Floodplains. It occurs on recently disturbed lands including ice-scoured islands, new alluvial deposits along the edge of rivers, and abandoned river channels.  
Hydrology: Mesic, although during high river flows it is nearly always inundated.  
Soils: Soils are derived from fluvial deposition and range from silt to sand to gravel to cobbles.  
Landcover class: Tall shrub.  
Sampled sites occur in the following detailed subsection: Yukon River Valley: Yukon River active floodplain.  
Successional stage: Early seral association specific to the floodplain sere.



**Vegetation**

*Alnus viridis* ssp. *crispa* dominates or codominates the overstory with *Salix glauca*, other *Salix* species or *Populus balsamifera* ssp. *balsamifera*. Their heights range up to 7 meters tall. Understory species include *Linnaea borealis*, *Picea glauca*, *Rosa acicularis* and *Viburnum edule*. The ground surface is litter or mineral soil (sand, rocks).

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	50	3	5	–
<i>Populus balsamifera</i>	50	8	15	>5
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	100	79	63-95	4.6- >5
<i>Cornus sericea</i> ssp. <i>sericea</i>	100	4	3-5	0.9
<i>Rosa acicularis</i>	100	2	1-3	0.5-0.9
<i>Salix glauca</i>	50	19	38	>5
<i>Viburnum edule</i>	100	3	2-3	0.9
<b>Herbaceous</b>				
<i>Equisetum arvense</i>	50	8	15	<0.2
<i>Linnaea borealis</i>	50	8	15	–
<b>Non-vascular</b>				
Moss	100	2	1-3	<0.2
<i>Rhytidiadelphus triquetrus</i>	50	8	15	–

***Amelanchier alnifolia* Plant Association**  
**Saskatoon serviceberry Plant Association**

Plots sampled: 1 Site (from Wesser and Devoe 1987).  
Rank: G?; S?  
Other Studies: Wesser and DeVoe 1987.

**Environmental Characteristics**

Distribution: This is an incidental association in Yukon-Charley Rivers NP.  
Patch size: Small patches.  
Elevation: Low elevation.  
Slope (deg): Steep.  
Landform position: It occurs as small patches on steep eroding south-facing river bluffs.  
Hydrology: Dry.  
Soils: Not sampled.  
Landcover class: Low shrub.  
Successional stage: Disturbance includes fire and substrate erosion.

**Vegetation**

This association is dominated by *Amelanchier alnifolia*. *Artemisia frigida*, *Calamagrostis purpurascens*, *Chamerion angustifolium* ssp. *angustifolium* and *Rosa acicularis* are common. Scattered *Populus tremuloides* are present. This association occurs as inclusions within other bluff communities. The bluffs and valley slopes are typically dominated by a few species whose dominance often shifts as one travels across a bluff. These species are *Artemisia frigida*, *Pseudoroegneria spicata* ssp. *spicata*, *Calamagrostis purpurascens*, *Juniperus communis* and *Rosa acicularis* (Roland 1990).

***Artemisia frigida* Plant Association**  
**Fringed sagebrush Plant Association**

Plots sampled: Site data from written descriptions by Roland (1990).  
Rank: G3; S3.  
Other Studies: Howenstein, Murray and Armbruster 1985; Roland 1990, Young and Racine 1976.

**Environmental Characteristics**

Distribution: Incidental association in Yukon-Charley Rivers NP.  
Patch size: Small patches.  
Elevation: Low elevation.  
Slope (deg): Up to 50.  
Landform position: It occurs as small patches on steep, rapidly eroding portions of low elevation river bluffs.  
Hydrology: Dry; aspect is typically south, but ranges from east to west.  
Soils: Mineral and rocky outcrops are common.  
Landcover class: Low shrub.  
Likely occurs in the following detailed subsections: Biederman Hills bluffs; Little Black River Hills bluffs; Ogilvie Foothills bluffs.  
Successional stage: Disturbance includes fire and substrate erosion.

**Vegetation**

This association is dominated by *Artemisia frigida* and exposed mineral soil is common. Other species include *Artemisia alaskana*, *Chenopodium album*, *Descurainia sophioides*, *Populus balsamifera* ssp. *balsamifera*, and *Rumex longifolia*. This association may dominate a bluff or simply be an inclusion within other bluff communities. The bluffs are typically dominated by a few species whose dominance often shifts as one travels across a bluff. These species are *Artemisia frigida*, *Pseudoroegneria spicata* ssp. *spicata*, *Calamagrostis purpurascens*, *Juniperus communis* and *Rosa acicularis* (Roland 1990).

***Artemisia frigida* - *Calamagrostis purpurascens* - *Pseudoroegneria spicata* ssp. *spicata* Plant Association**

**Fringed sagebrush - Purple reedgrass - Bluebunch wheatgrass Plant Association**

Plots sampled: 6 (from Wesser and Devoe 1987).  
Rank: G3; S3.  
Other Studies: Batten, Murray and Dawe 1979, Roland 1990, Wesser and DeVoe 1987.

**Environmental Characteristics**

Distribution: Incidental association in Yukon-Charley Rivers NP.  
Patch size: Small.  
Elevation: Low elevation.  
Slope (deg): 35 to 45.  
Landform position: Small patches on low elevation, steep river bluffs.  
Hydrology: Dry; aspect is typically south, but ranges from east to west.  
Soils: Soils lack an organic layer and show characteristics of grassland soils such as organic enrichment of the A horizon and soil structure development. Rocky outcrops are common.  
Landcover class: Low shrub.  
Likely occurs in the following detailed subsections: Biederman Hills bluffs; Little Black River Hills bluffs; Ogilvie Foothills bluffs.  
Successional stage: Disturbance includes fire and substrate erosion.



**Vegetation**

This association is codominated by *Artemisia frigida* and *Calamagrostis purpurascens* and/or *Pseudoroegneria spicata* ssp. *spicata*. Other species include *Galium boreale*, *Linum lewisii*, *Penstemon gormanii*, *Pulsatilla patens*, *Rosa acicularis* and *Solidago multiradiata*. Mosses and lichens grow in some bare areas. This association may dominate a bluff or simply be an inclusion within other bluff communities. The bluffs are typically dominated by a few species whose dominance often shifts as one travels across a bluff. These species are *Artemisia frigida*, *Pseudoroegneria spicata* ssp. *spicata*, *Calamagrostis purpurascens*, *Juniperus communis* and *Rosa acicularis* (Roland 1990).

***Betula nana* Plant Association**  
**Dwarf birch Plant Association**

Plots sampled: 12.  
Rank: G5; S5.  
Other Studies: Young and Racine 1976.

**Environmental Characteristics**

Distribution: Major association within Yukon-Charley Rivers NP.  
Patch size: Occurs as large patches bordering the alpine zone or as small patches within the boreal forest.  
Elevation (meters): 899 to 1,189.  
Slope (deg): 0 to 38.  
Landform position: Bedrock knobs, rounded to flat ridges, sideslopes, toeslopes, and broad valley bottoms.  
Hydrology: Mesic.  
Soils: Soils consist of a thin layer (3 to 10 centimeters) of organic matter and litter, over silt/sand, gravel or rock. The pH ranges from 5.0 to 7.2.  
Landcover class: Low shrub; Low shrub lichen.  
Sampled sites occur in the following detailed subsections: Charley Foothills; Upper Charley Valleys: Subalpine valleys; Three Fingers Subalpine Basin; Tintina Hills; Upper Charley Mountain Tundra: Barren domes; Upper Charley Mountain Tundra: Gentle vegetated ridges.  
Successional stage: This association often follows fire in *Picea mariana* forests and charred snags are common. The youngest site-age since fire is 14 years. Most sites, however, show no immediate sign of fire.



**Vegetation**

*Betula nana* dominates the sites and may form a continuous cover or a mosaic amongst other associations such as *Dryas octopetala*. Shrub height ranges up to 2.3 meters tall. Other common species include *Carex bigelowii*, *Empetrum nigrum*, *Ledum palustre* ssp. *decumbens*, *Salix pulchra*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. *Picea glauca* regeneration is common on some sites. Moss cover ranges from 9 to

95% and include *Hylocomium splendens*, *Polytrichum* species and *Sphagnum* species. Lichen cover ranges from 0 to 41% and the common lichen genera are *Cetraria* and *Cladonia*.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	42	1	1-3	<1-3.1
<i>Picea mariana</i>	8	1	15	–
<b>Shrubs</b>				
<i>Arctostaphylos rubra</i>	33	2	3-20	–
<i>Betula nana</i>	100	59	30-85	0.4-2.3
<i>Empetrum nigrum</i>	58	14	5-76	<1
<i>Ledum palustre</i>	17	1	3-13	<1
<i>Ledum palustre</i> ssp. <i>decumbens</i>	42	2	3-15	<0.2
<i>Salix pulchra</i>	50	6	3-38	0.9-1.5
<i>Vaccinium uliginosum</i>	83	7	2-15	<1
<i>Vaccinium vitis-idaea</i>	83	6	2-22	<1
<b>Herbaceous</b>				
<i>Arctagrostis</i> sp.	8	2	23	<1
<i>Carex bigelowii</i>	25	3	3-15	<0.2
<i>Carex podocarpa</i>	8	2	20	–
<i>Festuca altaica</i>	25	4	3-38	<0.2
<i>Hedysarum alpinum</i>	17	6	38	–
<i>Hierochloe alpina</i>	8	2	20	<0.2

***Betula nana* / *Carex bigelowii* Plant Association**  
**Dwarf birch / Bigelow's sedge Plant Association**

Plots sampled: 7.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Widespread association from the boreal forest zone to alpine in Yukon-Charley Rivers NP.  
Patch size: Small to large and often mosaiced with other low shrub associations.  
Elevation (meters): 213 to 1,173.  
Slope (deg): 0 to 15.  
Landform position: Relatively level valley bottoms adjacent to forests, low angle sideslopes, rounded hill tops, rounded ridges, and cirque basins.  
Hydrology: Mesic to wet. Standing water is common between tussocks. Permafrost is common.  
Soils: The soil profile includes low tussocks at high elevations to tussocks up to 0.6 meters tall at lower elevations. The tussocks form over peat and then mineral soil ranging from silt to fractured granite.  
Landcover class: Low shrub tussock.  
Sampled sites occur in the following detailed subsections: Thanksgiving Loess Plain; Upper Charley Valleys: Copper Creek tussock slopes; Upper Charley Mountain Tundra: Gentle vegetated ridges; Yukon River Valley: Wet terraces with few ponds; Yukon River Valley: Wet Terraces with thermokarst lakes.  
Successional stage: On lower elevation sites this association often follows fire in *Picea mariana* forests and charred snags are common. Most sites, however, show no immediate sign of fire.



**Vegetation**

*Betula nana* either dominates the site, or is codominant with *Empetrum nigrum*, *Ledum palustre* ssp. *decumbens*, *Salix pulchra*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. *Carex bigelowii* is the dominant sedge although *Eriophorum vaginatum* is common in some sites. The wetter sites support more sedges and the drier sites more low shrubs. Moss cover ranges from 4 to 94% and the common mosses are *Hylocomium splendens* and *Sphagnum* species. Lichen cover is low and exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea mariana</i>	29	3	1-18	0.2-2.3
<b>Shrubs</b>				
<i>Betula nana</i>	86	39	12-85	<1
<i>Chamaedaphne calyculata</i>	14	2	15	<0.2
<i>Empetrum nigrum</i>	57	3	2-15	<1
<i>Ledum groenlandicum</i>	43	2	3-5	0.2
<i>Ledum palustre</i> ssp. <i>decumbens</i>	57	8	3-22	<1
<i>Myrica gale</i>	14	2	15	–
<i>Salix arbusculoides</i>	43	3	2-15	<1
<i>Salix barclayi</i>	14	2	15	0.9
<i>Salix pulchra</i>	57	6	2-20	<1
<i>Vaccinium uliginosum</i>	57	7	8-15	<1
<i>Vaccinium vitis-idaea</i>	43	4	3-15	<1
<b>Herbaceous</b>				
<i>Carex bigelowii</i>	86	67	27-85	<1
<i>Carex spectabilis</i>	14	2	15	–
<i>Eriophorum vaginatum</i>	14	2	15	<0.2
<b>Non-vascular</b>				
<i>Hylocomium splendens</i>	71	11	5-38	<1
<i>Pleurozium schreberi</i>	29	3	3-15	<1
<i>Sphagnum</i> spp.	71	22	8-63	<1

***Betula nana* - *Ledum palustre* ssp. *decumbens* - *Vaccinium uliginosum* Plant Association**  
**Dwarf birch - Marsh Labrador tea - Bog blueberry Plant Association**

Plots sampled: 17.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Major association within Yukon-Charley Rivers NP.  
Patch size: Small patches within the boreal forest; forming medium to large patches bordering the alpine zone.  
Elevation (meters): 699 to 1,158.  
Slope (deg): 5 to 40.  
Landform position: Sideslopes, toe slopes, terraces and plateaus.  
Hydrology: Mesic  
Soils: Soils are mesic and consist of a thin layer (2 to 17 centimeters) of organic matter and litter over silt/sand, gravel or rock. The pH ranges from 4.6 to 6.5. Rocky shallow mineral soils typically occur on the steeper slopes. Burned organic layers are common in the soil profiles, and permafrost (at 7 centimeters) may occur.  
Landcover class: Low shrub.  
Sampled sites occur in the following detailed subsections: Little Black River Hills; Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Upper Charley Mountain Tundra: Gentle vegetated ridges.  
Successional stage: The association often follows fire in *Picea mariana* forests and charred snags are common. The youngest site age since fire was 2 years. Other sites show no immediate sign of fire.



**Vegetation**

*Betula nana* typically codominates with *Ledum palustre* ssp. *decumbens* and *Vaccinium uliginosum* although one of the species may have a reduced cover in some sites. Height of the dominant shrub species ranges up to 2.4 meters tall. Other common species include *Alnus viridis* ssp. *crispa*, *Empetrum nigrum* and *Salix pulchra*. Young *Picea mariana* and *Picea glauca* are common, and *Betula papyrifera* were present sporadically. In sites that had burned recently the shrub cover is typically low, and early seral

species such as *Chamerion angustifolium* ssp. *angustifolium* and *Calamagrostis canadensis* are common. Moss cover is highly variable and the common mosses are *Hylocomium splendens*, *Pleurozium* species and *Polytrichum* species. *Sphagnum* species cover ranges from 0 to 63%. Common lichen genera include *Cladonia* and *Peltigera*. Exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	47	2	1-6	>5-0.2
<i>Picea mariana</i>	41	1	1-4	0.3->3.1
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	24	2	2-30	0.5-1.8
<i>Betula nana</i>	100	34	10-85	0.2-2.4
<i>Cassiope tetragona</i>	6	2	38	<0.2
<i>Empetrum nigrum</i>	82	14	<1-63	<0.2
<i>Ledum</i> spp.	12	2	15-21	0.2
<i>Ledum palustre</i>	47	8	1-50	0.3-0.61
<i>Ledum palustre</i> ssp. <i>decumbens</i>	47	7	7-38	0.5-<0.2
<i>Salix</i> spp.	24	2	1-15	0.5-0.7
<i>Salix arbusculoides</i>	6	2	38	0.9
<i>Salix glauca</i>	29	2	2-15	0.9-1.8
<i>Salix pulchra</i>	29	2	3-15	0.5-2.3
<i>Vaccinium uliginosum</i>	100	23	2-63	>0.2-0.9
<i>Vaccinium vitis-idaea</i>	94	7	2-15	<0.2
<b>Herbaceous</b>				
Grass	41	3	3-38	0.2-0.3

***Juniperus communis* Plant Association**  
**Common juniper Plant Association**

Plots sampled: Site data from written descriptions by Roland (1990).  
Rank: G3; S3.  
Other Studies: Roland 1990, Young and Racine 1976.

**Environmental Characteristics**

Distribution: Incidental association in Yukon-Charley Rivers NP.  
Patch size: Small.  
Elevation (meters): Up to 762.  
Slope (deg): 35 to 40.  
Landform position: Steep eroding river bluffs.  
Hydrology: Dry; aspect is typically south, but ranges from east to west.  
Soils: Soils are mineral often with rocky outcrops.  
Landcover class: Low shrub.  
Likely occurs in the following detailed subsections: Biederman Hills bluffs; Little Black River Hills bluffs; Ogilvie Foothills bluffs.  
Successional stage: Disturbance includes fire and substrate erosion.

**Vegetation**

This association is codominated by *Juniperus communis* and one or all of the following: *Pseudoroegneria spicata* ssp. *spicata*, *Artemisia frigida*, *Calamagrostis purpurascens* and *Rosa acicularis* (Roland 1990). The sites are also being invaded by *Picea glauca* and *Populus balsamifera* ssp. *balsamifera*. This association occurs as inclusions within other bluff communities. The bluffs and valley slopes are typically dominated by a few species whose dominance often shifts as one travels across a bluff. These species are *Artemisia frigida*, *Pseudoroegneria spicata* ssp. *spicata*, *Calamagrostis purpurascens*, *Juniperus communis* and *Rosa acicularis*. Herbaceous species that are nearly always present but with low cover include *Galium boreale*, *Penstemon gormanii*, *Potentilla nivea*, *P. hookeriana*, *Pulsatilla patens*, *Solidago decumbens* and *S. multiradiata* (Roland 1990).

***Ledum palustre* ssp. *decumbens* Plant Association**  
**Marsh Labrador Tea Plant Association**

Plots sampled: 1  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Incidental yet widespread plant association within Yukon-Charley Rivers NP.  
Patch size: Small to moderate.  
Elevation (meters): 697.  
Slope (deg): 7.  
Landform position: Sideslopes.  
Hydrology: Permafrost and water table were not recorded.  
Soils: The soils are a 7 to 15 centimeters organic mat over silt, and the pH is 6.6.  
Landcover class: Low shrub; Low shrub lichen.  
Sampled sites occur in the following detailed subsection: Little Black River Hills.  
Successional stage: It follows fire in *Picea mariana* forests and charred snags are common.



**Vegetation**

*Ledum palustre* ssp. *decumbens* is the diagnostic species and other common species include *Betula nana*, *Equisetum sylvaticum* and *Vaccinium vitis-idaea*. Moss cover ranges up to 30% dominated by *Aulacomnium* and *Distichium* species. Lichen cover ranges up to 40% dominated by *Cladonia* species.

<b>Species</b>	<b>Foliar cover (%)</b>	<b>Height (m)</b>
<b>Trees</b>		
<i>Picea glauca</i>	5	2.1
<b>Shrubs</b>		
<i>Betula nana</i>	10	1.2
<i>Ledum palustre</i>	40	0.5
<i>Salix pulchra</i>	5	–
<i>Vaccinium uliginosum</i>	5	–
<i>Vaccinium vitis-idaea</i>	2	–
<b>Herbaceous</b>		
<i>Equisetum sylvaticum</i>	40	–
<b>Non-vascular</b>		
<i>Aulacomnium</i> sp.	5	–
<i>Cladonia</i> sp.	20	–
<i>Distichium</i> sp.	5	–
<i>Peltigera aphthosa</i>	5	–
<i>Sphagnum</i> sp.	5	–

***Ledum palustre* ssp. *decumbens* / *Eriophorum vaginatum* Plant Association**  
**Marsh Labrador Tea / Tussock cottongrass Plant Association**

Plots sampled: 21.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Widespread association from the boreal forest zone to subalpine of Yukon-Charley Rivers NP.  
Patch size: Small to large and often adjacent to low shrub and *Picea* dominated associations.  
Elevation (meters): 244 to 945.  
Slope (deg): 0 to 18.  
Landform position: Valley bottoms, toeslopes, sideslopes, and rounded ridges.  
Hydrology: Mesic to wet. Standing water is common between tussocks. Permafrost is common.  
Soils: The soil profile includes low tussocks at high elevations to tussocks up to 0.6 meters tall at lower elevations. The tussocks form over peat and then mineral soil. The one pH measured is 5.4.  
Landcover class: Low shrub tussock.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Charley Foothills; Upper Charley Valleys: Copper Creek tussock slopes; Yukon River Valley: Nation / Kandik / Bonanza valleys; Snowy Domes; Tintina Hills; Yukon River Valley: Yukon River active floodplain; Yukon River Valley: High terraces, undulating.  
Successional stage: Often follows fire in *Picea mariana* forests and charred snags are common.



**Vegetation**

*Ledum palustre* ssp. *decumbens* or *Ledum groenlandicum* nearly always dominate the sites, or codominate with *Betula nana*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. *Eriophorum vaginatum* is the dominant sedge although *Carex bigelowii* is common in some sites. Other common species include *Alnus viridis* ssp. *crispa* and *Picea mariana*. Moss cover ranges from 5 to 83% dominated primarily by *Sphagnum* species and *Hylocomium splendens*. Lichen cover is low and exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea mariana</i>	62	1	<1-5	0.3-2.3
<b>Shrubs</b>				
<i>Alnus crispa</i>	24	2	1-15	<1
<i>Betula nana</i>	81	12	3-63	<1
<i>Ledum groenlandicum</i>	24	5	3-38	<1
<i>Ledum palustre</i>	19	4	10-34	<1
<i>Ledum palustre</i> ssp. <i>decumbens</i>	71	23	15-63	<0.2
<i>Vaccinium uliginosum</i>	86	14	<1-38	<1
<i>Vaccinium vitis-idaea</i>	95	14	3-38	<1
<b>Herbaceous</b>				
<i>Carex bigelowii</i>	24	5	6-63	<1
<i>Eriophorum vaginatum</i>	100	59	18-85	<1
<i>Rubus chamaemorus</i>	52	5	2-15	<1

***Ledum palustre* ssp. *decumbens* - *Vaccinium uliginosum* Plant Association**  
**Marsh Labrador tea - Bog blueberry Plant Association**

Plots sampled: 6.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Major association of Yukon-Charley Rivers NP.  
Patch size: It typically occurs as small patches within the boreal forest to forming large patches bordering the alpine zone.  
Elevation (meters): 579 to 732.  
Slope (deg): 5 to 27.  
Landform position: Moderate to steep sideslopes, toe slopes, terraces and plateaus.  
Hydrology: Mesic.  
Soils: The one soil pedon recorded was a thin layer (3 centimeters) of organic matter and litter over silt/sand, gravel or rock, and permafrost at 17 centimeters.  
Landcover class: Low shrub.  
Sampled sites occur in the following detailed subsections: Little Black River Hills; Ogilvie Foothills; Upper Charley Mountain Tundra: Gentle vegetated ridges.  
Successional stage: The association often follows fire in *Picea mariana* forests and charred snags are common. Other sites show no immediate sign of fire.



**Vegetation**

*Ledum palustre* ssp. *decumbens* codominates with *Vaccinium uliginosum*. Height of the dominant shrub species ranges up to 1 meter tall. Other common species include *Alnus viridis* ssp. *crispa*, *Betula nana* and *Vaccinium vitis-idaea*. Young *Betula papyrifera*, *Picea glauca*, and *Picea mariana* were present sporadically. In sites that had burned recently the shrub cover is typically low and early seral species such as *Calamagrostis canadensis* may be common. Common mosses are *Hylocomium splendens*, *Polytrichum* species and *Sphagnum* species. Lichen cover ranges up to 24% and the common lichens are *Cetraria* and *Cladonia*. Exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	7	1	1-6	0.3-4
<i>Picea mariana</i>	24	2	1-6	0.3
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	67	5	1-18	0.9-3.7
<i>Betula nana</i>	67	2	<1-5	0.3-0.9
<i>Empetrum nigrum</i>	50	2	<1-7	<1
<i>Ledum palustre</i>	83	14	13-25	<1
<i>Ledum palustre</i> ssp. <i>decumbens</i>	33	7	3-38	<1
<i>Spiraea stevenii</i>	67	2	1-5	0.3-0.6
<i>Vaccinium uliginosum</i>	83	13	17-30	<1
<i>Vaccinium vitis-idaea</i>	100	18	8-38	<1
<b>Herbaceous</b>				
<i>Calamagrostis canadensis</i>	33	2	5-8	0.2
<i>Calamagrostis purpurascens</i>	17	5	30	
<i>Equisetum sylvaticum</i>	33	5	1-20	0.1-0.3
<i>Eriophorum vaginatum</i>	17	3	18	<1

***Ledum groenlandicum* Plant Association**  
**Bog Labrador tea Plant Association**

Plots sampled: 3.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Incidental yet widespread plant association in Yukon-Charley Rivers NP.  
Patch size: Small.  
Elevation (meters): 387 to 579.  
Slope (deg): Relatively level.  
Landform position: Rolling hills.  
Hydrology: Mesic.  
Soils: Soils are a 10 to 20 centimeters organic mat over silt and sand. The water table is shallow (15 to 20 centimeters), pH is 5.6 to 6.0, and permafrost occurs at 23 to 36 centimeters.  
Landcover class: Low shrub.  
Sampled sites occur in the following detailed subsections: Thanksgiving Loess Plain; Tintina Hills.  
Successional stage: It follows fire in *Picea mariana* forests and charred snags are common.



**Vegetation**

*Ledum groenlandicum* is the diagnostic species and other common species include *Calamagrostis canadensis*, *Carex podocarpa*, *Eriophorum vaginatum* and *Rosa acicularis*. Shrub height ranges up to 1 meter, and moss cover ranges up to 35%. Lichen cover is low.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea mariana</i>	33	1	3	<1
<b>Shrubs</b>				
<i>Ledum groenlandicum</i>	100	21	15-28	<1
<i>Ledum palustre</i>	33	1	3	<1
<i>Rosa acicularis</i>	33	5	15	0.5
<i>Vaccinium vitis-idaea</i>	100	2	1-3	<1
<b>Herbaceous</b>				
<i>Calamagrostis canadensis</i>	67	17	20-30	0.3
<i>Carex podocarpa</i>	33	3	10	-
<i>Eriophorum vaginatum</i>	67	4	5-7	<1
<i>Polystichum</i> sp.	33	2	5	-
<i>Rubus chamaemorus</i>	33	2	7	<1
<b>Non-vascular</b>				
<i>Cladonia</i> sp.	33	2	5	<1
Moss	67	9	7-20	-
<i>Polytrichum</i> sp.	33	3	8	<1
<i>Sphagnum</i> sp.	33	9	26	<1

***Myrica gale* Plant Association**  
**Sweetgale Plant Association**

This plant association is not well defined and needs additional field information.

Plots sampled: 2.  
Rank: G?; S?  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Minor yet widespread association of Yukon-Charley Rivers NP.  
Patch size: Small.  
Elevation (meters): 209 to 368.  
Slope (deg): Level.  
Landform position: Tussocky ground and on pond edges.  
Hydrology: Wet, and standing water is common between tussocks. Permafrost is common.  
Soils: The soil profile includes tussocks up to 0.6 meter tall.  
Landcover class: Low shrub; Low shrub tussock.  
Sampled sites occur in the following detailed subsection: Ogilvie Foothills.  
Successional stage: Unknown.



**Vegetation**

*Myrica gale* cover ranges from 30 to 60% and dominates the low shrub layer. The understory is dominated by either *Carex aquatilis* or *C. lugens*. Other species include *Betula nana*, *Dasiphora floribunda*, *Eleocharis uniglumis*, *Ledum palustre* ssp. *decumbens* and *Vaccinium uliginosum*.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Shrubs</b>				
<i>Betula nana</i>	50	10	20	0.6
<i>Chamaedaphne calyculata</i>	50	3	5	0.4
<i>Dasiphora floribunda</i>	50	3	5	0.3
<i>Ledum palustre</i> ssp. <i>decumbens</i>	50	4	8	0.3
<i>Myrica gale</i>	100	45	30-60	0.3-0.6
<i>Vaccinium uliginosum</i>	50	2	3	0.3
<b>Herbaceous</b>				
<i>Carex aquatilis</i>	50	38	75	0.6
<i>Carex lugens</i>	50	40	80	0.5
<i>Eleocharis uniglumis</i>	50	3	5	0.2

***Salix alaxensis* Floodplain Plant Association**  
**Feltleaf willow Floodplain Plant Association**

Plots sampled: 2.  
Rank: G5; S5.  
Other Studies: Farjon and Bogaers 1985, Young and Racine 1976.

**Environmental Characteristics**

Distribution: Incidental association of Yukon-Charley Rivers NP.  
Patch size: Small and often linear.  
Elevation (meters): 212 to 213.  
Slope (deg): Level.  
Landform position: Floodplains. It occurs on recently disturbed lands including ice-scoured islands, new alluvial deposits along the edge of rivers, and abandoned river channels.  
Hydrology: The sites are typically well drained although during high river flows they are nearly always inundated.  
Soils: Soils are derived from fluvial deposition and range from silt to sand to gravel to cobbles.  
Landcover class: Tall shrub.  
Sampled sites occur in the following detailed subsections: Yukon River Valley: Nation / Kandik / Bonanza valleys; Yukon River Valley: Yukon River active floodplain.  
Successional stage: This is an early seral association specific to the floodplain sere.



## Vegetation

*Salix alaxensis* dominates or codominates the overstory with *Alnus viridis* ssp. *crispa*. Their heights range up to 2 meters tall. Understory species include *Artemisia tilesii*, *Calamagrostis canadensis* and *Solidago canadensis* var. *saliborosa*. The ground surface is litter or mineral soil (sand, rocks).

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	50	8	15	–
<i>Salix alaxensis</i>	100	50	15-85	1.8
<b>Herbaceous</b>				
<i>Argentina egedii</i> ssp. <i>egedii</i>	50	8	15	<0.3
<i>Artemisia tilesii</i>	50	5	10	–
<i>Calamagrostis canadensis</i>	50	3	5	0.6
<i>Equisetum</i> sp.	50	8	15	–
<i>Eurybia sibirica</i>	50	3	5	0.3
<i>Hedysarum</i> sp.	50	3	5	0.9
<i>Solidago canadensis</i> var. <i>salebrosa</i>	50	3	5	0.3

***Salix alaxensis* Sideslope Plant Association**  
**Feltleaf willow Sideslope Plant Association**

Plots sampled: 1.  
Rank: G?; S?  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Incidental association in Yukon-Charley Rivers NP.  
Patch size: Small.  
Elevation (meters): 853.  
Slope (deg): 23.  
Landform position: Sideslope.  
Hydrology: Mesic.  
Soils: Not measured.  
Landcover class: Tall shrub.  
The sampled site occurs in the Ogilvie Foothills detailed subsection.  
Successional stage: Seral to *Betula papyrifera*.



**Vegetation**

*Salix alaxensis* dominates the overstory and ranges to over 2 meters in height. *Betula papyrifera* is also common. Ericaceous shrubs dominate the understory.

<b>Species</b>	<b>Foliar cover (%)</b>	<b>Height (m)</b>
<b>Trees</b>		
<i>Betula papyrifera</i>	18	2.4
<b>Shrubs</b>		
<i>Betula nana</i>	53	1.6
<i>Ledum groenlandicum</i>	15	<0.2
<i>Salix alaxensis</i>	41	2.4
<i>Vaccinium uliginosum</i>	15	<0.2
<i>Vaccinium vitis-idaea</i>	15	<0.2
<b>Herbaceous</b>		
<i>Festuca altaica</i>	15	<0.2
<i>Luzula rufescens</i>	15	<0.2
<b>Non-vascular</b>		
Moss	38	<0.2

***Salix pulchra* - *Betula nana* Plant Association**  
**Tealeaf willow - Dwarf birch Plant Association**

Plots sampled: 5.  
Rank: G5; S5.  
Other Studies: Buckley and Libby 1957.

**Environmental Characteristics**

Distribution: Incidental yet widespread association found just below the alpine zone in the Preserve.  
Patch size: Small to large.  
Elevation (meters): 382 to 1,189.  
Slope (deg): 3 to 11.  
Landform position: Terraces, mountain valleys, sideslopes, and ridge tops.  
Hydrology: Mesic, typically supporting tussocks.  
Soils: The one soil pedon sampled is 20 centimeters of organic matter over silt, and permafrost occurs at 28 centimeters.  
Landcover class: Low shrub.  
Sampled sites occur in the following detailed subsections: Little Black River Hills; Thanksgiving Loess Plain; Upper Charley Mountain Tundra: Gentle vegetated ridges.  
Successional stage: Unknown.



**Vegetation**

*Salix pulchra* and *Betula nana* are the dominant shrub species and range in height from 0.3 to over 2.3 meters. Other common species include *Calamagrostis canadensis*, *Carex bigelowii*, *Empetrum nigrum*, *Eriophorum vaginatum*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. Moss cover ranges up to 96% and is dominated by *Hylocomium splendens*. Lichen cover is low.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	40	3	5-9	0.3-4
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	20	2	10	2.1
<i>Betula nana</i>	100	41	15-66	0.6-2.3
<i>Empetrum nigrum</i>	60	11	3-38	<0.2
<i>Ledum groenlandicum</i>	40	3	3-10	<0.2-0.3
<i>Salix alaxensis</i>	20	4	20	0.6
<i>Salix pulchra</i>	100	41	30-63	0.6-2.3
<i>Vaccinium uliginosum</i>	60	8	1-38	<0.2
<i>Vaccinium vitis-idaea</i>	60	9	2-38	<0.2
<b>Herbaceous</b>				
<i>Calamagrostis canadensis</i>	80	29	5-63	<0.2-0.3
<i>Carex bigelowii</i>	60	21	30-38	<0.2
<i>Eriophorum vaginatum</i>	20	8	40	0.3
<i>Petasites frigidus</i> var. <i>nivalis</i>	20	8	38	–
<b>Non-vascular</b>				
<i>Hylocomium</i> sp.	20	8	38	–
<i>Hylocomium splendens</i>	20	13	63	<0.2
Moss	20	20	98	–
<i>Polytrichum</i> spp.	40	4	3-15	<0.2
<i>Sphagnum</i> sp.	20	8	38	–

***Vaccinium uliginosum* / *Carex bigelowii* Plant Association**  
**Bog blueberry / Bigelow's sedge Plant Association**

Plots sampled: 4.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Widespread association from the boreal forest zone to alpine of Yukon-Charley Rivers NP.  
Patch size: Small to large and often mosaiced with other low shrub associations.  
Elevation (meters): 213 to 1,006.  
Slope (deg): 0 to 18.  
Landform position: Valley bottoms adjacent to forests, low angle sideslopes, rounded hill tops, rounded ridges and cirque basins.  
Hydrology: Not sampled but likely mesic to wet.  
Soils: Not sampled, but probably tussocks forming over peat and then mineral soil ranging from silt to rocky. Permafrost is probably present.  
Landcover class: Low shrub tussock.  
Sampled sites occur in the following detailed subsections: Upper Charley Mountain Tundra: Gentle vegetated ridges.  
Successional stage: Unknown.



**Vegetation**

*Vaccinium uliginosum* either dominates the site, or is codominant with *Alnus viridis* ssp. *crispa*, *Betula nana*, *Ledum palustre* ssp. *decumbens*, *Salix pulchra* and *Vaccinium vitis-idaea*. *Carex bigelowii* is the dominant sedge although *Eriophorum vaginatum* is common in some sites. Moss cover ranges from 68 to 90% and the common mosses are *Hylocomium splendens* and *Sphagnum* species. Lichen cover is low and exposed mineral soil is rare.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	50	2	3-6	0.9-2.3
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	75	5	3-15	0.9-2.3
<i>Betula nana</i>	75	14	3-38	0.9
<i>Ledum</i> sp.	25	4	15	–
<i>Ledum palustre</i> ssp. <i>decumbens</i>	50	19	38	<0.2
<i>Salix barclayi</i>	25	4	15	0.9
<i>Salix pulchra</i>	50	8	15	0.9
<i>Salix reticulata</i>	25	4	15	–
<i>Vaccinium uliginosum</i>	100	42	15-63	<0.2
<i>Vaccinium vitis-idaea</i>	50	8	15	<0.2
<b>Herbaceous</b>				
<i>Carex bigelowii</i>	100	45	15-63	<0.2
<i>Eriophorum vaginatum</i>	50	8	15	<0.2
<b>Non-vascular</b>				
Feathermoss	25	4	15	–
<i>Hylocomium</i> sp.	25	4	15	–
<i>Hylocomium splendens</i>	25	16	63	<0.2
Lichen	50	2	3	<0.2
Moss	50	37	63-85	<0.2
<i>Pleurozium schreberi</i>	25	4	15	<0.2
<i>Sphagnum</i> spp.	50	20	15-63	<0.2

## DWARF SHRUB PLANT ASSOCIATIONS

### *Arctostaphylos rubra* Plant Association Bearberry Plant Association

Plots sampled: 1.  
 Rank: G5; S5.  
 Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

#### Environmental Characteristics

Distribution: Distribution of this association is not clear but appears to be an incidental type in subalpine and alpine areas of Yukon-Charley Rivers NP.  
 Patch size: Small and mosaiced with other dwarf shrub associations.  
 Elevation (meters): 791.  
 Slope (deg): 0 to 10.  
 Landform position: Sideslopes, ridges.  
 Hydrology: Mesic.  
 Soils: Thin layer (3 centimeters) of organic matter over mineral soil.  
 Landcover class: Dwarf shrub.  
 The sampled site occurs in the Little Black River Hills detailed subsection.  
 Successional stage: Unknown.



#### Vegetation

*Arctostaphylos rubra* occurs in large discontinuous patches mosaiced with bare ground (50%), lichen (30%), and other dwarf shrubs. Other common species are *Empetrum nigrum* and *Vaccinium vitis-idaea*, and lichens include species within the genera *Bryoria*, *Cetraria*, *Cladonia* and *Umbilicaria*.

Species	Foliar cover (%)	Height (m)
<b>Shrubs</b>		
<i>Arctostaphylos rubra</i>	40	–
<i>Empetrum nigrum</i>	10	–
<i>Vaccinium vitis-idaea</i>	2	–
<b>Non-vascular</b>		
<i>Bryoria</i> sp.	2	–
<i>Cetraria</i> sp.	5	–
<i>Cladonia</i> sp.	2	–
<i>Thamnolia</i> sp.	2	–
<i>Umbilicaria</i> sp.	15	–

***Betula nana* - *Vaccinium uliginosum* - *Carex bigelowii* Plant Association**  
**Dwarf birch - Bog blueberry - Bigelow's sedge Plant Association**

Plots sampled: 12.  
Rank: G5; S5.  
Other Studies: Buckley and Libby 1957.

**Environmental Characteristics**

Distribution: Widespread association in subalpine and alpine areas of Yukon-Charley Rivers NP.  
Patch size: Small to large and often mosaiced with other dwarf shrub or herbaceous associations.  
Elevation (meters): 823 to 1,341.  
Slope (deg): 5 to 23.  
Landform position: Rounded hill tops, rounded ridges, slopes, solifluction slopes and cirque basins.  
Hydrology: Wet; standing water is common between the tussocks.  
Soils: The one soil profile recorded was low tussocks (to 20 centimeters tall) over mesic to wet peat.  
Landcover class: Dwarf shrub.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Charley Foothills; Upper Charley Valleys: Subalpine valleys; Upper Charley Mountain Tundra: Barren domes; Upper Charley Mountain Tundra: Gentle vegetated ridges.  
Successional stage: Unknown.



**Vegetation**

A variety of dwarf shrubs may codominate in this association including *Betula nana*, *Cassiope tetragona*, *Empetrum nigrum*, *Ledum palustre* ssp. *decumbens*, *Salix pulchra*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. *Carex bigelowii* is the dominant sedge although *Eriophorum vaginatum* is common in some sites. The wetter sites support more sedges and the drier sites more dwarf shrubs. *Sphagnum* species is the dominant moss ranging up to 63% cover, and other mosses include *Pleurozium schreberi* and *Hylocomium splendens*. The cover of lichen and bare ground is typically sparse.

Species	Cosntancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Shrubs</b>				
<i>Alnus viridis</i> ssp. <i>crispa</i>	17	3	15	–
<i>Arctostaphylos rubra</i>	25	2	3-15	<0.2
<i>Betula nana</i>	100	20	3-41	<0.2-0.9
<i>Cassiope tetragona</i>	33	7	15-38	<0.2
<i>Empetrum nigrum</i>	83	11	3-38	<0.2
<i>Ledum palustre</i> ssp. <i>decumbens</i>	92	20	3-63	<0.2
<i>Salix pulchra</i>	67	6	3-15	0.85
<i>Vaccinium uliginosum</i>	100	26	5-38	<0.2-0.9
<i>Vaccinium vitis-idaea</i>	100	15	3-38	<0.2
<b>Herbaceous</b>				
<i>Carex</i> sp.	8	2	20	–
<i>Carex bigelowii</i>	100	60	20-85	<0.2
<i>Eriophorum vaginatum</i>	67	5	3-15	<0.2
<i>Festuca</i> sp.	8	3	41	<0.2
<b>Non-vascular</b>				
<i>Cladina</i> spp.	33	2	2-15	<0.2
<i>Hylocomium splendens</i>	33	8	15-38	<0.2
Lichen	42	4	3-15	<0.2
Moss	58	38	2-85	<0.2
<i>Pleurozium schreberi</i>	25	4	15	<0.2
<i>Sphagnum</i> spp.	67	27	15-63	<0.2

***Cassiope tetragona* Plant Association**  
**White arctic mountain heather Plant Association**

Plots sampled: 3.  
 Rank: G5; S5.  
 Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Widespread association in alpine areas of Yukon-Charley Rivers NP.  
 Patch size: Small and mosaiced with other dwarf shrub or herbaceous associations.  
 Elevation (meters): 1,202 to 1,665.  
 Slope (deg): 6 to 45.  
 Landform position: Steep faces of alpine terraces.  
 Hydrology: Mesic.  
 Soils: The soils consist of a thin layer (3 to 6 centimeters) of organic matter over mineral soil.  
 Landcover class: Dwarf shrub.  
 Sampled sites occur in the following detailed subsections: Ogilvie Lime / Dolostone Mountains; Upper Charley Mountain Tundra: Barren domes; Upper Charley Mountain Tundra: High and rugged.  
 Successional stage: Unknown.



**Vegetation**

*Cassiope tetragona* dominates the plant association. Other species include *Diapensia lapponica*, *Dryas octopetala* and *Hierochloe alpina*.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Shrubs</b>				
<i>Cassiope tetragona</i>	100	43	28-70	<0.1
<i>Diapensia lapponica</i>	66	4	1-12	<0.1
<i>Dryas octopetala</i>	66	4	5-7	<0.1
<b>Herbaceous</b>				
<i>Hierochloe alpina</i>	66	2	3-4	<0.1
<b>Non-vascular</b>				
Crustose lichen	66	5	4-10	–
Foliose lichen	66	4	1-10	<0.1
Moss	33	1	3	<0.1

***Dryas integrifolia* Plant Association**  
**Entireleaf mountain-avens Plant Association**

Plots sampled: 4.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Minor association in alpine areas of Yukon-Charley Rivers NP.  
Patch size: Small to large.  
Elevation (meters): 1,250 to 1,341.  
Slope (deg): Ranges up to 30.  
Landform position: Alpine valley bottoms, cirque basins, sideslopes, and ridges.  
Hydrology: Dry to mesic.  
Soils: The soils (not sampled) are likely a thin organic layer over bedrock or mineral soil. Exposed mineral soil and rock is common.  
Landcover class: Dwarf shrub.  
Sampled sites occur in the following detailed subsections: Upper Charley Mountain Tundra: Barren domes; Ogilvie Lime / Dolostone Mountains; Upper Charley Mountain Tundra.  
Successional stage: Unknown.



**Vegetation**

*Dryas integrifolia* dominates or codominates with other dwarf shrubs such as *Cassiope tetragona*, *Empetrum nigrum*, *Ledum palustre* ssp. *decumbens*, *Salix arctica*, *Salix reticulata* and *Vaccinium uliginosum*. Moss cover ranges from 10 to 38%, predominantly *Hylocomium splendens*, *Polytrichum* species and *Rhacomitrium* species. Lichen cover ranges from 10 to 63%.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Shrubs</b>				
<i>Arctostaphylos alpina</i>	25	4	15	< 0.2
<i>Arctostaphylos rubra</i>	25	2	7	0.1
<i>Betula nana</i>	25	4	15	< 0.2
<i>Cassiope tetragona</i>	75	10	1-38	0.1- <0.2
<i>Diapensia</i> sp.	25	2	7	0.1
<i>Dryas integrifolia</i> ssp. <i>integrifolia</i>	25	3	10.2	0.1
<i>Dryas integrifolia</i>	75	44	21-93	0.1- <0.2
<i>Empetrum nigrum</i>	50	5	1-18	0.1- <0.2
<i>Ledum palustre</i> ssp. <i>decumbens</i>	50	4	1-15	0.1- <0.2
<i>Salix arctica</i>	25	4	15	<0.2
<i>Salix ovalifolia</i>	25	4	15	<0.2
<i>Salix reticulata</i>	50	4	13-15	0.1- <0.2
<i>Vaccinium uliginosum</i>	75	5	1-15	<0.2
<b>Herbaceous</b>				
<i>Carex</i> spp.	50	4	3-13	0.1
<i>Festuca</i> sp.	25	4	15	< 0.2
<b>Non-vascular</b>				
<i>Cetraria cucullata</i>	50	5	1-30	0.1
Lichen	75	23	13-63	0.1- <0.2
<i>Masonhalea richardsonii</i>	50	6	1-5	0.1
Moss	75	13	<1-38	0.1- <0.2
<i>Pleurozium</i> sp.	25	4	17	0.1
<i>Tomentypnum</i> sp.	25	5	20	0.1

***Dryas octopetala* Plant Association**  
**Eightpetal mountain-avens Plant Association**

Plots sampled: 2.  
 Rank: G5; S5.  
 Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Minor yet widespread association in alpine areas of Yukon-Charley Rivers NP.  
 Patch size: Small to large.  
 Elevation (meters): 1,342.  
 Slope (deg): 0 to 45.  
 Landform position: Alpine valley bottoms, cirque basins, sideslopes, and ridges.  
 Hydrology: Dry to mesic.  
 Soils: The soil profile is less than 3 centimeters of organic matter over bedrock or mineral soil such as silt, sand, and gravel.  
 Landcover class: Dwarf shrub.  
 Sampled sites occur in the following detailed subsection: Ogilvie Lime / Dolostone Mountains.  
 Successional stage: Unknown.



**Vegetation**

*Dryas octopetala* dominates the plant association. Species diversity is low.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Shrubs</b>				
<i>Arctostaphylos alpina</i>	50	2	4	<0.1
<i>Cassiope tetragona</i>	50	1	2	<0.1
<i>Dryas octopetala</i>	100	48	26-70	<0.1
<i>Vaccinium uliginosum</i>	50	1	2	<0.1
<b>Herbaceous</b>				
<i>Carex</i> sp.	50	2	4	0.2
<i>Potentilla villosa</i>	50	1	2	<0.1
<b>Non-vascular</b>				
<i>Cetraria nivalis</i>	50	1	2	<0.1
Lichen	50	12	12	<0.1
Moss	50	1	1	<0.1

***Dryas octopetala* / *Carex stylosa* Plant Association**  
**Eightpetal mountain-avens / Variegated sedge Plant Association**

Plots sampled: 1.  
Rank: G?; S?  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: The distribution of the plant association is not clear but appears to be an incidental type in alpine areas of Yukon-Charley Rivers NP.  
Patch size: Small.  
Elevation (meters): 1,280.  
Slope (deg): 10.  
Landform position: Alpine.  
Hydrology: Mesic.  
Soils: Not sampled.  
Landcover class: Dwarf shrub  
The sampled site occurs in the Upper Charley Mountain Tundra: Gentle vegetated ridges detailed subsection.  
Successional stage: Unknown.



**Vegetation**

This is a mosaic of slightly moister sites dominated by *Carex* species and dryer sites dominated by dwarf shrubs. *Dryas octopetala* dominates or codominates the dwarf shrub layer, and the cover of *Carex stylosa* is greater than 20%. Other species include *Carex scirpoidea*, *Empetrum nigrum*, *Salix arctica* and *Salix reticulata*.

<b>Species</b>	<b>Foliar cover (%)</b>	<b>Height (m)</b>
<b>Shrubs</b>		
<i>Cassiope tetragona</i>	3	<0.2
<i>Dryas octopetala</i>	38	<0.2
<i>Empetrum nigrum</i>	3	<0.2
<i>Salix arctica</i>	15	<0.2
<i>Salix pulchra</i>	3	<0.2
<i>Salix reticulata</i>	15	<0.2
<i>Vaccinium uliginosum</i>	3	<0.2
<b>Herbaceous</b>		
<i>Carex scirpoidea</i>	15	<0.2
<i>Carex stylosa</i>	38	<0.2
<b>Non-vascular</b>		
<i>Aulacomnium</i> sp.	15	<0.2
<i>Cetraria cucullata</i>	3	<0.2
<i>Rhytidiadelphus</i> sp.	3	<0.2

***Dryas octopetala* - *Cassiope tetragona* Plant Association**  
**Eightpetal mountain-avens - White arctic mountain heather Plant Association**

Plots sampled: 6.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Major and widespread association in alpine areas of Yukon-Charley Rivers NP.  
Patch size: Small to large.  
Elevation (meters): 1,052 to 1,280.  
Slope (deg): 0 to 25.  
Landform position: Alpine valley bottoms, cirque basins, sideslopes, and ridges.  
Hydrology: Dry to mesic.  
Soils: The soils (not sampled) are likely a thin organic layer over bedrock or mineral soil.  
Exposed mineral soil and rock is common.  
Landcover class: Dwarf shrub.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Upper Charley Mountain Tundra: Barren domes; Upper Charley Mountain Tundra: Gentle vegetated ridges.  
Successional stage: Unknown.



**Vegetation**

*Dryas octopetala* codominates with other dwarf shrubs such as *Cassiope tetragona*, *Empetrum nigrum*, *Salix arctica* and *Vaccinium uliginosum*. Common moss species and genera include *Hylocomium splendens*, *Polytrichum* and *Rhacomitrium*. Lichen cover ranges from 1 to 25% and includes the genera *Cladina*, *Cetraria*, and *Stereocaulon*.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Shrubs</b>				
<i>Betula nana</i>	50	6	15	<0.2-0.9
<i>Cassiope tetragona</i>	67	9	10-15	<0.2
<i>Diapensia lapponica</i>	50	3	2-15	<0.2
<i>Dryas octopetala</i>	100	33	8-63	<0.2
<i>Empetrum nigrum</i>	33	3	3-15	<0.2
<i>Salix arctica</i>	33	3	3-15	<0.2
<i>Salix myrtillofolia</i>	17	3	15	<0.2
<i>Salix ovalifolia</i>	33	11	3-63	—
<i>Vaccinium uliginosum</i>	33	11	3-63	<0.2
<i>Vaccinium vitis-idaea</i>	67	2	1-3	<0.2
<b>Herbaceous</b>				
<i>Carex gmelinii</i>	17	3	15	—
<i>Festuca altaica</i>	17	11	63	—
<i>Dodecatheon jeffreyi</i>	17	3	15	—
<i>Lupinus arcticus</i>	33	3	3-15	<0.2
<i>Lycopodium</i> sp.	17	3	15	—
<i>Poa arctica</i>	33	3	3-15	<0.2
<b>Non-vascular</b>				
<i>Dicranum</i> spp.	33	2	3-10	<0.2
<i>Hylocomium</i> spp.	50	10	5-38	<0.2
Lichen	67	13	<1-38	<0.2
Moss	33	5	15	<0.2
<i>Polytrichum</i> spp.	33	2	1-9	0.1
<i>Rhytidiadelphus</i> sp.	17	3	15	—

***Empetrum nigrum* - *Vaccinium vitis-idaea* Plant Association**  
**Crowberry - Lingonberry Plant Association**

Plots sampled: 10.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Widespread association in alpine areas of Yukon-Charley Rivers NP.  
Patch size: Small to large.  
Elevation (meters): 1,128 to 1,328.  
Slope (deg): Ranges up to 23.  
Landform position: Alpine valley bottoms, cirque basins, sideslopes, and ridges.  
Hydrology: Dry to mesic.  
Soils: The soil is a thin layer of organic matter/roots/litter over silt, sand, gravel or rock.  
The single pH measured was 5.6.  
Landcover class: Dwarf shrub.  
Sampled sites occur in the following detailed subsections: Three Fingers Subalpine Basin, Upper Charley Mountain Tundra: Gentle vegetated ridges; Upper Charley Mountain Tundra: Barren domes.  
Successional stage: Unknown.



**Vegetation**

Dominance in this association is variable but it is typically codominated by *Empetrum nigrum* with *Betula nana*, *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and/or *Vaccinium vitis-idaea*. Moss cover ranges from 6 to 80%, predominantly *Aulacomnium palustre*, *Hylocomium splendens*, *Pleurozium schreberi* and *Polytrichum* species. Lichen cover ranges from 0 to 43% and includes species from the genera *Cetraria*, *Cladina*, and *Cladonia*.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea mariana</i>	50	1	<1-4	0.1-0.9
<b>Shrubs</b>				
<i>Arctostaphylos alpina</i>	40	6	1-38	<0.2
<i>Betula nana</i>	70	8	1-17	0.1-0.9
<i>Cassiope tetragona</i>	40	5	3-38	<0.2
<i>Diapensia lapponica</i>	40	3	1-20	0.1
<i>Dryas integrifolia</i>	20	2	3-15	<0.2
<i>Empetrum nigrum</i>	90	19	5-38	<0.2
<i>Ledum palustre</i>	50	2	<1-8	0.1-0.3
<i>Ledum palustre</i> ssp. <i>decumbens</i>	60	6	<1-23	<0.2
<i>Loiseleuria procumbens</i>	30	5	1-38	<0.2
<i>Salix pulchra</i>	20	2	1-15	–
<i>Vaccinium uliginosum</i>	80	13	3-38	<0.2
<i>Vaccinium vitis-idaea</i>	80	10	6-18	<0.2
<b>Herbaceous</b>				
<i>Carex atratiformis</i>	10	2	15	–
<i>Hedysarum alpinum</i>	20	2	<1-15	0.1

***Ledum palustre* ssp. *decumbens* - *Vaccinium uliginosum* - *Eriophorum vaginatum* Plant Association  
Marsh Labrador Tea - Lingonberry - Tussock cottongrass Plant Association**

Plots sampled: 9.

Rank: G5; S5.

Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Widespread association in meadows of the boreal forest zone up to the alpine zone of Yukon-Charley Rivers NP.

Patch size: Small to large and often mosaiced with other dwarf shrub or herbaceous associations.

Elevation (meters): 716 to 914.

Slope (deg): 2 to 10.

Landform position: Rounded hill tops, rounded ridges, valley bottoms and meadows within the boreal forest.

Hydrology: Soils are wet with standing water commonly found between tussocks.

Soils: Tussocks 10 to 30 centimeters tall are common (up to 51 centimeters).

Landcover class: Dwarf shrub; Tussock tundra.

Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Charley Foothills; Upper Charley Valleys: Copper Creek tussock slopes; Snowy Domes; Upper Charley Valleys: Subalpine valleys; Tintina Hills.

Successional stage: Unknown.



**Vegetation**

A variety of dwarf shrubs may codominate the association including *Betula nana*, *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. *Eriophorum vaginatum* is the dominant sedge although *Carex bigelowii* is common in some sites. The dominant moss is *Sphagnum* species. Scattered *Picea mariana* may also occur.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea mariana</i>	22	2	3-15	0.9
<b>Shrubs</b>				
<i>Betula</i> spp.	22	2	3-15	–
<i>Betula nana</i>	78	6	3-15	<0.2-0.9
<i>Empetrum nigrum</i>	33	2	3-15	<0.2
<i>Ledum</i> sp.	11	4	38	–
<i>Ledum palustre</i> ssp. <i>decumbens</i>	89	26	15-38	<0.2
<i>Vaccinium uliginosum</i>	100	21	3-38	<0.2-0.9
<i>Vaccinium vitis-idaea</i>	89	15	3-38	<0.2
<b>Herbaceous</b>				
<i>Carex</i> spp.	22	2	3-15	<0.2
<i>Carex bigelowii</i>	33	9	3-63	<0.2
<i>Eriophorum vaginatum</i>	100	75	38-85	<0.2
<b>Non-vascular</b>				
<i>Cetraria</i> spp.	33	9	3-63	<0.2
Lichen	33	15	38-63	<0.2
Moss	22	16	63-85	–
<i>Sphagnum</i> spp.	78	49	38-85	<0.2

***Salix pulchra* Plant Association**  
**Tealeaf willow Plant Association**

Plots sampled: 1.  
 Rank: G5; S5.  
 Other Studies: Buckley and Libby 1957.

**Environmental Characteristics**

Distribution: Incidental yet widespread plant association within the alpine zone of Yukon-Charley Rivers NP.  
 Patch size: Moderate and it bordered other alpine associations.  
 Elevation (meters): 1,407.  
 Slope (deg): 0 to 10.  
 Landform position: Alpine cirque basin.  
 Hydrology: Mesic.  
 Soils: Soil is a thin layer of moss and organic matter over 25 centimeters of silt, sand, and gravel (glacial till) over bedrock.  
 Landcover class: Dwarf shrub.  
 The sampled site occurs in the Upper Charley Mountain Tundra: Barren domes detailed subsection.  
 Successional stage: Unknown.

**Vegetation**

Dwarf *Salix pulchra* is the dominant species, and other common species include *Carex bigelowii*, *Dryas octopetala*, *Empetrum nigrum* and *Festuca altaica*. Common mosses include *Hylocomium splendens* and *Sphagnum* species.

Species	Foliar cover (%)	Height
<b>Shrubs</b>		
<i>Dryas octopetala</i>	10	<0.3
<i>Empetrum nigrum</i>	2	<0.3
<i>Salix arctica</i>	2	<0.3
<i>Salix pulchra</i>	40	0.2
<i>Vaccinium uliginosum</i>	3	<0.3
<b>Herbaceous</b>		
<i>Carex bigelowii</i>	2	0.2
<i>Festuca altaica</i>	10	0.3
<b>Non-vascular</b>		
<i>Hylocomium splendens</i>	20	<0.3
Moss	40	<0.3
<i>Sphagnum</i> sp.	20	<0.3

## HERBACEOUS PLANT ASSOCIATIONS

### *Artemisia alaskana* Plant Association Alaska wormwood Plant Association

Plots sampled: 1 site (from Wesser and Devoe 1987).  
Rank: G?; S?  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

#### Environmental Characteristics

Distribution: Incidental association in Yukon-Charley Rivers NP.  
Patch size: Small.  
Elevation: Low.  
Slope (deg): Steep.  
Landform position: Steep eroding south-facing river bluffs.  
Hydrology: Dry.  
Soils: Soils are dry often with rocky outcrops.  
Landcover class: Dry herbaceous.  
Likely occurs in the following detailed subsections: Biederman Hills bluffs; Little Black River Hills bluffs; Ogilvie Foothills bluffs.  
Successional stage: Disturbance includes fire and substrate erosion.

#### Vegetation

This association is codominated by *Artemisia alaskana* and *Cryptantha shacklettiana*. *Artemisia frigida*, *Bupleurum triradiatum* and *Galium boreale* also occur. It occurs as inclusions within other bluff communities. The bluffs and valley slopes are typically dominated by a few species whose dominance often shifts as one travels across a bluff. These species are *Artemisia frigida*, *Pseudoroegneria spicata* ssp. *spicata*, *Calamagrostis purpurascens*, *Juniperus communis* and *Rosa acicularis* (Roland 1990).

***Bromus inermis* var. *arcticus* Plant Association**  
**Pumpelly's brome Plant Association**

Plots sampled: 2.  
Rank: G3; S3.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Incidental association that occurs on dry valley sideslopes of Yukon-Charley Rivers NP.  
Patch size: Small.  
Elevation (meters): 396 to 488.  
Slope (deg): 42 to 50.  
Landform position: Sideslopes.  
Hydrology: Dry; the aspect is typically south-facing, but ranges from east to west.  
Soils: Not sampled.  
Landcover class: Dry herbaceous.  
Sampled sites occur in the following detailed subsection: Ogilvie Foothills.  
Successional stage: This is an early seral association that occurs 3 to 16 years after fire in sites seral to *Picea glauca* or *Populus tremuloides*.



**Vegetation**

The most common species is *Bromus inermis* var. *arcticus*, although its total cover is typically less than 25%. Other common or codominant species include *Arctagrostis latifolia*, *Chamerion angustifolium* ssp. *angustifolium*, *Equisetum scirpoides*, *Galium trifidum* and *Lupinus arcticus*. Seedling and sapling *Betula papyrifera* and *Populus tremuloides* are common, and *Picea glauca* and *Populus balsamifera* ssp. *balsamifera* also occur. The moss *Aulacomnium* species is common.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Shrub</b>				
<i>Rosa acicularis</i>	100	3	2-3	<1
<b>Herbaceous</b>				
<i>Arctagrostis latifolia</i>	100	9	4-14	<1
<i>Bromus inermis</i> var. <i>arcticus</i>	100	13	12-14	<1
<i>Chamerion angustifolium</i> ssp. <i>angustifolium</i>	100	9	5-12	<1
<i>Equisetum scirpoides</i>	100	4	1-8	<1
<i>Galium trifidum</i>	100	3	2-5	<1
<i>Lupinus arcticus</i>	50	2	10	<1
<i>Mertensia paniculata</i>	100	4	2-5	<1
<b>Non-vascular</b>				
<i>Aulacomnium</i> sp.	100	23	9-37	<1
<i>Peltigera</i> sp.	100	3	2-5	<1
<i>Polytrichum</i> sp.	50	3	6	<1

***Calamagrostis canadensis* Plant Association**  
**Bluejoint Grass Plant Association**

Plots sampled: 5.  
 Rank: G5; S5.  
 Other Studies: Batten, Murray and Dawe 1979, Buckley and Libby 1957, Farjon and Bogaers 1985, Young and Racine 1976.

**Environmental Characteristics**

Distribution: Incidental association in Yukon-Charley Rivers NP.  
 Patch size: Small to moderate.  
 Elevation (meters): 773.  
 Slope (deg): Level to moderate.  
 Landform position: Sideslopes, valley bottom and rounded ridge.  
 Hydrology: Mesic to wet.  
 Soils: Not sampled.  
 Landcover class: Dry herbaceous.  
 Sampled sites occur in the following detailed subsection: Upper Charley Mountain Tundra: Gentle vegetated ridges.  
 Successional stage: This is an early seral association that follows fire in sites seral to *Picea glauca* or *Picea mariana*.

**Vegetation**

Cover may be sparse in recently burned sites. *Calamagrostis canadensis* cover ranges from 9 to 20% but has 100% constancy. *Chamerion angustifolium* ssp. *angustifolium* occurs in most sites and its cover ranges up to 9%. Other species include *Ledum palustre* ssp. *decumbens*, *Rosa acicularis*, *Rubus chamaemorus* and *Vaccinium vitis-idaea*. *Picea mariana* or *Picea glauca* snags killed by fire are common.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	40	1	1-5	0.1-2.4
<b>Shrubs</b>				
<i>Betula nana</i>	40	2	3-8	1.5
<i>Ledum palustre</i>	80	1	<1-5	0.1-0.2
<i>Rosa acicularis</i>	80	1	<1-3	0.1-0.7
<i>Salix glauca</i>	20	1	5	1.5
<i>Vaccinium vitis-idaea</i>	100	1	<1-1	0.1
<b>Herbaceous</b>				
<i>Calamagrostis canadensis</i>	100	13	9-20	0.2-1.2
<i>Chamerion angustifolium</i> ssp. <i>angustifolium</i>	80	5	3-9	0.3-0.5
<i>Cornus canadensis</i>	40	1	<1-4	0.1
<i>Polygonum alpinum</i>	20	1	4	0.3-0.5
<i>Rubus chamaemorus</i>	60	1	<1-4	0.1
<b>Non-vascular</b>				
<i>Dicranum</i> sp.	20	7	33	0.1
Liverwort	20	3	13	0.1
<i>Polytrichum</i> spp.	80	10	1-44	0.1
<i>Sphagnum</i> spp.	40	3	1-13	0.1

***Calamagrostis purpurascens* Plant Association**  
**Purple reedgrass Plant Association**

Plots sampled: Site data from written descriptions by Roland (1990).  
Rank: G3; S3.  
Other Studies: Howenstein, Murray and Armbruster 1985, Roland 1990.

**Environmental Characteristics**

Distribution: Incidental association in Yukon-Charley Rivers NP.  
Patch size: Small.  
Elevation (meters): 259 to 762.  
Slope (deg): Steep.  
Landform position: River bluffs and dry valley sideslopes.  
Hydrology: Dry to mesic; aspect is typically south-facing, but ranges from east to west.  
Soils: Soils are mineral and show some enrichment of the A horizon with organic matter.  
Landcover class: Dry herbaceous.  
Successional stage: Disturbance includes fire and soil erosion although erosion is limited in this type.

**Vegetation**

The most common species in this association is *Calamagrostis purpurascens* although its total cover is typically less than 35% (Roland 1990). Additional species include *Populus tremuloides* seedlings, *Pseudoroegneria spicata* ssp. *spicata*, *Arenaria capillaris*, *Artemisia frigida*, *Buplurum triradiatum*, *Carex supina*, *Galium boreale*, *Minuartia yukonensis*, *Potentilla nivea* and *Pulsatilla patens*. Mosses and lichens grow in some bare areas.

This association may dominate a bluff or simply be an inclusion within other bluff communities. The bluffs and valley slopes are typically dominated by a few species whose dominance often shifts as one travels across a bluff. These species are *Artemisia frigida*, *Pseudoroegneria spicata* ssp. *spicata*, *Calamagrostis purpurascens*, *Juniperus communis* and *Rosa acicularis*. Herbaceous species that are nearly always present but with low cover include *Galium boreale*, *Penstemon gormanii*, *Potentilla nivea*, *P. hookeriana*, *Solidago decumbens* and *S. multiradiata* (Roland 1990).

**Carex aquatilis Plant Association**  
**Water Sedge Plant Association**

Plots sampled: 4.  
 Rank: G5; S5.  
 Other Studies: Farjon and Bogaers 1985; Roland 1990.

**Environmental Characteristics**

Distribution: Incidental association in Yukon-Charley Rivers NP.  
 Patch size: Small-patches or stringers on the edge of rivers, wet meadows and ponds.  
 Elevation (meters): 315 to 520.  
 Slope (deg): Level.  
 Landform position: Rolling hills, terraces or floodplains.  
 Hydrology: Wet.  
 Soils: The soil is saturated silt and sand and the pH ranges from 6.4 to 7.4.  
 Landcover class: Wet sedge.  
 Sampled sites occur in the following detailed subsections: Ogilvie Foothills; Hard Luck Lowland; Thanksgiving Loess Plain.  
 Successional stage: Unknown.



**Vegetation**

*Carex aquatilis* dominates the sites but other species are common including *Calamagrostis canadensis*, *Carex rostrata* and *Eriophorum* species.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Herbaceous</b>				
<i>Calamagrostis canadensis</i>	50	15	30	0.8
<i>Carex aquatilis</i>	100	66	40-90	0.5-0.8
<i>Carex rostrata</i>	25	4	15	0.5
<i>Comarum palustre</i>	25	1	5	0.1
<i>Eriophorum</i> sp.	25	3	10	0.3
<i>Juncus</i> sp.	25	1	5	0.2
<i>Poa pratensis</i> ssp. <i>alpigena</i>	25	1	5	0.3

***Carex bigelowii* Plant Association**  
**Bigelow's sedge Plant Association**

Plots sampled: 2.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Widespread association found in the alpine and subalpine zone of Yukon-Charley Rivers NP.  
Patch size: Small to large and may form a mosaic with dwarf shrub associations.  
Elevation (meters): 936 to 1,887.  
Slope (deg): 0 to 5.  
Landform position: Rounded ridges.  
Hydrology: Mesic.  
Soils: The soils are a thin layer (3 to 6 centimeters) of organic matter over bedrock or silt, sand, and gravel. Polygonal ground was present at higher elevations.  
Landcover class: Tussock tundra lichen.  
Sampled sites occur in the following detailed subsections: Upper Charley Mountain Tundra: Barren domes; Upper Charley Mountain Tundra: High and rugged; Upper Charley Mountain Tundra: Gentle vegetated ridges.  
Successional stage: Unknown.



**Vegetation**

*Carex bigelowii* dominates or codominates the association. Other species include *Arctostaphylos alpina*, *Betula nana*, *Empetrum nigrum*, *Luzula confusa* and *Vaccinium uliginosum*. Exposed rock is common on higher elevation sites.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Shrubs</b>				
<i>Arctostaphylos alpina</i>	50	3	5	–
<i>Betula nana</i>	50	3	5	0.3
<i>Empetrum nigrum</i>	50	2	3	–
<i>Salix pulchra</i>	50	2	3	0.2
<i>Salix reticulata</i>	50	2	3	–
<i>Vaccinium uliginosum</i>	50	3	5	–
<b>Herbaceous</b>				
<i>Carex bigelowii</i>	100	33	65	<0.1-0.3
<i>Luzula confusa</i>	50	5	10	–
<b>Non-vascular</b>				
Lichen	100	30	20-40	–
Moss	50	2	3	–

***Carex rostrata* Plant Association**  
**Beaked sedge Plant Association**

Plots sampled: 1.  
 Rank: G5; S5.  
 Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Incidental association in Yukon-Charley Rivers NP.  
 Patch size: Small.  
 Elevation: Low.  
 Slope (deg): Level.  
 Landform position: Slough on an active floodplain.  
 Hydrology: Wet sites often with standing water.  
 Soils: The soil in the one site sampled is saturated silt and sand with a pH of 7.7.  
 Landcover class: Wet sedge.  
 The sampled site occurs in the Yukon River Valley: Yukon River active floodplain detailed subsection.  
 Successional stage: Unknown.



**Vegetation**

*Carex rostrata* is the dominant species and species diversity is low.

Species	Foliar cover (%)	Height (m)
<b>Shrubs</b>		
<i>Salix alaxensis</i>	2	0.9
<i>Salix arbusculoides</i>	2	0.9
<b>Herbaceous</b>		
<i>Carex rostrata</i>	90	—
<i>Comarum palustre</i>	2	—
<i>Cornus sericea</i> ssp. <i>sericea</i>	2	—
<i>Eleocharis</i> sp.	5	—
<i>Poa</i> sp.	15	—
<i>Potamogeton gramineus</i>	2	—

***Chamerion angustifolium* ssp. *angustifolium* Plant Association**  
**Fireweed Plant Association**

Plots sampled: 1.  
 Rank: G5; S5.  
 Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Incidental association that occurs on valley sideslopes in Yukon-Charley Rivers NP.  
 Patch size: Small to moderate.  
 Elevation (meters): 658.  
 Slope (deg): 22.  
 Landform position: Sideslopes.  
 Hydrology: Mesic.  
 Soils: The soil in the one site sampled is an organic mat 25 centimeters thick over rock. The pH is 6.3 and permafrost was not encountered.  
 Landcover class: Dry herbaceous.  
 The sampled site occurs in the Ogilvie Foothills detailed subsection.  
 Successional stage: This is an early seral association that occurs after fire in sites seral to *Picea glauca* or *Picea mariana*.



**Vegetation**

Cover may be sparse in recently burned sites. In the one site sampled, *Chamerion angustifolium* ssp. *angustifolium* cover is 40%, and other species include *Calamagrostis canadensis*, *Festuca altaica*, *Mertensia paniculata* and *Salix glauca*. Moss and lichen cover is low. *Picea mariana* or *Picea glauca* snags killed by fire are common.

Species	Foliar cover (%)	Height (m)
<b>Shrubs</b>		
<i>Arctostaphylos rubra</i>	5	–
<i>Ledum palustre</i>	2	–
<i>Salix glauca</i>	5	1.4
<b>Herbaceous</b>		
<i>Calamagrostis canadensis</i>	15	–
<i>Chamerion angustifolium</i> ssp. <i>angustifolium</i>	40	–
<i>Festuca altaica</i>	15	0.8
<i>Mertensia paniculata</i>	5	–
<i>Papaver</i> sp.	2	–
<b>Non-vascular</b>		
<i>Ceratodon purpureus</i>	5	–
<i>Marchantia</i> sp.	5	–

***Eriophorum vaginatum* Plant Association**  
**Tussock cottongrass Plant Association**

Plots sampled: 5.  
Rank: G5; S5.  
Other Studies: This association has not been previously described in Yukon-Charley Rivers NP.

**Environmental Characteristics**

Distribution: Widespread association in Yukon-Charley Rivers NP.  
Patch size: Small to large.  
Elevation (meters): 747 to 884.  
Slope (deg): Slopes are rarely level but typically do not exceed 10°.  
Landform position: Low-angle valley and mountain slopes, toe slopes, and rounded ridges.  
Hydrology: Some water was present between tussocks.  
Soils: Tussocks dominate the sites and range up to 51 centimeters tall, and permafrost occurred in all sites.  
Landcover class: Tussock tundra.  
Sampled sites occur in the following detailed subsections: Upper Charley Valleys: Beverly / Copper / East Fork mountain slopes; Upper Charley Valleys: Copper Creek tussock slopes.  
Successional stage: Unknown.



**Vegetation**

This type is dominated by *Eriophorum vaginatum* but other species are common. Common species include *Betula nana*, *Carex bigelowii*, *Ledum palustre* ssp. *decumbens*, *Vaccinium uliginosum* and *Vaccinium vitis-idaea*. *Sphagnum* species cover is typically above 50% occurring between tussocks and on raised areas.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Shrubs</b>				
<i>Betula nana</i>	100	3	3	<0.2-0.9
<i>Empetrum nigrum</i>	60	2	3	<0.2
<i>Ledum palustre</i> ssp. <i>decumbens</i>	100	13	3-15	<0.2
<i>Vaccinium uliginosum</i>	100	6	3-15	<0.2-0.9
<i>Vaccinium vitis-idaea</i>	80	2	3	<0.2
<b>Herbaceous</b>				
<i>Carex bigelowii</i>	60	7	3-15	<0.2
<i>Eriophorum vaginatum</i>	100	85	85	<0.2
<b>Non-vascular</b>				
Lichen	40	1	3	<0.2
Moss	20	3	15	<0.2
<i>Sphagnum</i> sp.	80	50	38-85	<0.2

***Festuca altaica* - *Calamagrostis* species Plant Association**  
**Altai fescue - Reedgrass species Plant Association**

Plots sampled: 2; plus description from Roland (1990).  
Rank: G3; S3.  
Other Studies: Batten, Murray and Dawe 1979.

**Environmental Characteristics**

Distribution: Incidental association found in Yukon-Charley Rivers NP.  
Patch size: Small to large.  
Elevation (meters): 549 to 1,067.  
Slope (deg): Steep.  
Landform position: River bluffs and steep dry valley sideslopes.  
Hydrology: Dry; the aspect is typically south-facing, but ranges from east to west.  
Soils: Not sampled.  
Landcover class: Dry herbaceous.  
Sampled sites occur in the following detailed subsections: Ogilvie Foothills bluffs; Ogilvie Lime / Dolostone Mountains.  
Successional stage: Disturbance includes fire and soil erosion.



**Vegetation**

The most common species in this association are *Festuca altaica*, *Calamagrostis purpurascens* and *C. canadensis* although each species' cover is typically less than 35% (Roland 1990). Additional species include *Polygonum alpinum*, *Pulsatilla patens* and *Zygadenus elegans*. Moss and lichen cover may be high.

Species	Constancy	Foliar cover (%)		Height range (m)
		Average	Range	
<b>Trees</b>				
<i>Picea glauca</i>	50	2	3	4
<b>Shrubs</b>				
<i>Juniperus communis</i>	50	8	15	<0.2
<i>Spiraea stevenii</i>	50	8	15	<0.2
<b>Herbaceous</b>				
<i>Artemisia arctica</i>	100	3	3	<0.2-0.9
<i>Calamagrostis canadensis</i>	50	19	38	0.9
<i>Calamagrostis purpurascens</i>	50	8	15	0.9
<i>Chamerion angustifolium</i> ssp. <i>angustifolium</i>	50	8	15	<0.2
<i>Douglasia alaskana</i>	50	8	15	<0.2
<i>Festuca altaica</i>	100	27	15-38	0.9
<i>Zigadenus elegans</i>	50	19	38	<0.2
<b>Non-vascular</b>				
<i>Hypnum crista-castrensis</i>	50	19	38	<0.2
Lichen	100	51	38-63	<0.2
Moss	100	39	15-63	<0.2

## RELATIONSHIP OF LANDCOVER CLASSES AND PLANT ASSOCIATIONS TO DETAILED ECOLOGICAL SUBSECTIONS

Some general patterns are evident when contrasting the Ducks Unlimited (1998) landcover classes and this publication's plant associations with the detailed ecological subsections described by Swanson (2001). What follows is a general discussion contrasting these relationships based on both personal observation and Table 11 that gives the total landcover class acreage by detailed subsection.

To evaluate the general relationship of landcover classes and associations to subsections it was necessary to group the detailed subsections into logical aggregations. As stated by Swanson (2001), certain detailed subsections are good candidates for aggregation and are (the full names of the ecological subsections are given in Table 10):

- Floodplains and low terraces: YV1, YV2, YV3, YV4, YV6, YV7
- Lowlands: HL, KT, TL, YV5
- Hills: BH1, CF, LB1, OF1, TH
- Riverside bluffs: BH2, LB2, OF2
- Mountain valleys: UC1, UC2, UC3, UC4, TF
- Mountain tundra: MT1, MT2, MT3, SD

These groupings do not imply that, for example, MT2 and MT3 are nearly identical, but only that a given plant association or landcover class mapped in MT2 is likely to be similar to that class where mapped in MT3. For example, "Low Shrub - Tussock Tundra" occurs in both MT2 and MT3 and is probably fairly similar in both subsections, but it is much more widespread in MT3.

For the grouping "floodplains and low terraces" the vegetation on the active floodplain includes highly disturbed areas with little vegetation, floodplain shrubs, *Populus balsamifera* ssp. *balsamifera* and *Picea glauca* forest, and *Picea mariana* forest (Table 11). Several plant associations occur only on the active floodplains but not on the higher terraces including:

- *Populus balsamifera* / *Alnus viridis* ssp. *crispa* Floodplain
- Young *Populus balsamifera* Floodplain
- *Picea glauca* / *Alnus viridis* ssp. *crispa* Floodplain
- *Alnus viridis* ssp. *crispa* Floodplain
- *Salix alaxensis* Floodplain

On the higher terraces the vegetation tends to be woodland *Picea mariana* forest, tussock associations such as *Vaccinium uliginosum* / *Carex bigelowii* and *Eriophorum vaginatum*, and/or the wet sedge associations *Carex aquatilis* and *Carex rostrata*. Plant associations and landcover classes that occur on the higher terraces also occur on other level landscapes or north-facing slopes within the Preserve. The wet sedge landcover class, however, has a high fidelity for the "floodplains and low terraces" grouping.

For the "lowlands" grouping, the topography is level to gently sloping surfaces that may be dissected by small streams. The lithology is Cretaceous argillite, sandstone, mudstone, and conglomerate, probably loess-covered, and old terraces. The landcover is mostly tussock wetlands, *Picea mariana* woodland or forest, and *Betula papyrifera* forest on steeper slopes, especially on burns (Table 11). The plant associations and landcover classes that occur in the "lowlands" grouping occur commonly in other subsections such as on the Yukon River Valley Tatonduk Valley detailed subsection. The associations

include most of the *Picea mariana* associations, plus tussock associations such as *Vaccinium uliginosum* / *Carex bigelowii* and *Eriophorum vaginatum*. No plant association or landcover class is found exclusively in the “lowlands” grouping.

Table 10. List of subsections and detailed subsections (Swanson 2001).

<b>Symbol</b>	<b>Subsection</b>	<b>Detailed subsection</b>
BH1	Biederman Hills	Biederman Hills
BH2		Biederman Hills bluffs
CF	Charley Foothills	Charley Foothills
HL	Hard Luck Lowland	Hard Luck Lowland
KT	Kandik Tableland	Kandik Tableland
LB1	Little Black River Hills	Little Black River Hills
LB2		Little Black River Hills bluffs
OF1	Ogilvie Foothills	Ogilvie Foothills
OF2		Ogilvie Foothills bluffs
OM	Ogilvie Lime/Dolostone Mountains	Ogilvie Lime/Dolostone Mountains
SD	Snowy Domes	Snowy Domes
TL	Thanksgiving Loess Plain	Thanksgiving Loess Plain
TF	Three Fingers Subalpine Basin	Three Fingers Subalpine Basin
TH	Tintina Hills	Tintina Hills
MT1	Upper Charley Mountain Tundra	High and rugged
MT2		Barren domes
MT3		Gentle vegetated ridges
UC1	Upper Charley Valleys	Subalpine valleys
UC2		Beverly/Copper/East Fork mountain slopes
UC3		Copper Creek tussock slopes
UC4		Upper Charley plain
YV1	Yukon River Valley	Yukon River active floodplain
YV2		Wet terraces with oxbows
YV3		Wet terraces with few ponds
YV4		Wet terraces with thermokarst lakes
YV5		High terraces, undulating
YV6		Nation/Kandik/Bonanza valleys
YV7		Tatonduk Valley
YV8		Yukon River

Table 11. Summary of Landcover Class by detailed ecological subsection (acres) (Ducks Unlimited 1998, Swanson 2001). The full names of the ecological subsections are given in Table 10.

Detailed Subsection	Open			Woodland			Closed Deciduous Forest	Open Deciduous Forest	Closed Mixed Forest	Open Mixed Forest	Tall Shrub	Low Shrub	Low Lichen	Low Shrub Tussock
	Closed Needleleaf Forest	Open Needleleaf Forest	Open Needleleaf Lichen Forest	Woodland Needleleaf Forest	Woodland Needleleaf Lichen Forest	Woodland Needleleaf Moss Forest								
BH1	602	54,593	315	5,545	167	47	22,316	1,174	21,656	7,247	0	1,333	0	924
BH2	22	1,253	0	214	5	2	1,740	521	717	418	0	364	0	207
CF	890	119,175	2	58,456	646	161	8,015	955	9,554	11,354	1,212	11,174	0	9,372
HL	216	26,603	0	5,941	724	24	813	114	967	1,520	0	936	0	1,251
KT	195	10,973	0	3,954	16	110	4,642	155	4,676	2,357	0	470	0	385
LB1	135	20,882	65	2,938	9	6	1,091	683	1,075	1,075	0	611	0	176
LB2	98	4,890	0	686	16	22	1,555	1,066	1,567	1,059	0	474	0	312
MT1	0	16	0	46	2	0	0	0	0	3	17	696	0	319
MT2	8	8,692	0	12,533	9	10	53	0	135	1,034	6,779	69,353	0	14,848
MT3	28	29,257	0	39,147	155	34	429	52	324	2,838	12,750	95,325	4	24,152
OF1	3,148	131,590	0	16,304	479	89	34,587	6,547	29,405	16,115	1,794	8,986	0	5,401
OF2	54	1,327	0	289	5	5	2,298	822	1,349	570	94	651	0	371
OM	330	17,548	0	3,769	177	21	365	74	1,035	1,576	1,076	5,343	0	1,436
SD	0	185	0	444	1	0	12	22	4	65	37	404	0	342
TF	1	16,737	0	9,804	0	1	0	0	2	99	1,145	25,123	0	10,152
TH	506	89,695	0	46,025	258	126	37,027	5,042	27,157	42,525	72	17,417	0	13,830
TL	932	36,784	0	16,205	2	176	6,037	126	5,982	2,855	0	1,183	0	2,245
UC1	28	8,818	0	13,914	0	0	33	2	38	655	1,355	9,822	19	5,712
UC2	246	74,515	0	74,995	153	2	248	0	176	2,376	4,062	23,834	7	18,408
UC3	77	4,465	0	5,047	6	0	6	0	12	70	0	765	108	6,609
UC4	56	2,996	0	2,381	0	0	3	0	11	53	4	513	0	1,667
YV1	698	6,896	0	759	9	42	8,034	29	4,389	939	0	80	0	141
YV2	108	4,281	0	3,352	85	18	346	14	521	318	0	936	0	804
YV3	1,067	26,364	0	23,574	278	493	2,747	232	3,084	3,921	0	5,380	0	11,178
YV4	11	920	0	870	8	37	27	6	52	57	0	175	0	185
YV5	2,122	29,347	2	5,833	37	24	4,153	88	5,747	2,316	0	516	0	850
YV6	918	23,550	0	17,060	498	334	3,584	243	5,251	3,923	0	3,658	0	5,449
YV7	129	2,279	0	131	4	1	342	4	610	133	0	13	0	8
YV8	26	703	0	121	1	16	1,081	14	250	118	0	21	0	56
Total Area	12,650	755,333	385	370,337	3,752	1,802	141,584	17,988	125,746	107,589	30,398	285,555	138	136,788
Percent	0.5%	30.0%	0.0%	14.7%	0.1%	0.1%	5.6%	0.7%	5.0%	4.3%	1.2%	11.4%	0.0%	5.4%

**Table 11. (continued)**

Detailed Subsection	Tussock															Detailed Subsection Total Area	Detailed Subsection Percent
	Dwarf Shrub	Wet Sedge	Dry Herb	Tussock Tundra	Tundra Lichen	Aquatic Bed	Sparse Veg	Clear Water	Turbid Water	Snow	Rock and Gravel	Clouds	Cloud Shadow	Terrain Shadow	Fire		
BH1	139	0	12	109	0	0	503	20	150	0	133	0	0	9,172	7,917	134,074	5.3%
BH2	0	0	0	17	0	0	803	9	83	0	108	0	0	171	321	6,974	0.3%
CF	652	0	25	2,464	0	0	1,494	585	0	1	291	0	0	18,717	25,441	280,637	11.2%
HL	0	0	0	14	0	0	19	4	0	0	5	0	0	622	0	39,774	1.6%
KT	0	1	0	22	0	0	10	3	25	0	8	0	0	624	0	28,626	1.1%
LB1	0	0	2	4	0	0	21	0	0	0	1	0	0	730	12,624	42,127	1.7%
LB2	0	0	0	11	0	0	398	31	448	1	72	0	0	1,090	2,845	16,643	0.7%
MT1	2,920	0	89	28	0	0	3,404	22	0	2,721	15,373	0	0	4,480	0	30,137	1.2%
MT2	70,970	0	8,638	1,712	0	0	42,902	189	0	4,141	62,445	0	0	16,261	29	320,739	12.8%
MT3	27,967	0	3,631	5,493	6	0	7,208	6	0	1	3,445	0	0	4,197	471	256,921	10.2%
OF1	155	0	26	228	0	0	1,634	182	122	6	300	412	300	33,078	0	290,887	11.6%
OF2	0	0	0	38	0	0	614	1	68	0	58	0	0	171	0	8,786	0.3%
OM	2,787	0	798	38	0	0	4,240	0	0	0	1,523	290	28	8,782	2	51,238	2.0%
SD	66	0	76	70	385	0	8	0	0	0	0	0	0	0	627	2,749	0.1%
TF	1,083	0	73	1,083	0	0	365	16	0	0	143	0	3	64	0	65,896	2.6%
TH	26	1	0	685	0	0	310	20	60	0	30	0	0	5,101	0	285,913	11.4%
TL	17	0	1	312	0	0	95	167	21	0	12	0	0	729	0	73,884	2.9%
UC1	733	0	101	1,598	0	0	557	5	0	0	354	0	0	358	0	44,101	1.8%
UC2	1,296	0	46	7,620	1	0	1,466	410	0	0	507	0	0	1,487	0	211,857	8.4%
UC3	20	0	0	5,874	89	0	98	291	0	0	93	0	0	106	0	23,738	0.9%
UC4	17	0	0	745	0	0	187	203	0	0	164	0	0	120	0	9,120	0.4%
YV1	0	14	0	14	0	0	2,008	388	5,222	0	1,004	14	0	97	4	30,781	1.2%
YV2	0	88	0	4	0	1	27	726	57	0	10	0	0	9	0	11,706	0.5%
YV3	0	162	0	260	0	7	225	702	570	0	129	0	0	212	292	80,879	3.2%
YV4	0	8	0	1	0	14	3	989	8	0	5	0	0	2	46	3,426	0.1%
YV5	1	6	0	54	0	0	79	242	181	0	35	0	38	393	991	53,054	2.1%
YV6	2	27	0	858	0	0	426	2,012	49	0	166	0	2	1,018	765	69,794	2.8%
YV7	0	0	0	1	0	0	77	254	0	0	60	0	0	108	0	4,152	0.2%
YV8	0	0	0	9	0	0	1,241	87	31,030	0	994	15	0	44	0	35,826	1.4%
Total Area	108,852	307	13,520	29,365	481	22	70,422	7,566	38,094	6,872	87,471	731	371	107,945	52,375	2,514,436	
Percent	4.3%	0.0%	0.5%	1.2%	0.0%	0.0%	2.8%	0.3%	1.5%	0.3%	3.5%	0.0%	0.0%	4.3%	2.1%		100.0%

For the “hills” grouping of detailed subsections, the topography is moderately steep forested hills and low mountains composed of granitic, metamorphic or sedimentary rocks. The subsections are located just below tree line. The landcover classes are mostly *Betula papyrifera* forest in burns and mixed *Betula papyrifera* and *Picea glauca* forest where not burned (Table 11). *Picea mariana* forest occurs on some north-slopes and lower slopes. Sparse vegetation, sedge tussocks and low shrubs occur on high ridges or summits. The plant associations and landcover classes that occur in the “hills” grouping occur commonly in other subsections such as in the Upper Charley Valleys - Beverly / Copper / East Fork mountain slopes detailed subsection. These associations include most of the *Betula papyrifera*, *Picea glauca*, and *Picea mariana* associations, plus tussock associations such as *Vaccinium uliginosum* / *Carex bigelowii* and *Eriophorum vaginatum*. No plant association or landcover class is found exclusively in the “hills” grouping.

For the “riverside bluffs” grouping, the topography is steep south-facing (sometimes west-facing) bluffs composed of sedimentary and volcanic rocks. The landcover is *Betula papyrifera* and *Populus tremuloides* forest, mixed with *Picea* on the moister sites such as ravines. Many of the steep exposed sites support dry herbaceous and low shrub landcover classes plus sparsely vegetated areas, scree, and exposed rock (Table 11). The low shrub and herbaceous plant associations tend to have a high fidelity to the “riverside bluffs” grouping and include:

- *Amelanchier alnifolia*
- *Artemisia alaskana*
- *Artemisia frigida*
- *Artemisia frigida* - *Calamagrostis purpurascens* - *Pseudoroegneria spicata* ssp. *spicata*
- *Bromus inermis* var. *arcticus*
- *Calamagrostis purpurascens*
- *Festuca altaica* / *Calamagrostis* species
- *Juniperus communis*

The landcover classes that these plant associations occur within (low shrub and herbaceous), however, are common to other subsections. The *Picea glauca*, *Betula papyrifera* and *Populus tremuloides* plant associations and landcover classes of “riverside bluffs” are also commonly found in other detailed subsections.

For the “mountain valleys” grouping of detailed subsections, the topography includes a variety of gently sloping valley bottoms and lower slopes surrounded by higher mountains. It is located just below tree line. The landcover classes are mostly sedge tussocks and low shrubs in valley bottoms, with riparian brush along streams (Table 11). The valley slopes support sparse *Picea* forests and tall shrubs on the steep slopes of ravines. The plant associations and landcover classes that occur in the “mountain valleys” grouping occur commonly in other subsections such as the Biederman Hills. These associations include most of the *Betula papyrifera*, *Picea glauca*, and *Picea mariana* associations, plus tussock associations such as *Vaccinium uliginosum* / *Carex bigelowii* and *Eriophorum vaginatum*. No plant association or landcover class is found exclusively in the “mountain valleys” grouping.

For the “mountain tundra” grouping of detailed subsections, the topography is steep mountains with cliffs and sharp ridge lines and cirques, or rounded mountains. The lithology is granite and schist. The subsections occur above tree line. The landcover classes are mostly sparsely vegetated with considerable rock rubble and bedrock exposed at the surface in cliffs (Table 11). Herbaceous plants or dwarf shrubs

occur on gentle slopes, and low or dwarf shrub and herbaceous plants occur in valleys. Tussock tundra may also occur. The dwarf shrub and herbaceous landcover classes and many of their respective plant associations have a high fidelity to the “mountain tundra” grouping. The plant associations include:

- *Arctostaphylos rubra*
- *Betula nana* - *Vaccinium uliginosum* - *Carex bigelowii*
- *Carex bigelowii*
- *Cassiope tetragona*
- *Dryas integrifolia*
- *Dryas octopetala*
- *Dryas octopetala* / *Carex stylosa*
- *Dryas octopetala* - *Cassiope tetragona*
- *Empetrum nigrum* - *Vaccinium vitis-idaea*
- *Ledum palustre* ssp. *decumbens* - *Vaccinium uliginosum* - *Eriophorum vaginatum*
- *Salix pulchra*

*Dryas octopetala* may be more common in the regions with limestone and dolostone, such as the Ogilvie lime/dolostone mountains subsection.

The rock and gravel landcover class and sparse vegetation class also occur predominantly in the “mountain tundra” grouping of subsections. The low shrub and tussock tundra landcover classes and their respective plant associations are common in other subsections of Yukon-Charley Rivers NP.

**Appendix 1. List of plant associations found within the Ducks Unlimited (1998) landcover classes. Several associations occur in more than one landcover class.**

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**Closed Needleleaf Forest**

*Picea glauca* / *Rosa acicularis*

**Open Needleleaf Forest**

Dwarf *Picea mariana* / *Betula nana* - *Carex bigelowii*  
Dwarf *Picea mariana* / *Betula nana* - *Eriophorum vaginatum*  
Dwarf *Picea mariana* / *Eriophorum vaginatum*  
Dwarf *Picea mariana* / *Ledum palustre* ssp. *decumbens*  
Dwarf *Picea mariana* / *Vaccinium vitis-idaea*  
*Picea glauca* - *Picea mariana* / *Vaccinium uliginosum*  
*Picea glauca* / *Alnus viridis* ssp. *crispa* Floodplain  
*Picea glauca* / *Betula nana* / *Carex bigelowii*  
*Picea glauca* / *Rosa acicularis*  
*Picea glauca* / *Vaccinium uliginosum*  
*Picea mariana* / *Alnus viridis* ssp. *crispa*  
*Picea mariana* / *Betula nana*  
*Picea mariana* / *Ledum palustre* ssp. *decumbens*

**Open Needleleaf Lichen Forest**

Dwarf *Picea mariana* / *Betula nana*  
*Picea glauca* / Bryophyte  
*Picea mariana* / Bryophyte

**Woodland Needleleaf Forest**

Dwarf *Picea mariana* / *Betula nana* - *Carex bigelowii*  
Dwarf *Picea mariana* / *Betula nana* - *Eriophorum vaginatum*  
Dwarf *Picea mariana* / *Carex lugens*  
Dwarf *Picea mariana* / *Eriophorum vaginatum*  
Dwarf *Picea mariana* / *Ledum palustre* ssp. *decumbens*  
Dwarf *Picea mariana* / *Vaccinium vitis-idaea*  
*Picea glauca* / *Betula nana* / *Carex bigelowii*  
*Picea glauca* / *Salix* species / *Carex bigelowii*  
*Picea mariana* / *Alnus viridis* ssp. *crispa*  
*Picea mariana* / *Betula nana*  
*Picea mariana* / *Ledum palustre* ssp. *decumbens*  
Woodland *Picea glauca* / *Betula nana*

**Woodland Needleleaf Lichen Forest**

Dwarf *Picea mariana* / *Betula nana*  
*Picea mariana* / Bryophyte  
Woodland *Picea glauca* / *Betula nana*

**Woodland Needleleaf Moss Forest**

*Picea glauca* / Bryophyte  
*Picea mariana* / Bryophyte  
Woodland *Picea glauca* / *Betula nana*

**Closed Deciduous Forest**

*Betula papyrifera* / *Rosa acicularis*  
*Populus balsamifera* / *Alnus viridis* ssp. *crispa* Floodplain  
*Populus tremuloides* / *Rosa acicularis*

**Open Deciduous Forest**

*Populus balsamifera* / *Alnus viridis* ssp. *crispa* Floodplain  
*Populus tremuloides* / *Rosa acicularis*  
Young *Betula papyrifera*  
Young *Populus balsamifera* Floodplain  
Young *Populus tremuloides*

**Closed Mixed Needleleaf / Deciduous Forest**

*Picea glauca* - *Betula papyrifera* / *Rosa acicularis*  
*Picea glauca* - *Populus tremuloides*  
*Picea mariana* - *Betula papyrifera* / *Alnus viridis* ssp. *crispa*  
Young *Picea glauca* - *Betula papyrifera*

**Open Mixed Needleleaf / Deciduous Forest**

*Picea glauca* - *Betula papyrifera* / *Rosa acicularis*  
*Picea glauca* - *Populus tremuloides*  
*Picea mariana* - *Betula papyrifera* / *Alnus viridis* ssp. *crispa*  
Young *Picea glauca* - *Betula papyrifera*  
Young *Picea mariana* - *Betula papyrifera*

**Tall Shrub**

*Alnus viridis* ssp. *crispa* / *Eriophorum vaginatum*  
*Alnus viridis* ssp. *crispa* Floodplain  
*Salix alaxensis* Floodplain  
*Salix alaxensis* Sideslope

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## Appendix 1. (continued)

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### Low Shrub

*Amelanchier alnifolia*  
*Artemisia frigida*  
*Artemisia frigida* - *Calamagrostis purpurascens* - *Pseudoroegneria spicata* ssp. *spicata*  
*Betula nana*  
*Betula nana* - *Ledum palustre* ssp. *decumbens* - *Vaccinium uliginosum*  
*Juniperus communis*  
*Ledum groenlandicum*  
*Ledum palustre* ssp. *decumbens*  
*Ledum palustre* ssp. *decumbens* - *Vaccinium uliginosum*  
*Myrica gale*  
*Salix pulchra* - *Betula nana*

### Low Shrub Lichen

*Betula nana*  
*Ledum palustre* ssp. *decumbens*

### Low Shrub Tussock

*Betula nana* / *Carex bigelowii*  
*Ledum palustre* ssp. *decumbens* / *Eriophorum vaginatum*  
*Vaccinium uliginosum* / *Carex bigelowii*

### Dwarf Shrub

*Arctostaphylus rubra*  
*Betula nana* - *Vaccinium uliginosum* - *Carex bigelowii*  
*Cassiope tetragona*  
*Dryas integrifolia*  
*Dryas octopetala*  
*Dryas octopetala* / *Carex stylosa*  
*Dryas octopetala* - *Cassiope tetragona*  
*Empetrum nigrum* - *Vaccinium vitis-idaea*  
*Ledum palustre* ssp. *decumbens* - *Vaccinium vitis-idaea* - *Eriophorum vaginatum*  
*Salix pulchra*

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### Wet Sedge/Wet Graminoid

*Carex aquatilis*  
*Carex rostrata*

### Dry Herbaceous

*Artemisia alaskana*  
*Bromus inermis* var. *arcticus*  
*Calamagrostis canadensis*  
*Calamagrostis purpurascens*  
*Chamerion angustifolium* ssp. *angustifolium*  
*Festuca altaica* / *Calamagrostis species*

### Tussock Tundra

*Eriophorum vaginatum*  
*Ledum palustre*-*Vaccinium vitis-idaea*-*Eriophorum vaginatum*

### Tussock Tundra Lichen

*Carex bigelowii*

## Appendix 2. Indicator species used in the key to plant associations.

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### Trees

*Betula papyrifera*  
*Picea glauca*  
*Picea mariana*  
*Populus balsamifera*  
*Populus tremuloides*

### Shrubs

*Alnus viridis* ssp. *crispa*  
*Amelanchier alnifolia*  
*Arctostaphylos rubra*  
*Artemisia frigida*  
*Betula nana*  
*Cassiope tetragona*  
*Dryas integrifolia*  
*Dryas octopetala*  
*Empetrum nigrum*  
*Juniperus communis*  
*Ledum groenlandicum*  
*Ledum palustre* ssp. *decumbens*  
*Myrica gale*  
*Rosa acicularis*  
*Salix alaxensis*  
*Salix pulchra*  
*Salix* species  
*Vaccinium uliginosum*  
*Vaccinium vitis-idaea*

### Herbaceous

*Artemisia alaskana*  
*Bromus inermis* var. *arcticus*  
*Calamagrostis canadensis*  
*Calamagrostis purpurascens*  
*Carex aquatilis*  
*Carex bigelowii*  
*Carex lugens*  
*Carex rostrata*  
*Carex stylosa*  
*Chamerion angustifolium* ssp. *angustifolium*  
*Eriophorum vaginatum*  
*Festuca altaica*  
*Pseudoroegneria spicata* ssp. *spicata*

### Bryophyte

Bryophyte

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## GLOSSARY

Most of the ecological terms below are from Hamilton (1999), Gallant et al. (1995), Viereck et al. (1992) and Gabriel and Talbot (1984).

**Accumulation zone**—The zone of a glacier where snow doesn't melt even during summer.

**Ablation zone**—Zone where glacial ice melts at the end of the glacier.

**Alliance**—Physiognomically uniform group of plant associations sharing one or more dominant or diagnostic species, which as a rule are found in the uppermost stratum of the vegetation (Grossman et al. 1998).

**Alluvial fans**—Erosional-depositional system in which rock and sediment are transported down-valley and deposited where it emerges from the confines of the valley into a larger valley or plain. They tend to be fan-shaped in plan view; a segment of a cone radiating away from a single point source.

**Alluvial**—Characterized by the deposition of sediment by a stream or other running water at any point along its course.

**Alpine**—Zone on mountain tops between permanent snow and the cold limits of trees.

**Ancient outwash**—Outwash that is no longer flooded by river water.

**Annual**—Plant species that complete their life-cycle within a single growing season.

**Aquatic**—Refers to sites with vegetation that is submerged, floating, or growing in permanent water.

**Arête**—Steep-sided rock ridge separating valley or cirque glaciers. The basic form is the result of undercutting by glaciers which evacuate any rock debris and thus maintain steep rock slopes.

**Bare-ground**—Refers to (1) a landcover class with less than 15% vegetation cover, or (2) a soil surface devoid of vegetation.

**Bedrock**—Solid rock beneath the soil and superficial rock. A general term for solid rock that lies beneath soil, loose sediments, or other unconsolidated material.

**Biennial**—Plant species that complete their life-cycle within two growing seasons.

**Bog**—Bogs are wetlands with organic soils, typically dominated by *Sphagnum* (peat moss) species, sedges, grasses, or reeds. Bogs require depressions (ponds) in level areas where precipitation exceeds evapotranspiration. Precipitation is the primary water source in a bog, with little or no ground-water flow. Consequently the sites are nutrient-poor and acidic, commonly with a pH less than 4.7. The water table is at or close to the surface most of the year. Because of the continuum of site and vegetation change within a peatland, it is often difficult to clearly separate a fen from a bog in the field.

**Boreal**—Northern biogeographical region typically referring to subpolar and cold temperate areas.

**Broad-leaved**—Describes a plant with leaves that have well-defined leaf blades and are relatively wide in outline (shape) as opposed to needle-like or linear; leaf area is typically greater than 500 square millimeters or 1 square inch.

**Bryophyte**—Nonvascular, terrestrial green plant, including mosses, hornworts, and liverworts.

**Bunch grass**—Multi-stemmed (caespitose) life form of grasses characterized by clumps of erect shoots that slowly spread horizontally by tillers, generally creating distinct individual plants spaced across the ground; often applied to sedges and other graminoids with similar life forms.

**Caespitose (cespitose)**—Describes a low branching pattern from near the base that forms a multi-stemmed or a bunched appearance.

**Canopy cover**—Percent of the ground in the polygon covered by the gross outline of an individual plant's foliage (canopy), or the outline collectively covered by all individuals of a species or life-form within the polygon (Daubenmire 1959).

**Cirque**—Valley end with an arcuate, cliffed headwall and a gently sloping floor or rock basin.

**Classification**—Process of assigning individual pixels of an image to categories, generally on the basis of spectral reflectance characteristics.

**Cliff**—Any high, very steep to perpendicular, or overhanging face of a rock outcrop.

**Colluvium**—Unconsolidated surface materials that have been transported downslope and deposited on the lower slopes. Colluvium is moved by landslides, flow slides, talus rubble, rock-glaciers, solifluction and unconsolidated runoff.

**Crustose lichen**—Lichen life form that grows in intimate contact with its substrate, lacks a lower cortex and rhizoids (root-like structures), and is impossible to separate from the substrate without destroying the thallus; lichen with an unlobed, flattened thallus, growing adnate (joined) to the substrate.

**Deciduous**—Describes a woody plant that seasonally loses all of its leaves and becomes temporarily bare-stemmed.

**Depauperate**—Plant appears dwarfed or starved.

**Digital image processing**—Computer manipulation of the digital-number values of an image.

**Digital image**—Image where the property being measured has been converted from a continuous range of analogue values to a range expressed by a finite number of integers, usually recorded as binary codes from 0 to 255, or as one byte.

**Dominant**—Species that contributes greater than 50% of the total canopy cover of a plant association's tallest layer.

**Drumlins**—Elongated hills, usually made up of unconsolidated glacial deposits that can be several miles long and hundreds of meters high. It is common to find several drumlins grouped together and are called a swarm.

**Dwarf shrub**—Shrub life form growing less than 0.2 meters tall.

**Ecoregions**—Landscape units defined based on similar patterns in potential natural communities, soils, hydrologic function, landform, topography, lithology, climate, and natural processes such as nutrient

cycling, productivity, succession, and natural disturbance regimes associated with flooding, wind, or fire. Climate, as modified by topography, is the dominant criterion at the scale mapped for Yukon-Charley National Preserve.

**Ecosystem**—Community and its environment treated together as a functional system. The community, ranging in size from small ponds to entire forests, interacts with the climate and soil, transferring and circulating energy and matter (Whittaker 1975).

**Eolian**—Wind blown sand and silt deposits.

**Ephemeral forb vegetation**—Annual vegetation that, during favorable periods, dominates areas that are usually sparsely vegetated or unvegetated for most of the year.

**Eskers**—Ice-channel deposit that looks like an elongate ridge. They are formed in three ways: 1. Deposition between ice blocks, 2. Collapse of outwash of varying thickness. 3. Deposition in a tunnel through the glacier or under the ice.

**Evapotranspiration**—Describes the combination of water that is evaporated and transpired by plants as a part of their metabolic processes.

**Evergreen**—Describes a plant that has green leaves all year round.

**Exposed Bedrock**—Refers to exposed rock typically at higher elevations and includes all the jagged rocky ridges, peaks, cirque headwalls and cirque basins. It has little or no soil development.

**Fen**—Fens are wetlands with wet organic soils, dominated by aquatic, emergent, and dwarf shrubs, or raised peat dominated by shrubs and trees. Ground water, the primary water source in a fen, is nutrient rich because of its contact with mineral soils. Waters may be acidic or basic, but typically with a pH above 4.7. Water is lost through evapotranspiration, seepage (infiltration through the soil), and surface outflow.

**Fire interval**—Average number of years between two successive fire events in a given area.

**Floodplain**—Fluvial plain formed by non-glacial fed rivers.

**Foliose lichen**—Lichen life form that is leafy in appearance and loosely attached to its substrate; lichen with a lobed, flattened thallus growing loosely attached to the substrate, the lobes are flattened or inflated with distinctly differentiated upper and lower surfaces; umbilicate lichens are included.

**Forb**—Broad-leaved herbaceous plant.

**Fresh water**—Water with a salinity of less than 0.5 parts per thousand.

**Frost Scar**—Exposed bare mineral soil formed by frost action in the soil.

**Fruticose lichen**—Lichen life form that is bunched, shrubby or "hairy" in appearance and loosely attached to its substrate; lichen with the thallus branched, the branches solid, or hollow and round, or flattened without distinctly differentiated upper and lower surfaces; squamulose lichens are included.

**Gelifluction**—see solifluction

**Geographic Information System (GIS)**—Data-handling and analysis system based on sets of data distributed spatially in two dimensions. The data sets may be map oriented, when they comprise qualitative attributes of an area recorded as lines, points, and areas often in vector format; or image oriented, when the data are quantitative attributes referring to cells in a rectangular grid usually in raster format. It is also known as a geobased or geocoded information system.

**Geomorphic process**—Refers to the mechanical transport of organic and inorganic material such as mass movement, surface erosion, the transport of material (silt) by water, and biogenic soil movement by root throw and animals.

**Glacial drift**—Material transported by a glacier and then deposited either directly from the ice or from the melt water. Numerous types of glacial drift occur including moraines, kettle-kame topography, eskers, drumlins, glacial till and outwash.

**Glacial outwash**—Fluvial plains formed when glacially fed rivers deposit their sediment in stream channels and the associated plain. Due to continual channel shifting the sediment is spread across an area called an outwash plain. Outwash plains typically have braided rivers consisting of multiple, wide, shallow channels characterized by rapid erosion, deposition and channel shifts.

**Glacial till**—Surface formed by sediment originating directly from glacial ice and typically has no discernible sediment stratification.

**Global Positioning System (GPS)**— GPS is a worldwide satellite navigation system that is funded and supervised by the U.S. Department of Defense. GPS satellites transmit specially coded signals. These signals are processed by a GPS receiver that computes extremely accurate measurements, including 3-dimensional position, velocity, and time on a continuous basis.

**Graminoid**—Grasses and grass-like plants, including sedges and rushes.

**Grassland**—Vegetation dominated by perennial graminoid plants.

**Ground layer**—Applies to the herbaceous layer.

**Growth form**—Shape or appearance of a plant; it primarily reflects the influence of growing conditions.

**Herbaceous**—Vascular plant without significant woody tissue above or at the ground; an annual, biennial, or perennial plant lacking significant thickening by secondary woody growth, with perennating buds borne at or below the ground surface (hemicryophytes, geophytes, helophytes, and therophytes of Raunkier).

**Image**—Pictorial representation of a scene recorded by a remote sensing system. Although image is a general term, it is commonly restricted to representations acquired by non-photographic methods.

**Infra Red (IR) color photograph**—Color photograph in which the red-imaging layer is sensitive to photographic IR wavelengths, the green-imaging layer is sensitive to red light, and the blue-imaging layer is sensitive to green light. Also known as camouflage detection photographs and false-color photographs.

**Interpretation**—Process in which a person extracts information from an image.

**Kame**—Stratified sediment deposited in a lake situated upon a glacier. When the glacier melts the sediments form a mound on the ground.

**Kettle**—Depression formed by ice block which, after separation from the body of glacier (usually the snout), is covered with outwash then slowly melts resulting in a depression which may be dry or a lake.

**Krumholtz**—Growth form assumed by tree species at the upper tree line or in the alpine zone; characterized by a creeping and multi-stemmed growth pattern due to desiccation and physical damage caused by wind and blowing ice crystals near the upper tree line; the same species grows as an erect, single-stemmed tree at lower elevation.

**Lacustrine deposits**—Derived from materials deposited in lake water and exposed when the water level is lowered or the land is raised.

**Landform**—Landform refers to the form of the land surface and associated ecosystems at a smaller scale than associated with landscapes.

**LandSat (formerly ERTS)**—The LandSat program, first known as the Earth Resources Technology Satellite (ERTS) Program, is a development of the National Aeronautics and Space Administration (NASA) in association with NOAA, USGS, and Space Imaging. The activities of these combined groups led to the concept of dedicated Earth-orbiting satellites, the defining of spectral and spatial requirements for their instruments, and the fostering of research to determine the best means of extracting and using information from the data. The first satellite, ERTS 1, was launched on July 23, 1972. The second satellite was launched on January 22, 1975. Concurrently, the name of the satellites and program was changed to emphasize its prime area of interest (land resources). The first two satellites were designated as LandSat 1 and 2. LandSat 3 was launched on March 5, 1978. LandSat 4 was launched on July 16, 1982. LandSat 5 (launched March 1, 1984) is currently in service providing selected data to worldwide researchers. The Enhanced Thematic Mapper Plus (ETM+) is a multispectral scanning radiometer that is carried on board the LandSat 7 satellite. The sensor has provided nearly continuous acquisitions since July 1999, with a 16-day repeat cycle. An instrument malfunction occurred on May 31, 2003, with the result that all Landsat 7 scenes acquired since July 14, 2003 have been collected in "SLC-off" mode

**Landscape**—Land unit larger than a landform. This includes moraines, outwash plains, and deltas.

**Lateral Moraine**—Landform formed by the accumulation of valley-side material on either side of a glacier.

**Lichen**—Organism generally recognized as a single plant that consists of a fungus and an alga or cyanobacterium living in symbiotic association.

**Life form**—Shape or appearance of a plant that mostly reflects inherited or genetic influences.

**Low shrub**—Low-growing shrub life form between 0.1 and 1 meter tall.

**Mass balance**—Glacial term for the balance between snow accumulation high up on the upper part of the glacier, and what melts near the glacier's terminus.

**Meander scroll**—Formed on the convex side of river bends by alluvial deposition. As alluvium is deposited, it forms point bars and further inland an undulating topography of levees and depression. The meander scroll depressions often are filled with standing water or act as overflow channels during high flows.

**Mesic**—Sites are moist and tussocks may dominate. Permanent standing water is not present.

**Mixed forest**—Describes vegetation in which evergreen and deciduous species each generally contribute 25-75% to the total canopy cover.

**Moraine**—Depositional feature composed of glacial till that may be in association with active ice or deposited by former glaciers.

**Mosaic**—Composite image or photograph made by piecing together individual images or photographs covering adjacent areas. Also, plant associations—or landcover classes—that occur adjacent to each other in a complex pattern.

**Nonvascular plant**—A plant without specialized water or fluid conductive tissue (xylem and phloem); includes bryophytes, lichens, and algae.

**Nunatak**—Mountain completely surrounded by glacial ice.

**Oxbow**—Oxbows are formed when a river abruptly changes course, cutting off a stream segment. Typically, the oxbow will partially fill with water.

**Patch size**—The size of a plant association or map class. Varies from:

- Matrix = Forming a large continuous matrix across the landscape;
- Large = patch size is 250-1,000 acres in size;
- Moderate = 50-250 acres;
- Small = less than 50 acres;
- Linear = the patch shape is linear such as along streams and the coast.

**Perennial**—Plant species with a life-cycle that characteristically lasts more than two growing seasons and persists for several years.

**Pixel**—Term for a processed signal of a remotely sensed area of ground. Contraction of picture element.

**Plant association**—Finest level of both the Viereck et al. (1992) and National Vegetation Classification System (Grossman et al. 1998) classifications. It is defined as "a plant community type of definite floristic composition, uniform habitat conditions, and uniform physiognomy" (Flahault and Schroter 1910).

**Remote sensing**—Collection and interpretation of information about an object without being in physical contact with the object.

**Resolution**—Ability to separate closely spaced objects on an image or photograph. Resolution is commonly expressed as the most closely spaced line-pairs per unit distance that can be distinguished. Also called spatial resolution.

**Roche moutonnée**—Eroded and smoothed bedrock hills commonly found in formerly glaciated valleys. The hills have one side ice-molded and the other side steepened and often cliffed. The morphology of roches moutonnées seems to reflect the contrast between abrasion on the smoothed up-side and plucking on the lee side.

**Saltwater**—Water with a salinity of greater than 30 parts per thousand.

**Satellite**—Object in orbit around a celestial body.

**Scene**—Area on the ground that is covered by an image or photograph.

**Scree**—Sheet of coarse rock debris covering a mountain slope without an adjacent cliff.

**Scrub**—Vegetation dominated by shrubs, including thickets.

**Seasonal**—Showing periodicity related to the seasons; applied to vegetation exhibiting pronounced seasonal periodicity marked by conspicuous physiognomic changes.

**Sere**—Same as a successional sequence

**Shrub**—Perennial woody species that typically has several stems arising from or near the ground.

**Solifluction (or gelifluction)**—Flow of soil in association with frozen ground. During the spring and summer thaw, water in the active layer cannot penetrate below the permafrost table. Soils are often saturated, and the loss of friction and cohesion causes them to behave like viscous fluids. The soil thus slowly ‘flows.’ The downslope fronts of the solifluction lobes are marked by near-vertical scarps as high as 2 meters.

**Sorted stripes**—Refers to patterned ground that consists of linear alignments of soil, vegetation and stones on slopes. Often strips of stone separated by broad zones of finer sediment and vegetation. The strips are up to several meters in width and 100 meters in length.

**Sparsely vegetated**—Describes vegetation in map classes with low total plant cover (between 15 and 25%) that is scattered.

**Spectral reflectance**—Reflectance of electromagnetic energy at specified wavelength intervals.

**Striae**—Term for small scratches on the bedrock. Larger grooves are also created by abrasion in a concentrated zone.

**Subalpine**—Upper mountain vegetation immediately below the cold limits of tree and tall shrub growth.

**Successional sequence**—Succession is the replacement of one community (or population) by another over time. A successional sequence describes vegetation and site (soil and landform) succession, and sequentially links plant associations. Two types of succession are generally recognized, primary and secondary. **Primary succession** is succession on newly created surfaces such as sediment filling in a lake, new alluvial bar deposits along rivers, tectonically uplifted tidal flats, or exposed mineral soil because of glaciation or landslides. **Secondary succession** occurs after vegetation is destroyed or altered by a disturbance but the site characteristics, such as soil and hydrology, are left intact. Common disturbances leading to secondary succession are fire, disease, blowdown, insect infestation, and flooding.

**Supervised classification**—Digital information extraction technique in which the operator provides training-site information that the computer uses to assign pixels to categories.

**Tall shrub**—Tall-growing shrub life form greater than 1.5 meters tall.

**Talus**—Sloping accumulation of coarse rock fragments at the base of a cliff.

**Tarn**—Lake found in a cirque.

**Temperate**—Geographically, the region between the polar and tropical regions; climatically, the region is moderate with distinct seasons of alternating long, warm summers and short, cold winters.

**Tephra**—Fragmental materials thrown out by a volcano, including ash, cinders, lapilli, bombs and pumice.

**Terminal moraine**—Accumulation of till material that develops against the front of a glacier, and marks the furthest point of glacial flow.

**Terraces**—Floodplains and outwash plains removed from frequent flooding due to down-cutting of the river.

**Texture**—Frequency of change and arrangement of tones on an image.

**Thematic Data**—Thematic data layers in a data set are layers of information that deal with a particular theme. These layers are typically related information that logically go together. Examples of thematic data would include a data layer whose contents are roads, railways, and river navigation routes.

**Thematic Mapper (TM)**—Cross-track scanner deployed on Landsat that records seven bands of data from the visible through the thermal IR regions. 30- to 120-meter multispectral data from Landsat 4 and 5 (1982 to present).

**Till**—Surface formed by sediment originating directly from glacial ice and typically has no discernible sediment stratification.

**TM**—Thematic mapper.

**Topographic Map**—Map that presents the horizontal and vertical positions of the features represented; distinguished from a planimetric map by the addition of relief in measurable form.

**Topography**—Configuration (relief) of the land surface; the graphic delineation or portrayal of that configuration in map form, as by contour lines; in oceanography the term is applied to a surface such as the sea bottom or a surface of given characteristics within the water mass.

**Tree line**—Zone where the normal growth of trees is limited; cold temperatures often combined with drought form the upper or arctic tree line, and drought combined with hot temperatures form lower or arid tree line.

**Tuff**—Type of pyroclastic rock made up principally of small fragments of consolidated volcanic ash.

**Tundra**—Treeless region north of the Arctic Circle (arctic tundra) or above the tree line of high mountains (alpine tundra) and on some sub-Antarctic islands; characterized by very low winter temperatures, short cool summers, permafrost below a surface layer subject to summer melt, short growing season, and low precipitation.

**Tussock**—Graminoid life form consisting of bunch-like tufts, sometimes more than 1 meter tall, in which the hard, old, withered leaves are intermingled with the fresh, young, green leaves.

**Understory**—General term that in these descriptions applies to the shrub and herbaceous layers of a vegetation type, as well as the tree regeneration layer. We have tried to use "shrub layer" or "herbaceous

layer" in most cases, but understory is used in some places. "Undergrowth" is the more specific term used for shrub and herbaceous layers in forests or woodland vegetation types, and has been little used in these descriptions.

**Unsupervised classification**—Digital information extraction technique in which the computer assigns pixels to categories with no instructions from the operator.

**U-shaped valley**—Typical valley form resulting from alpine glaciation. The glacier scours out a mountain valley and transforms it from one with a V-shape to one with a U-shape, steepening the sides and flattening the bottom.

**Vascular plant**—Plant with water and fluid conductive tissue (xylem and phloem); includes seed plants, ferns, and fern allies.

**Wet**—Refers to sites where the dominant vegetation is emergent—not submerged or floating—and semi-permanent or standing water is present.

**Woody plant**—Plant species life form with woody tissue and buds on that woody tissue near or at the ground surface or above.



The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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**National Park Service**  
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